EFFECTIVENESS OF FUNCTIONAL EQUIVALENCE TRAINING PLUS CONTINGENCY MAPPING WITH A CHILD WITH AUTISM

by

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ABSTRACT

Functional equivalence training (FET) and functional communication training (FCT) interventions are among the most widely researched positive behavior support strategies used with individuals with autism. Although many studies have demonstrated that FET/FCT interventions can be combined with extinction to reduce the frequency of problem behavior, others have demonstrated that punishment may be a necessary component of FET/FCT interventions in some instances. The use of punishment with FET/FCT interventions remains controversial in the literature and alternative strategies may be needed to bolster the power of FET/FCT interventions. This study evaluated the effectiveness of an FET intervention that combined two such strategies: the pairing of an arbitrary reinforcer with a functional reinforcer to increase the participant's motivation to use the alternative behavior, and the use of contingency mapping, a new visual support strategy designed to enhance a participant's understanding of the contingencies associated with FET interventions. Contingency mapping and the use of an arbitrary reinforcer may provide additional resources to interventionists when individuals fail to respond to FET + extinction interventions or when the use of extinction procedures are not possible.

A multiple baseline ABCD design across three tasks using a multiple probe strategy was used to evaluate the intervention. The study compared no treatment (A) with both a verbal contingency intervention (B) and contingency mapping (C). A brief follow-up condition (D) was also instituted. The study was conducted in a general education classroom with one child who was diagnosed with autism. The child's persistent prompt dependency was treated by teaching a functionally equivalent behavior. Results showed that the verbal contingency intervention had no effect while a contingency mapping intervention resulted in an immediate, dramatic, and

sustained reduction in problem behavior. Social validation data indicated that the contingency mapping intervention was viewed as easy to use and effective in the classroom. The results are discussed in terms of previous and future research and educational/clinical implications.

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CHAPTER 1

Introduction

Positive Behavior Support

Positive behavior support (PBS) was defined by Carr et al. (2002) as "an applied science that uses educational methods to expand an individual's behavior repertoire and systems change methods to redesign an individual's living environment to first enhance the individual's quality of life and, second, to minimize his or her problem behavior" (p. 4). Within the framework of PBS, behavior is understood as the outcome of a transactional process between an individual's competence and environmental contexts (Albin, Lucyshyn, Horner, & Flannery, 1996; Carr et al., 2002). In order to produce meaningful, durable change, those creating PBS interventions typically seek to address many aspects of the environment-behavior relationship simultaneously. PBS interventions often include lifestyle changes, environmental re-design or adaptations, skill development or the teaching of alternative behaviors, and changes to the consequences maintaining problem behavior (Koegel, Koegel, & Dunlap, 1996).

Functional Assessment and the Competing Behavior Diagram

One of the foundations of PBS is *functional assessment* (Horner, 2000; Lucyshyn, Horner, Dunlap, Albin, & Ben, 2002). It is through functional assessment that the environment-behavior relationship can be understood and that PBS interventions can be developed. Functional assessment was defined by Sugai et al. (2000) as "a systematic process for identifying problem behaviors and the events that (a) reliably predict occurrences and non-occurrences of those behaviors and (b) maintain the behaviors across time" (p. 137). One of the most widely used methods for conducting a functional assessment was proposed by O'Neill et al. (1997) in their handbook entitled *Functional Assessment and Program Development for Problem Behavior.*

This method involves the construction of a *competing behavior diagram* as a bridge between assessment and intervention that ensures the fidelity of a behavior support plan. As can be seen in Figure 1, the competing behavior diagram can be viewed as the pathway or map for both the problem behavior and more desired alternative behaviors.

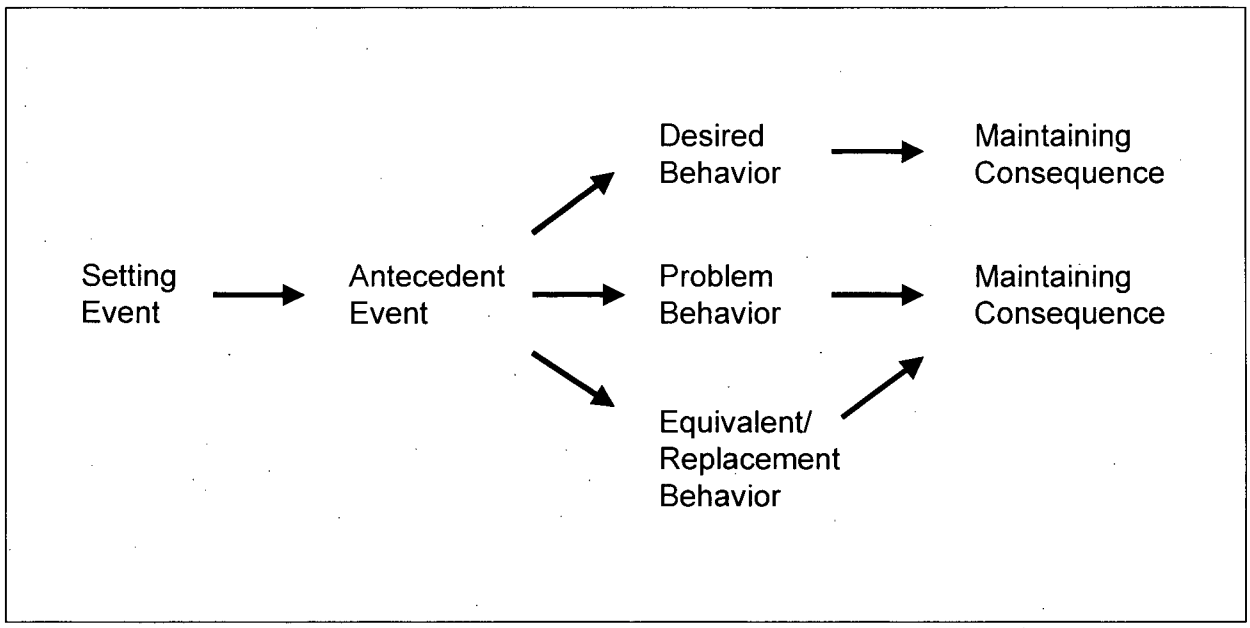

Figure 1. Competing behavior diagram (O'Neill et al., 1999, p. 71)

Interventionists use the competing behavior model to guide the development of behavior support plans. The competing behavior model has been used in both clinical and research applications to train parents, teachers, and others to develop behavior support plans (Dunlap & Kincaid, 2001; Lucyshyn et al., 2002; Marshall & Mirenda, 2002). One of the reasons for the popularity and effectiveness of the competing behavior diagram is the graphic nature by which it represents the relationships between the problem behavior, the proposed alternative behavior, and the environment. The graphic nature of the competing behavior diagram is an effective teaching instrument to convey the principles and practices of behavior support to parents and other support persons, and also provides an effective visual check that can be used to assess

intervention fidelity. Not only does the diagram depict both the problem and replacement behaviors, it also shows that the replacement behavior should be performed by the individual in response to the same antecedent events as the problem behavior, and should be met with the same functional reinforcer.

Teaching Functionally Equivalent Behavior

As is noted in Carr et al.'s (2002) definition, one goal of PBS is to teach one or more alternative replacement behaviors to individuals who engage in problem behavior. Typically, the replacement behavior is a social skill, play skill, or other physical action; this is referred to as Functional Equivalence Training or FET (Sprague & Horner, 2001). In some cases, the functionally equivalent behavior is a communication skill such as a manual sign, a point to a picture symbol, or a gesture; this variation of FET is known as Functional Communication Training or FCT (Carr et al., 1994; Durand & Merges, 2001). Regardless of whether the replacement behavior is a physical action or a communicative response, the important feature is that it is maintained by the same functional reinforcer as the problem behavior – in other words, the replacement behavior must be functionally equivalent to the problem behavior. In this manuscript, the term FET will be used to refer to interventions that do *not* involve communicative behaviors, and the term FCT will be used to refer to those that do. The term FET/FCT will be used to refer to the entire set of interventions based on the principle of functional equivalence.

Barry and Singer (2001) provided a powerful example of a behavior support plan that used FET to reduce problem behavior. In this study, the authors attempted to teach functionally equivalent behaviors to a 10-year-old child with autism who was demonstrating high frequency aggressive behaviors toward his infant sibling. The problem behaviors included, among other

things, smothering, shaking, and choking the infant. These behaviors were assessed as being maintained by parental attention. In order to decrease the aggressive behavior, Barry and Singer designed an intervention plan to teach the child with autism appropriate alternative means of interacting with the infant, including giving the infant a pacifier, playing with the infant, and reading to the infant. These alternative behaviors were made functionally equivalent to the problem behaviors by teaching the boy's parents to provide praise and other forms of positive attention immediately after they occurred. The parents were also taught to provide minimal attention to the child contingent upon the occurrence of problem behavior. This intervention was effective in producing immediate and sustained reductions in aggressive behavior. As a result of the intervention success, the child with autism was able to continue living with his family, a situation that was previously in jeopardy.

Another example in which the teaching of alternative replacement behavior was used to reduce problem behavior was provided by Durand (1999) in an FCT study that was designed to reduce the problem behaviors exhibited by five children with a variety of labels, including autism. The problem behaviors exhibited by the children included self-injurious behavior (SIB), crying, screaming, and aggression. The function of each child's behavior was first assessed at their school. Matt's and David's problem behaviors were assessed as serving the function of escape from difficult tasks, Allison's and Mike's problem behaviors were assessed as being maintained by access to desired items and objects, and Ron's problem behavior was determined to be maintained by attention. All five children were taught to use voice-output communication aids (VOCAs) to deliver spoken messages that served the same functions as their problem behaviors. For example, Allison, whose behavior enabled her to gain acess to desired objects and activities, was taught to use her VOCA to say *"I want more, please."* For all five children, these

FCT interventions were successful in producing immediate and sustained reductions in problem behavior to near-zero levels, both in their classrooms and in various community settings.

Both Durand (1999) and Barry and Singer (2001) provided examples of interventions in which functionally equivalent behaviors were taught in order to ameliorate problem behaviors. The literature is replete with such examples; however, there also exist a number of studies in which FET or FCT strategies have been shown to be *ineffective* in producing positive behavior change without the addition of various punishment procedures (e.g., Bowman, Fisher, Thompson, & Piazza, 1997, Fisher, Thompson, Hagopian, Bowman, & Krug, 2000; Fisher et al., 1993; Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998; Perry & Fisher, 2001; Wacker et al., 1990). For example, Fisher et al. (2000) attempted to use an FCT intervention with Jan, a 7-year-old girl diagnosed with microcephaly and profound mental retardation. A functional assessment determined that Jan's destructive behaviors enabled her to gain access to preferred items, such as toys. In a controlled clinic setting, Jan was taught to sign *more* in order to access desired toys, and this was successful in reducing her destructive behaviors to near zero levels. However, in Jan's living unit outside of the clinic, the intervention was ineffective in reducing her destructive behaviors. Thus, Fisher and colleagues added first extinction and then a punishment procedure to the existing intervention. The punishment that was used with Jan was a form of brief restraint, namely a "basket-hold" time-out. Although Jan failed to respond to FCT + extinction in the living unit, her destructive behaviors reduced to near-zero levels and her signing of *more* increased when punishment was added to the FCT intervention. The two conditions were alternated within an ABAB design to demonstrate that the results were due to the FCT + punishment intervention and not to other factors.

The occasional inability of educative behavior support strategies such as FET and FCT to produce reductions in problem behaviors is not simply confined to the research domain – these strategies also occasionally fail to produce the desired changes in clinical practice. In my own behavior consultation practice, I have experienced situations where FET and FCT interventions, despite seemingly sound methodology, failed to produce meaningful reductions in problem behavior. Marco & Del are two examples of such failures.

Marco's Story (Functional Equivalence Training)

Marco was a 5-year-old boy with autism who attended kindergarten in his small suburban neighborhood school. Marco was adorable, gregarious, affectionate, and energetic. Though Marco's verbal skills were beginning to emerge, his primary mode of communication was through gestures and behaviors. Although Marco generally adapted to and functioned well in most environments, he often engaged in tantrums that usually included screaming, crying, hitting, and running away. His tantrum behavior was most problematic at school, and often resulted in Marco being removed from class and placed in "time-out." One day, while being escorted to time-out, Marco ran away from his educational assistant, was hit by a car, and sustained a broken leg. Following this incident, behavior consultation was sought to advise Marco's home and school support team about a better approach. A functional assessment revealed that Marco's tantrums occurred primarily in response to specific types of noises, including crying children, sirens, loud motorcycles, and loud kitchen appliances. The assessment also revealed that the tantrums served the function of allowing Marco to escape from the noisy environments. Following the assessment, an intervention was recommended that included both FET and FCT. Marco's support team agreed to teach Marco to cover his ears (FET) and to use a arm and hand gesture (i.e., a point) toward the nearest door (FCT) to ask to leave the

environment when confronted with an aversive noise. They also agreed to honor Marco's requests to leave the environment immediately after he gestured, and to stop removing him when tantrums occurred (i.e., escape extinction). Team members were taught how to use verbal and gestural prompts to teach Marco the new alternative behaviors. Unfortunately, though the support plan appeared to be technically sound and was vigorously supported by Marco's team, this intervention failed to produce meaningful change. Marco steadfastly continued to engage in tantrums whenever he encountered specific types of noise, despite the fact that tantrums no longer resulted in his ability to escape from the noise.

Del's Story (Functional Communication Training)

Del was a 6-year-old boy diagnosed with autism and a mild mental handicap. Del was a tall, charming boy who had strong verbal skills yet often failed to understand complex messages spoken to him. Del had a high need for structure and order. When everything was going his way, Del seemed to be the happiest child in his rural school; however, when unpredictable events or changes occurred, he often engaged in problem behaviors that included screaming, yelling, and crying. A few months into his grade one year, Del also began to engage in self-injurious behavior (SIB) that included hitting his head with the heel of his hand and banging his forehead on hard surfaces. Although Del's peers had been accepting and seemingly unfazed by his crying and screaming, they were quite distressed by his SIB and appeared to Del's teaching staff to be afraid of him.

As a result of the emergence of SIB, behavior consultation was initiated. A functional assessment was conducted, and it was determined that Del's behavior occurred primarily during specific seatwork activities in the grade one classroom and during his Thursday physical education (PE) class. Interviews with Del's teaching staff indicated that paper-and-pencil tasks

were difficult for Del. Observations across several PE classes suggested that the Thursday class was unique in several ways, including the fact that it was led by a different teacher and usually involved novel, varied, and highly unpredictable activities. It was hypothesized that the function of Del's behavior was to escape from difficult paper-and-pencil exercises and to avoid the unpredictable PE activities. A FCT intervention was designed in which Del was encouraged to (a) ask to *watch* his PE class instead of participate in it actively and (b) either ask for a *break* or ask for *help* with paper-and-pencil tasks. All of these verbal messages were well within Del's ability; however, despite the provision of verbal and gestural prompting during paper-and-pencil tasks and at the start of his Thursday morning PE classes, Del continued to engage in problem behavior and failed, with any notable frequency, to use the desired mands.

Both Del and Marco are examples of children who failed to benefit from FET and FCT interventions that appeared to be technically sound. In both cases, the functionally equivalent behaviors that were identified were well within their ability level. In both cases, the alternative behaviors required less physical effort than the problem behaviors and were made to be more efficient and effective than the problem behaviors through the use of differential reinforcement and extinction procedures. Despite the fact that appropriate situational prompting was provided to both children, efforts to encourage them to initiate the alternative behaviors did not produce positive results. Both boy's support teams believed that the primary barrier to success was the their inability to communicate the new behavior-consequence contingencies to the children. They hypothesized that a visual teaching aid might enable them to teach Marco and Del that the new, alternative behaviors were now the means through which they could get their needs met. As a result, a new strategy called *contingency mapping* was developed for Marco and Del.

Contingency Mapping

Contingency mapping is a method for graphically representing the complex environment-behavior relationships inherent in many behavior support plans. Contingency mapping is used in a PBS intervention to teach a child about the relationship between his or her behavior and the maintaining environmental consequences, and to teach the child to use a new behavior to achieve desired outcomes. Contingency mapping borrows from O'Neill et al.'s (1997) competing behavior diagram. Like the competing behavior diagram, contingency mapping graphically represents what alternative behaviors are desired, when those behaviors should be performed, and what the positive outcomes for the child will be. Simultaneously, contingency mapping is used to show what behaviors are <u>not</u> desired and that previously reinforcing consequence(s) will no longer be delivered upon the performance of problem behavior. In short, contingency mapping is a method for making the behavior support plan more transparent for a child by graphically depicting the current and alternative antecedent-behavior-consequence pathways related to the problem behavior. As such, contingency mapping must represent all of, and the relationships between, the following components: (a) the situations in which the problem and alternative behaviors are to occur, (b) the topography of both the problem and alternative behaviors, (c) the functional reinforcer(s) that will be provided contingent on alternative behavior, and (d) the previously-available functional reinforcer(s) that will no longer be provided contingent on problem behavior.

As described previously, both Marco and Del failed to respond to standard FET and FCT interventions. Because contingency mapping seemed to fit well with their learning style, this intervention was combined with the original FET and FCT interventions in an attempt to reduce their problem behaviors. Their stories continue in the sections that follow .

Marco's Story (FET/FCT + Contingency Mapping)

Because many members of Marco's team believed him to be a strong visual learner, a decision was made to depict the new antecedent-behavior-consequence contingencies of his support plan using a contingency map (see Figure 2).

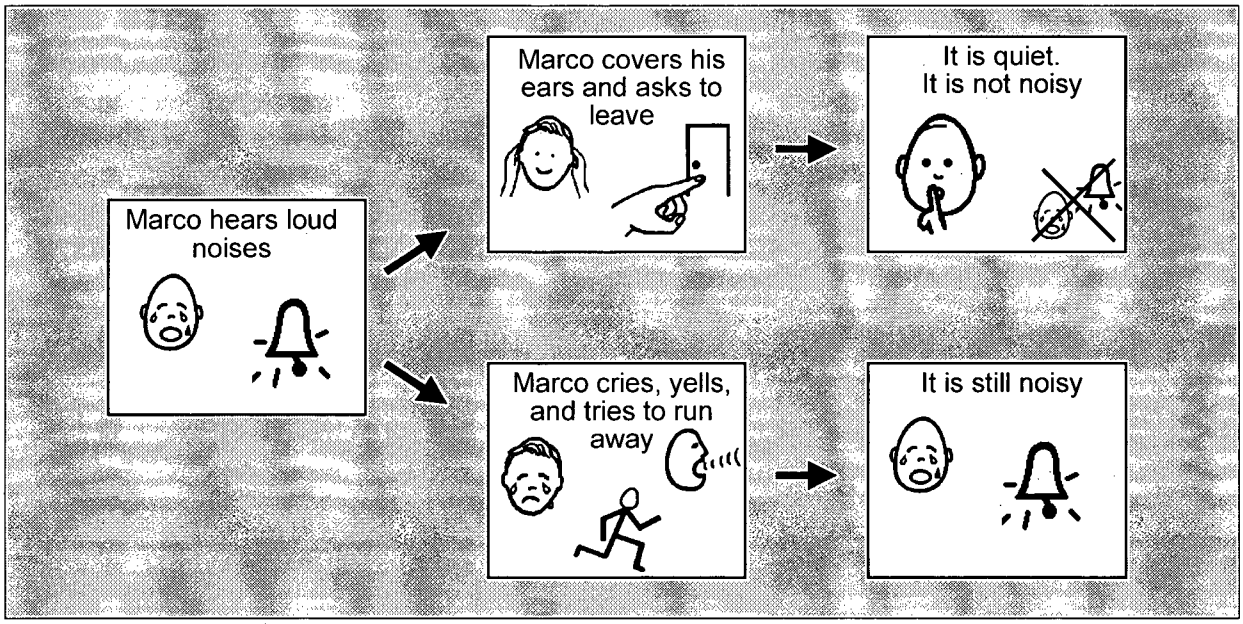

Figure 2. Contingency map developed for Marco to diagram the FET/FCT intervention. Images created from Boardmaker (1994) computer software using Picture Communication Symbols (Mayer Johnson, Inc., 1991-1994). Some Picture Communication Symbols were modified using MS Paint (1998) computer software.

Each image (i.e., component) on the contingency map and how the various components were related to one another were explained to Marco in simple terms. Specifically, he was told that, if he encountered noisy situations, he was no longer to tantrum, and that tantruming would not result in him getting away from the noise. He was also told that, in such situations, he should put his hands over his ears and ask to leave by pointing to the door. Marco was told that if he asked to leave he would be allowed to do so, to get away from the noise. It was hoped that by visually depicting the new environment-behavior relationships through the contingency map, Marco would better understand and therefore respond to the existing FET/FCT intervention.

The contingency map was presented to Marco throughout the day before every major transition, with a brief explanation. Within a few days, his problem behavior was reduced to near-zero levels and he began to respond to his educational assistant's prompts to place his hands over his ears and gesture to leave. These behavioral gains were maintained through the rest of the school year. It seemed that the contingency map assisted Marco to learn the new behavior-environment relationship that was being promoted by the FET/FCT intervention, and to understand what the team expected of him and what he needed to do in order to get his needs met.

Del's Story (FCT + Contingency Mapping)

As was the case with Marco, Del's support team indicated that Del had significant problems understanding complex spoken language and decided to use two related contingency maps depicting the new environment-behavior relationships inherent in his behavior support plan (see Figure 3). Immediately following presentation of the contingency maps, Del began using appropriate verbal speech to ask for (a) permission to sit on the sideline and watch the class in PE class and (b) help or a break during seatwork activities in his classroom. His problem behaviors were reduced to near-zero levels. In addition, Del began to participate in PE after watching his peers perform each new activity from the sideline and began to complete his grade one worksheets, at first with frequent breaks but gradually with fewer required. The dramatic reduction in Dels' problem behaviors was maintained throughout the remainder of his grade one year. In grade two, during which there were no incidents of SIB, screaming, and yelling (and very few incidents of crying), Del was voted the most popular child by his peers when Del's new teacher polled the students in order to form a new seating plan.

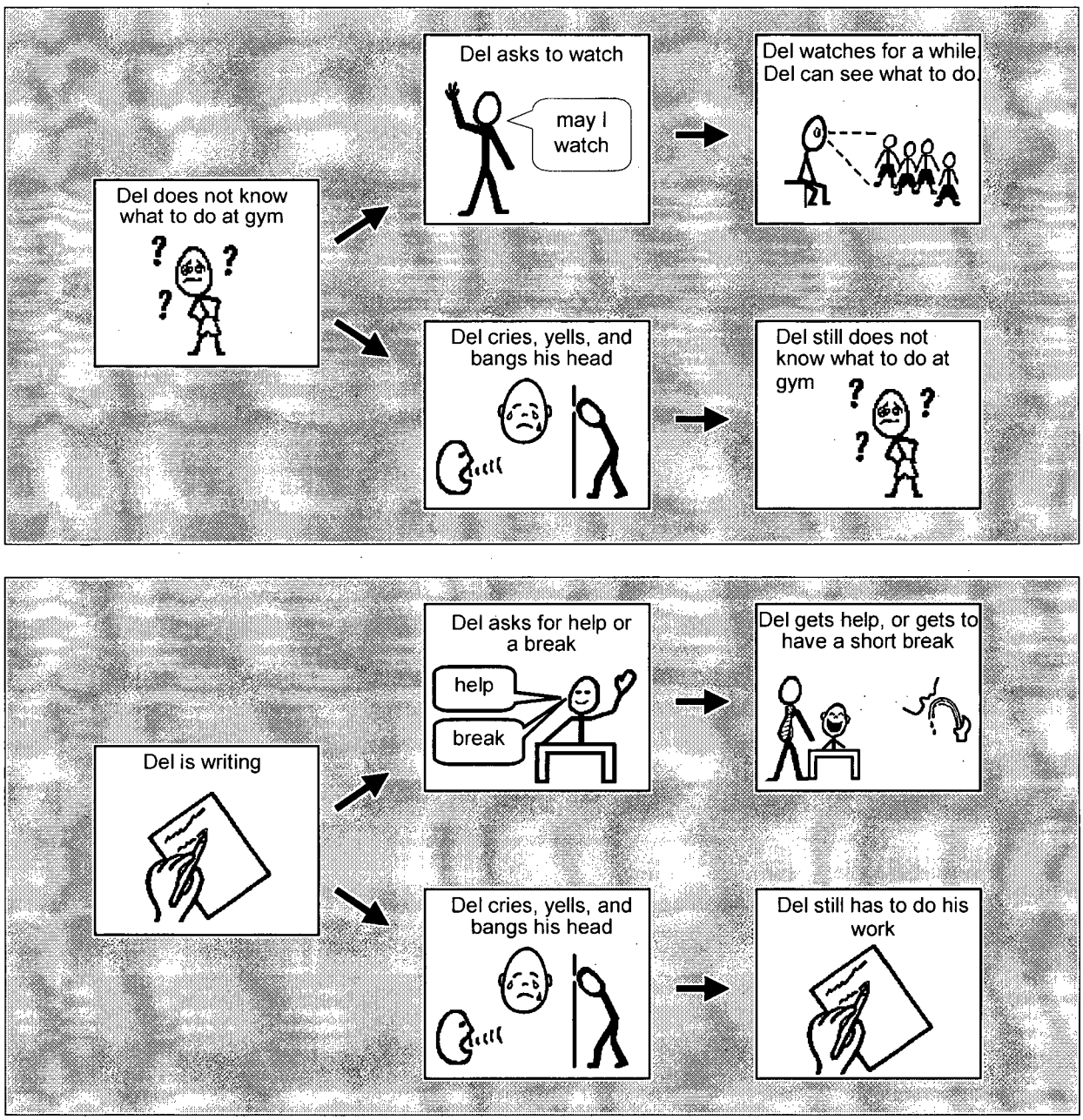

Figure 3. Contingency maps developed for Del to diagram FCT interventions in his gym class and with paper-and-pencil tasks. Images created from Boardmaker (1994) computer software using Picture Communication Symbols (Mayer Johnson, Inc., 1991-1994). Some Picture Communication Symbols were modified using MS Paint (1998) computer software.

Both Del's and Marco's stories illustrate logical, assessment-driven behavior support plans that were enhanced through the use of contingency mapping. Over the past 11 years of

providing behavior consultation, I have become convinced of the benefits of contingency mapping to graphically represent the contingencies of behavior support plans, and I have incorporated this procedure into many of the behavior support plans I have designed. I have come to believe that graphically depicting the contingencies of behavior support plans enhances the support team's ability to communicate the "rules" of the plan to children with receptive language challenges, thereby making the plan more transparent for the child. Though this belief seems logical, there exists no strong empirical research exploring the use of contingency maps or similar interventions.

Purpose of the Proposed Study

The purpose of the proposed study was to test the effectiveness of contingency mapping as an adjunct to behavior support plans that involve FET/FCT. The specific research questions addressed were (a) is there a functional relationship between the use of a contingency mapping intervention and decreases in a child's problem behavior?, and (b) is a contingency mapping intervention more effective at reducing behavior problems than a verbal contingency intervention?

CHAPTER 2

Review of the Literature

The information presented in this chapter will focus on two main areas. First, the literature related to the use of FET and FCT with persons with autism will be discussed. Second, because no research exists on contingency mapping *per se*, a review of similar visual support strategies for individuals with autism will be presented. Particular attention will be paid to the literature regarding between-activity schedules, within-activity schedules, and visually augmented social stories. Additional visual support interventions with less empirical support will also be discussed.

Functional Equivalence Training and Functional Communication Training

As noted previously, functional equivalence training (FET) is a behavior support strategy designed to reduce problem behavior by rendering it superfluous through the enhancement of an individual's repertoire of appropriate alternative behaviors that serve the same function. The theory behind FET is deceptively simple: if an individual is taught an appropriate means to meet his or her needs, the individual will have little need for the problem behavior.

Functional communication training (FCT) is a variant of FET. FCT is a set of procedures used to teach *communication* skills that match the function of an individual's problem behavior. The goal of FCT is to replace socially unacceptable behavior with an acceptable communicative response (Durand, Berotti, & Weiner, 1993; Durand & Merges, 2001). FCT differs from FET only with regard to the range of alternative behaviors that are available to be taught; FCT involves the teaching of communicative responses only, whereas FET involves the teaching of *any* alternative behavior that matches the function of the problem behavior. Regardless, the

procedures involved in implementing either FET or FCT include (a) performing a functional assessment to determine the function of and the conditions maintaining the problem behavior; (b) selecting an appropriate alternative behavior that is within the same functional class as the problem behavior and that meets specific requirements; (c) teaching the alternative behavior to the individual; (d) eliminating, as much as possible, the consequences that formerly maintained the problem behavior; and (e) making those consequences contingent on the performance of the new, alternative behavior.

This section will begin by describing strategies for conducting a functional assessment, the first step in developing FET and FCT interventions. A brief summary of the FET and FCT research will then be presented. Next, practical considerations that serve to enhance the effectiveness of these interventions will be discussed.

Functional Assessment

Functional assessment is the first procedure that must be conducted when developing FET or FCT intervention. Functional assessment can be thought of as a collection of techniques for gathering and analyzing relevant information regarding problem behavior. These techniques provide practitioners with a rationale for matching a particular intervention to a given individual's needs. The functional assessment literature contains several methods for assessing the relationship between problem behavior and environmental contingencies. In their description of these techniques, Iwata, Vollmer, and Zarcone (1990) organized the methods used by researchers and clinicians into three basic categories: *indirect assessment*, *descriptive analysis*, and *functional analysis*. Carr, Langdon, and Yarbrough (1999) echoed Iwata and colleagues' conceptualization, but used slightly different and more descriptive terms for the same three basic categories: *informant method*, *direct observation*, and *functional analysis*. For the purpose of this

discussion, Carr et al.'s terminology will be used. These three basic categories of functional assessment will be discussed below.

Informant methods. Informant assessment methods, such as the *Functional Assessment Interview Form* (FAIF; O'Neill *et al.,* 1997) and the *Motivational Assessment Scale* (MAS; Durand & Crimmins, 1988), provide efficient means for gathering information regarding functional relationships from the individual and/or others who know the individual well. Although informant assessment methods are used frequently by many practitioners, some investigators question their utility in isolation of more sophisticated functional analysis methods (e.g., Halle & Spradlin, 1993; Horner, 2000; Iwata et al., 1990; Zarcone, Rodgers, Iwata, Rourke, & Dorsey, 1991). Of particular concern are the possible confounding effects of interview style and characteristics of the informant-subject relationship (Halle & Spradlin, 1993), and the findings that some informant assessments are less reliable than observation and functional analysis techniques (Mace, 1994). Despite these shortcomings, informant methods have demonstrated considerable utility in FET and FCT research. Informant methods have been used as screening devices to narrow the range of possible functions to be tested in analogue functional analyses (e.g., Hagopian, Wilson, Wilder, 2001; Peck-Peterson, Derby, Harding, Weddle, & Barretto, 2002; Sprague & Horner, 1992) and have also been used in combination with direct observation methods to generate hypotheses about the function of problem behavior (e.g., Baker, 2000; Bird, Dores, Moniz, & Robinson, 1989; Kemp & Carr, 1995).

Direct observation. Direct observation techniques involve observing the individual engaged in everyday routines in his/her natural environment (Carr et al., 1999). Examples of this technique include the *scatter plot* (Touchette, MacDonald, and Langer, 1985) and the *Functional Assessment Observation form* (FAO; O'Neill et al., 1997). Although direct observation

techniques have been shown to be effective for identifying the salient characteristics of environment-behavior relationships (Carr & Carlson, 1993; Horner & Budd, 1985; Koegel, Stiebel, & Koegel, 1998), they have been criticized as being either too time consuming and expensive (Halle & Spradlin, 1993) or potentially failing to sample the full range of conditions that influence an individual's problem behavior (Horner, 2000). Nevertheless, direct observation methods have been used extensively in FET and FCT research to clarify the results of analogue functional analyses (e.g., Richman, Wacker, Asmus, & Casey, 1998) and, in combination with informant methods, to generate hypotheses about the function of problem behavior (e.g., Braithwate & Richdale, 2000; Jensen, McConnachie, & Pierson, 2001).

Functional analysis. The third and final strategy described by Carr et al. (1999) is functional analysis. This strategy was first employed in a study by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) in which the authors demonstrated that direct manipulation of environmental factors in analogue conditions could be used to determine the factors maintaining participants' problem behaviors. Several variations of functional analysis procedures have been used in subsequent FET and FCT research. However, all of these strategies share common elements toward a common goal – namely, to identify the functional relationship between specific environmental antecedents and problem behaviors. This is achieved through the direct, experimental manipulation of environmental variables that are believed to be either related to or *not* related to the behavior under investigation. Typically, an analogue control condition and at least one experimental condition are created by manipulating both antecedents and consequences. For example, in a control condition the researcher may provide a high level of positive attention (consequence) while the participant is engaged in an easy, preferred activity (antecedent). In one experimental condition the researcher may provide escape (consequence)

contingent on the occurrence of problem behavior during a difficult task (antecedent); while in a contrasting condition, the researcher may provided attention (consequence) contingent on the occurrence of problem behavior while the participant is engaged in an easy task (antecedent). The frequency of problem behavior is monitored while alternating the conditions, to determine when problem behavior is most likely to occur. In this way, specific environmental factors that maintain the occurrence of problem behaviors can be identified, along with their related functions. The two main criticisms regarding functional analysis procedures are that (a) the analog conditions may be too simplistic and too contrived to produce the target behavior, and (b) the high level of training required to conduct a functional analysis may limit the ability of some clinicians to conduct this form of assessment (Halle & Spradlin, 1993).

Together, the three assessment techniques described in this section provide a powerful array of options available to both researchers and clinicians. Because of the potential biases and problems that are inherent in all assessment techniques, most researchers employ a combination of approaches. Whether a researcher or clinician uses informant methods, direct observation, or functional analysis, the outcome is the same: the functional assessment provides information regarding an individual's problem behavior and the context in which it is performed. This information is vital to both FET and FCT interventions in order to tailor the interventions to achieve "goodness-of-fit" (Albin et al., 1996) with an individual's problem behavior and the context(s) in which it occurs. In order to further describe the relationship between functional assessment and intervention, representative selections of FET and FCT studies across functional classes (attention, tangible, escape, and sensory functions) are described below.

FET Interventions Across Functional Classes

Over the past several decades, numerous studies have demonstrated the effectiveness of FET with individuals with autism across functional classes. Barry and Singer's (2002) FET study that was designed to reduce problematic attention-seeking behaviors was discussed in the previous chapter, and demonstrated the effectiveness of teaching appropriate social interactions between a child with autism and his infant sibling. FET studies that were designed to reduce sensory-, escape-, and tangible-motivated behaviors will be discussed in this section.

Sensory-motivated behavior and FET. Richman et al. (1998) provided an example of an FET intervention designed to replace problem behavior that served a sensory function. In this study, Amy, a 27-year-old woman diagnosed with autism and profound mental retardation, engaged in SIB consisting of finger rubbing/picking. This problem behavior had produced lacerations and scabs on several of her fingers. The authors conducted a brief functional analysis and determined that the problem behavior served an automatic or sensory (i.e., "self-stimulatory") function. Richman et al. designed a FET intervention to teach Amy the alternative behavior of manipulating preferred objects such as toys. In addition, the authors physically prevented her from finger picking by blocking her attempts to do so, and thereby eliminated the sensory feedback she received from the problem behavior. This intervention was evaluated using a ABAB reversal design with a 3 month follow-up. Richman and colleagues showed that the FET intervention was immediately effective in reducing Amy's finger picking to near-zero levels across 100 sessions, and that the reduction was maintained over 3 months.

Escape-motivated behavior and FET. Hoch, McComas, Thompson, and Paone (2002) used FET to reduce the escape-motivated problem behavior of three children with autism who demonstrated SIB, aggression, or disruptive behavior. The results of a functional analysis

indicated that the problem behaviors of all three children enabled them to escape from difficult tasks and teacher demands in the classroom. The authors taught the children that task completion and compliance with teacher demands resulted in both escape from difficult tasks and access to preferred activities. They documented both substantial reductions in problem behaviors and dramatic increases in task completion as well as generalization across novel tasks and support personnel.

Tangible-motivated behavior and FET. Koegel et al. (1998) used FET to reduce tangible-motivated problem behavior in two young children with pervasive developmental disorders. Both participants demonstrated aggressive behavior toward their infant siblings. A functional assessment indicated that the majority of aggressive behavior served the function of enabling them to (a) access a toy held by the infants or (b) retain a toy in which the infants seemed interested. The FET intervention consisted of teaching the children with autism to provide their infant brothers with appropriate alternative toys to play with so that they could either attain or retain possession of the desired toys. This intervention was successful in producing immediate and substantial reductions in participants' aggressive behaviors to near-zero levels. Follow-up data indicated that the results were maintained at 4 months for one child and at 1 year for the other.

Multiply-motivated behavior and FET. All of the studies described previously were conducted with children who demonstrated problem behavior that served a single function. However, in real-world situations it is often the case that an individual may demonstrate problem behavior that serves multiple functions (e.g., escape, attention, and tangible). This was the case for Jon, an 11-year-old boy with autism and a mild mental handicap (Piazza, Moes, & Fisher, 1996). Jon engaged in severe aggression, SIB, disruption, and property destruction. Although the

problem behaviors often occurred during academic tasks, a functional analysis revealed that they were motivated by escape, attention, and tangible consequences. As an alternative behavior, Piazza and colleagues taught demand compliance – that is, they taught Jon to comply with teacher requests for work. The authors created "functional matching" by ensuring that Jon's compliance with teacher requests was reinforced with (a) short breaks from work, (b) teacher attention, and (c) preferred objects. Simultaneously, Jon's problem behaviors were placed on extinction – that is, they no longer resulted in escape from work, teacher attention, or access to preferred objects. A multi-element reversal design was used to test the efficacy of the intervention. During both baseline and an escape extinction condition, Jon's aggressive, destructive, and self-injurious behaviors increased dramatically. However, when the FET intervention was added, Jon's problem behavior decreased to near-zero levels across 28 sessions.

Breadth of FET research. The example studies described in this section were selected to demonstrate that FET interventions can be effective with individuals with autism across the four functional classes. FET interventions have been employed effectively with individuals with autism to teach a wide range of additional alternative behaviors as well, including (a) interactive play activities to replace sensory-motivated stereotypies or repetitive behaviors (Baker, 2000; Baker, Koegel, Koegel, 1998), (b) solitary leisure activities to replace escape-motivated disruptive behaviors and sensory-motivated stereotypies and SIB (Hanley, Iwata, Thompson, & Lindberg, 2000; Rincover, Cook, Peoples, & Packard, 1979), and (c) choice making of preferred objects to replace tangible-motivated aggression (Carr & Carlson, 1993). Table 1 summarizes the information from these studies, including the author, participant age and diagnosis, intervention setting, problem behavior, functional motivation, assessment technique, intervention used, and study outcome.

Table 1:

Summary of Selected FET Research Articles

Author	Participant (Age & Diagnosis)	Intervention Setting	Problem Behavior	Functional Motivation	Functional Assessment Method	Intervention	Outcome
Baker 2000	Ken (5, A); Wayne (5, A); Annie (6, A)	playrooms (G to school & home)	ritualistic behavior	presumed sensory	interview, observation	FET (play activities)	ISR-PB & ISI-AB; GE
Baker et al., 1998	Don (7, A); Amy (5, A); Jenny (8, A)	recess and lunch at integrated school	stereotypy	presumed sensory	interview, observation	FET (play activities) P-AB	ISI-AB, 1-2 mo. FU
Barry & Singer 2001	boy (10, A)	family home	aggression toward infant sibling	attention (parental)	observation	FET (appropriate child-infant interaction skills) & RB & Self-Management	ISR-PB & ISI-AB (across multiple PB & AB across time)
Carr & Carlson, 1993	Mark (18, A, MR); Danny (16, A, MR)	community (supermarket)	aggression	tangible	observation	FET (tangible choice); FCT-Verbal; Ext.; P-AB	ISR-PB & ISI-AB (Mark); GSR-PB & GSI-AB (Danny)
Fisher et al., 1994	Jeff (5, PDD, PMR); Tom (3, PDD, SMR)	Treatment room of inpatient unit	pica	presumed sensory	observation	FET (eating food), PUN	ISR-PB & ISI-AB, 9-month FU, GE/S (no effect without PUN)
Hanley et al., 2000	Jane (36, A, PMR, blind); Jake (46, A, PMR)	state residential facility	stereotypy	sensory	FA	FET (leisure materials), P-AB, & RB	ISR-PB & ISI-AB
Hoch et al., 2002	Mickey (9, A); Emily (11, A); Sean (10, A, MMR, sensory impairments)	small private segregated school (Mickey & Emily), segregated class (Sean)	aggression (Mickey); SIB (Emily); disruptive behavior (Sean)	escape academic/vocational tasks	FA	FET (work compliance), R+ (preferred activities)	ISR-PB & ISI-AB

Author	Participant (Age & Diagnosis)	Intervention Setting	Problem Behavior	Functional Motivation	Functional Assessment Method	Intervention	Outcome
Koegel et al., 1998	child 1 (5, A); child 2 (4, A-like); Child 3 (4, A)	family home	aggression toward infant sibling	tangible (toy), escape (noise)	observation	FET (give alternative toy to infant), FCT-V, & environmental manipulations P-AB	ISR-PB (child 1 & 2); GSR-PB (child 3)
Piazza et al., 1996	Jon (11, A, mild MR)	observation room in hospital	aggression, SIB, property destruction	escape of task	FA	FET (walk away, & new room, activity, social for task completion) & Ext	ISR-PB & ISI-AB
Piazza et al., 2002	Brandy (19, A, SMR, Cornelia de Lange); Sue (15, A, SMR)	state residential facility	Pica	sensory	FA	FET (preferred sensory objects) & increased effort for Pica	ISR-PB
Richman et al., 1998	Amy (27, A, PMR)	inpatient unit	SIB, disruptive behavior	escape(disruptive), sensory (SIB)	FA, observation	Sensory: FET (toy play) & RB/Ext., P-AB; Escape: FCT-AAC & Ext.	ISR-PB & ISI-AB; 3-month FU
Rincover et al., 1979	Larry (8, A, SMR); Reggie (9, A, visually impaired, SMR); Karen (10, A, SMR); Janet (8, A, SMR)	empty classroom	self-stimulatory behavior	Sensory (visual, proprioceptive, auditory)	FA	FET (leisure activities) & Ext	ISR-PB & ISI-AB; 1-13 mo. FU

Note. A = autism; ASD = Autism Spectrum Disorder; Ext = extinguish problem behavior; FA = analogue functional analysis; FCT-AAC = functional communication training-augmentative & alternative communication; FCT-V = functional communication training – verbal communication; FET = functional equivalence training; FU = Follow-up; GE/S= generalization of strategy & results to novel environment/support person; GSI-AB = gradual substantial increase in alternative behavior; GSR-PB = gradual and substantial reduction in identified problem behavior; GVI-AB = gradual varied increase in alternative behavior; GVR-PB = gradual varied reduction in problem behavior; ISI-AB = immediate substantial increase in alternative behavior; ISR-PB = immediate (within 3 sessions/days) and substantial reduction in identified problem behavior; M = maintenance; MA = mental age; MMR = moderately mentally retarded; MR = mental retardation; P-AB = prompt alternative behavior; PB = problem behavior; PDD-NOS = pervasive developmental disability-not otherwise specified; PMR = profoundly mentally retarded; R = redirect problem behavior; RB = response blocking; R+ = arbitrary highly preferred reinforcer; SIB = self-injurious behavior; SMR = severely mentally retarded; TO = time-out for problem behavior; PUN = punishment for problem behavior.

Table 1 shows that FET interventions have been employed effectively with individuals with autism from 3 years of age (Koegel et al., 1998) to 46 years of age (Hanley et al., 2000), across the range of intellectual ability from profound mental retardation (Hanley et al., 2000) to typical cognitive ability (Baker et al., 1998). FET interventions have also been employed in a number of different settings, including hospitals (Richman et al., 1998), residential facilities (Piazza, Roane, Keeney, Boney, & Abt, 2002), segregated classrooms (Hoch et al., 2002), integrated schools (Baker et al., 1998), family homes (Barry & Singer, 2001), and community settings (Carr & Carlson, 1993). Regardless of functional class, behavior topography, participant characteristic, or setting, all of the studies presented in Table 1 demonstrated immediate and sustained reductions in problem behavior and/or immediate sustained increases in alternative behavior following the implementation of the FET intervention.

Clearly, FET interventions have broad applications for individuals with autism across a range of problem behaviors, environments, and participant characteristics. FET has been used across the four functional classes of problem behavior. Similarly, FCT has been shown to be widely useful in the remediation of problem behavior with children with autism. A representative sample of FCT interventions across functional classes is presented in the section that follows.

FCT Interventions Across Functional Classes

In an elegantly designed research study, Carr and Durand (1985) employed functional analyses to generate hypotheses regarding the function of four individuals' problem behaviors. Based on these hypotheses, Carr and Durand taught the participants to engage in functionally equivalent communicative responses and demonstrated that these interventions

effectively eliminated the problem behaviors. In this, Carr and Durand provided the first clinical example demonstrating the utility of logical, assessment driven, functional communication training to reduce problem behavior. Since Carr and Durand's (1985) seminal FCT study, numerous additional reports have demonstrated the utility of teaching functional alternative communicative responses to individuals with autism in order to reduce problem behavior. A selection of FCT studies is presented below to demonstrate the utility of FCT across functional classes.

Escape-motivated behavior and FCT. Durand and Carr (1991) demonstrated the effectiveness of FCT with Tim and Hal, two 12-year-old children with autism who engaged in serious SIB and disruptive behavior in their classrooms. The authors first conducted a functional assessment and concluded that the boys' behaviors were motivated by escape from either frustrating, difficult tasks (Tim) or from directions that were stated in language that was too complex (Hal). The authors taught the children to request assistance by saying either *"Help me"* (Tim) or *"I don't understand"* (Hal). The boys' use of these mands was reinforced immediately with either task assistance (Tim) or by rephrasing and simplifying the misunderstood direction (Hal), and their problem behaviors were ignored. Immediately following implementation, both Tim's and Hal's problem behavior decreased dramatically as their use of the new communicative behaviors increased. For Tim, the intervention was maintained over 2 subsequent academic years. For Hal, follow-up measures in his second academic year showed a relapse; his problem behavior had returned to baseline levels despite his use of the phrase *"I don't understand,"* because his new teacher did not understand his speech. Hal was provided with several "booster sessions" from a speech-language pathologist who focused exclusively on increasing the intelligibility of his speech production.

Immediately afterward, Hal's problem behavior significantly decreased again, and was maintained over the next academic year as well. This study not only confirmed the utility of FCT to remediate escape-motivated problem behavior; it also extended the literature by demonstrating evidence of impressive durability and generalization of the new communicative behaviors. In addition, Hal's experience highlighted the need for selecting a communicative response that is both recognizable by a communication partner and successful at achieving the desired end result. These issues will be discussed in greater detail in subsequent sections of this chapter.

Tangible-motivated behavior and FCT. Horner and Budd (1985) published the first example of FCT used to decrease tangible-motivated problem behavior, with an 11-year-old boy with autism who was nonverbal and used manual signs to communicate. For this boy, a functional assessment revealed that aggressive behaviors (grabbing and yelling) served to gain access to preferred items or activities in the classroom. The boy was taught manual signs (JUICE, TIMER, CHOOSE, BOTTLE, and BOOK/FOLDER) to request each of the preferred items. Once the manual signs were taught in the classroom setting, the child showed an increase in appropriate manual sign use, accompanied by an immediate and substantial reduction in his aggressive behaviors.

Attention-motivated behavior and FCT. Durand and Carr (1992) provided an example of a FCT intervention designed for a child with autism who engaged in attention-motivated problem behavior. In this study, the oppositional and tantrum behavior of 4-year-old Jaynie was determined to serve the function of gaining teacher attention. The authors taught Jaynie to ask the teacher *"Am I doing good work?"* as an alternative way to obtain attention. Whenever Jaynie used the alternative phrase, she received brief teacher attention; conversely,

when she engaged in problem behavior, her behavior was ignored. Jaynie quickly learned to use the alternative phrase and, within four sessions, Jaynie's problem behavior had decreased from close to 100% of all intervals to near-zero levels. Jaynie continued to use the appropriate phrase to gain the attention of the new adults as well, and her problem behavior remained at near-zero levels.

Sensory-motivated behavior and FCT. FCT was applied to the remediation of autonomic or sensory-motivated problem behavior by Wacker et al. (1990). In this study, Barb, a nonverbal 30-year-old woman with profound mental retardation as a result of untreated phenylketonuria, demonstrated "almost continuous body rocking" (p. 419) which significantly interfered with her activities in her day program. The authors conducted a functional analysis of Barb's rocking behavior and hypothesized that it served a sensory function. As an alternative, Barb was taught to use a simple voice output communication device to request activities that resulted in similar types of sensory stimulation, such as a rocking chair or exercise bike. This FCT intervention was effective in dramatically reducing Barb's body rocking from 100% of the time during baseline to less than 10% of the time.

Breadth of FCT research. The FCT studies described in this section and in Table 2 effectively demonstrate the utility of reducing problem behavior of children with autism through the teaching of appropriate communicative behaviors.

Table 2:

Summary of Selected FCT Research Articles

Author	Participant (Age & Diagnosis)	Intervention Setting	Problem Behavior	Functional Motivation	Functional Assessment Method	Intervention	Outcome
Bird et al., 1989	Greg (27, A, PMR)	day program	SIB, aggression	escape	interview, observation	FCT-AAC (token exchange), R+, Ext or physical R	ISR-PB; GE/S
Braithwate & Richdale, 2000	Michael (7, A, MR)	segregated school	SIB & aggression	tangible, escape	interview, observation	FCT-V Ext., P-AB	ISR-PB & ISI-AB
Bowman et al., 1997	Jerry (12, PDD, ADHD, MMR, seizure disorder)	observation room in inpatient pediatric unit	property destruction	tangible	FA, interview, observation	FCT-V & PUN (response cost)	ISR-PB & ISI-AB (with PUN; limited effect with Ext.)
Campbell & Lutzker, 1993	Don (8, A)	home 1:1, home routine, & community	cry, scream, property destruction	tangible	observation	FCT-AAC (sign & gesture) & RB, R	GSR-PB & GSI-AB; GE
Carr & Carlson, 1993	Mark (18, A, MR); Danny (16, A, MR)	community (supermarket)	aggression	tangible	observation	FCT-Verbal & Ext., P-AB (FET choice, delay tolerance, & embedded demands also used)	ISR-PB & ISI-AB (Mark); GSR-PB & GSI-AB (Danny)
Carr & Durand, 1985	Jim (13, A, MR)	auxiliary classroom	aggression, tantrums, SIB, opposition	escape	FA	FCT-Verbal Ext.	ISR-PB & ISI-AB
Day, Horner, O'Neill, 1994	Brandi (9, A)	home	SIB & aggression	escape & tangible	FA	FCT-AAC (ASL) & Ext, P-AB	ISR-PB & ISI-AB
Durand & Carr, 1991	Tim (12, A, MMR); Hal (12, A, SMR); Ben (9, PDD, MMR)	segregated school	disruption (all), SIB (Tim, Hal)	escape (Tim, Hal, Ben), attention (Ben)	interview, FA	FCT-V & Ext.	ISR-PB & ISI-AB; 3 year FU (booster session for Hal)

Author	Participant (Age & Diagnosis)	Intervention Setting	Problem Behavior	Functional Motivation	Functional Assessment Method	Intervention	Outcome
Durand & Carr, 1992	Jaynie (4, A)	segregated school	opposition & tantrum	attention	interview, FA	FCT-V & Ext.	ISR-PB & ISI-AB; GS
Durand, 1999	Ron (9.5, A, SMR); David (11.5, A, SMR)	classroom & community	aggression (Ron), SIB (David)	attention (Ron), escape (David)	interview, FA	FCT-AAC (VO) & Ext.	ISR-PB & ISI-AB; GE/S
Fisher et al., 2000	Glen (19, A, PMR)	treatment rooms in in-patient unit	SIB, aggression, destruction	tangible	FA	FCT-AAC (sign) & Ext.	ISR-PB; ISI-AB
Frea, Arnold, Vittimberga, 2001	Tim (4, A, MMR)	integrated preschool	aggression	tangible implied	dose not specify	FCT-AAC (PECS) & P-AB	ISR-PB & ISI-AB
Hagopian et al., 2001	Preston (6, A, mild MR)	inpatient facility	aggression, disruption, SIB, spitting	escape (from attention), tangible	interview, FA	FCT-V & Ext., NCR	ISR-PB & ISI-AB
Horner & Budd, 1985	male (11, A, SMR	segregated class	grabbing & yelling	tangible	observation	FCT-AAC (sign) & Ext P-AB	ISR-PB; ISI-AB
Horner & Day, 1991	Peter (14, PMR, A tendencies) Mary (27, A, SMR)	group home (Peter & Mary), work setting (Mary)	SIB	escape	FA	FCT-AAC (sign or card)	ISR-PB; ISI-AB
Jensen et al., 2001	Gerald (35, A, MR)	400 person institution, community group home	SIB, assault, property destruction	tangible or sensory	interview, observation	FCT-V; FET (sit in chair); environmental changes	ISR-PB & ISI-AB (FCT); GSR-PB & GSI-AB (FET)
Keen, Sigafoos, & Woodyatt, 2001	Dave (7, A); Beth (3, A); Ian (4, A); Patrick (4, A)	part-time educational program classroom	pre-linguistic behaviors	Dave (attention & tangible); Ian, Patrick, Beth (tangible)	interview, observation, 'structured assessment'	FCT-AAC (gesture, sign, point to photo) & P-AB	GVI-AB to ISI-AB & GVR-PB to ISR-PB across 11/12 AB taught (1/12 AB not effective)

Author	Participant (Age & Diagnosis)	Intervention Setting	Problem Behavior	Functional Motivation	Functional Assessment Method	Intervention	Outcome
Kelley, Lerman, Van Camp, 2002	Gary (9, A, SMR)	unused school rooms	aggression	escape	FA	FCT-AAC (card) & Ext.	ISR-PB & GSI-AB (with FCT+Ext.); GVR-PB & GVI-AB (with FCT alone)
Kemp & Carr, 1995	Bill (28, A, SMR); Michael (26, A, SMR); Maggie (30, A, SMR	work placement	non-compliance (all), stereotypy(Michael), aggression (Bill, Maggie)	escape (all)	interview, observation	FCT-AAC (PCS; Bill & Michael); FCT-V (Maggie) & choice, rapport R+ for PB (escape)	ISR-PB & ISI-AB
Kennedy Meyer, Knowles, & Shulka, 2000	James (10, A, S-PMR)	school 1:1 room	stereotype	attention, escape, tangible	FA	FCT-AAC (ASL) & Ext, RB, P-AB	ISR-PB & ISI-AB (escape, tangible); GVR-PB & GVI-AB (attention)
Koegel et al. 1998	child 1 (5, A); child 2 (4, A-like); Child 3 (4, A)	family home	aggression toward infant sibling	tangible (toy), escape (noise)	observation	FCT-V, FET (give alternative toy to infant), environmental manipulations & P-AB	ISR-PB (child 1 & 2); GSR-PB (child 3)
Marcus & Vollmer, 1996	CJ (5, A)	empty room in school	SIB & tantrums	tangible	FA	FCT-AAC (gesture, sign, verbal) & Ext.	IVR-PB; ISI-AB
O'Neill & Sweetland-Baker, 2001	Randall (6, A, SMR); PJ (15, A, SMR)	self-contained classroom	aggression, destruction (Randall), SIB (PJ), running away (both)	escape	FA	FCT-AAC (card) & Ext.	GVR-PB to ISR-PB (PJ); GVR-PB to ISR-PB (across 4/5 tasks for Randall); no effect for 1/5 tasks
Peck-Peterson et al., 2002	Jolene (10, PDD-NOS, MMR)	school, home, community	aggression & swearing	attention, tangible, escape	interview, observation, FA	FCT-AAC (PCS) & TO & additional interventions	GSR-PB & GSI-AB

Author	Participant (Age & Diagnosis)	Intervention Setting	Problem Behavior	Functional Motivation	Functional Assessment Method	Intervention	Outcome
Richman et al., 1998	Amy (27, A, PMR)	inpatient unit	SIB, disruptive behavior	escape(disruptive), sensory (SIB)	FA, observation	Escape: FCT-AAC (micro-switch) & Ext. PB; Sensory: FET (toy play) & RB/Ext., P-AB	ISR-PB & ISI-AB; 3-month FU
Sigafoos & Meikle, 1996	Dale (8, A, M-SMR); Pete (8, A, M-SMR)	segregated classroom	aggression, SIB, disruption	attention & tangible	FA	FCT-AAC & Ext. (Dale); FCT-V & Ext. (Pete)	ISR-PB; ISI-AB
Sprague & Horner, 1992	Barbara (12, A, SMR)	segregated classroom	tantrum, aggression, SIB	escape, attention	interview, observation, FA	FCT-V & RB	ISI-AB; no effect on PB
Wacker et al., 1990	Bobby (11, A, S-PMR)	classroom in inpatient unit	SIB(severe hand biting)	tangible	FA	FCT-AAC (sign) & P-AB, TO	ISR-PB & ISI-AB (FCT+TO); no effect for FCT+Ext.

Note. A = autism; ASD = Autism Spectrum Disorder; Ext = extinguish problem behavior; FA = analogue functional analysis; FCT-AAC = functional communication training-augmentative & alternative communication; FCT-V = functional communication training – verbal communication; FET = functional equivalence training; FU = Follow-up; GE/S= generalization of strategy & results to novel environment/support person; GSI-AB = gradual substantial increase in alternative behavior; GSR-PB = gradual and substantial reduction in identified problem behavior; GVI-AB = gradual varied increase in alternative behavior; GVR-PB = gradual varied reduction in problem behavior; ISI-AB = immediate substantial increase in alternative behavior; ISR-PB = immediate (within 3 sessions/days) and substantial reduction in identified problem behavior; M = maintenance; MA = mental age; MMR = moderately mentally retarded; MR = mental retardation; NCR = non-contingent reinforcement; P-AB = prompt alternative behavior; PB = problem behavior; PCS = Picture Communication Symbols ®; PDD-NOS = pervasive developmental disability-not otherwise specified; PECS = Picture Exchange Communication System (Kirky & Frost, 2002); PMR = profoundly mentally retarded; PUN = punishment; R = redirect problem behavior; RB = response blocking; RC = response cost; R+ = arbitrary highly preferred reinforcer; SIB = self-injurious behavior; SMR = severely mentally retarded; TO = time-out for problem behavior.

Table 2 summarizes information from these studies, including the author, participant age and diagnosis, intervention setting, problem behavior, functional motivation, assessment technique, intervention used, and study outcome. As is evident from Table 2, most FCT studies with individuals with autism to date have demonstrated immediate, dramatic, and sustained reductions in problem behavior. A minority of studies have demonstrated more gradual but sustained reductions in problem behavior (Campbell & Lutzker 1993; Carr & Carlson, 1993; Peck-Peterson et al., 2002), and only a few studies have demonstrated variable or unsustained reductions (Keen et al., 2001; Kelly et al., 2002; Kennedy et al., 2000; O'Neill & Sweetland-Baker, 2001) or limited effects on problem behavior (O'Neill & Sweetland-Baker, 2001; Sprague & Horner, 1992). The gains made through FCT have been shown to generalize across settings and support persons (e.g., Bird et al., 1989; Durand, 1999), and have been shown to be durable up to 3 years follow-up (Durand & Carr, 1991).

Table 2 also shows that FCT interventions with individuals with autism have been applied across all four functional classes of behavior and have been effective with individuals ranging from 3 years of age (Keen et al., 2001) to 35 years of age (Jensen et al., 2001). FCT has been effective with individuals with autism across all levels of cognitive ability, from profound mental retardation (Richman et al., 1998; Bird et al., 1989) to average intelligence (Durand & Carr, 1992). In addition, these interventions have been applied in a variety of settings, including inpatient units, community group homes, family homes, segregated schools, integrated classrooms and preschools, day programs, integrated workplaces, and community settings (Bird et al., 1989; Braithwate & Richdale, 2000; Day et al., 1994; Durand 1999; Frea et al., 2001; Hagopian et al., 2001; Kemp & Carr, 1995; Koegel et al., 1998). Problem behaviors treated with FCT have included SIB, aggression, property destruction, disruptive behavior, running away,

stereotyped behavior, and non-compliance (Jensen et al., 2001; Kemp & Carr, 1995; Kennedy et al., 2000; Marcus & Vollmer, 1996; O'Neill & Sweetland Baker, 2001; Richman et al., 1998; Sigafoos & Meikle, 1996).

Although teaching an alternative behavior in the same functional class is the most essential component of both FET and FCT interventions, several additional factors also serve to increase the likelihood of successful treatment. These factors were described in some detail by Durand and his colleagues (Durand et al., 1993; Durand & Merges, 2001) and are discussed in the section that follows.

Considerations for Enhancing the Efficacy of FET and FCT Interventions

Although the logic behind FET and FCT is uncomplicated, several factors should be considered in order to ensure successful outcomes. These factors include *response matching*, *response mastery*, *response milieu*, and the *consequences available* for problem behavior (Durand et al., 1993; Durand & Merges, 2001).

Response matching. Response matching requires the selection of a behavior (or response) that is in the same functional class as the problem behavior (Durand & Merges, 2001). As discussed previously, the procedures involved in ensuring a response match include (a) performing a functional assessment of the problem behavior, (b) selecting an alternative behavior that is logically linked to the same consequence as the problem behavior, and (c) providing environmental control to ensure that the consequences maintaining the problem behavior are delivered in response to the presentation of the alternative behavior.

Carr and Durand (1985), in their seminal demonstration of FCT, clearly evidenced the need for response matching. The study involved four children with developmental disabilities, including one with autism, who displayed a variety of aggressive and disruptive behaviors. Using

the techniques of functional analysis, Carr and Durand determined that the problem behaviors of two of the children were maintained by teacher attention, while the problem behavior of the others were maintained by escape from difficult tasks. The children were placed in situations that were likely to illicit problem behavior (i.e., either difficult tasks or situations of low adult attention). During some sessions, the children were taught to use relevant communicative phrases, including "*I don't understand*" to elicit assistance during difficult tasks, and "*Am I doing good work?*" to elicit teacher attention during situations of low attention. To test the need for response matching, the children were also taught to use *irrelevant phrases* during control sessions – that is, they were taught to say "*Am I doing good work?*" during difficult task conditions, and "*I don't understand*" during low-attention conditions. The conditions were varied using an ABACA reversal design. Consistent with the principles of response matching, the children's problem behavior increased to baseline levels during the conditions when irrelevant phrases were taught, and their use of the irrelevant phrases decreased to near-zero levels. However, during sessions when the children were taught to use relevant, functionally equivalent phrases, their problem behaviors quickly reduced to near-zero levels and their use of the relevant communicative phrases concurrently increased. These findings were replicated by Brown et al., 2000 and unequivocally demonstrate the need for response matching when conducting FCT interventions.

Although response matching has been shown to be a necessary component of FET and FCT interventions, it may not be sufficient to produce meaningful behavior change. In their discussion regarding FCT procedures, Durand and colleagues (1993, 2001) argue that clinicians and researchers also need to consider (a) the relative ability of the alternative behavior to evoke the desired outcomes, (b) factors in the teaching environment that may effect the child's learning,

and (c) what approach will be taken with the child when inappropriate behaviors occur. These considerations are discussed below.

Response mastery. In addition to response matching, Durand and Merges (2001) argued that response mastery should also be considered by those teaching alternative replacement behaviors. Durand and Merges defined response mastery as the ability of the alternative behavior to produce the desired consequence. The authors discuss four interrelated components of response mastery: response efficiency, response success, response acceptability, and response recognizability.

According to Durand and Merges (2001), *response efficiency* refers to the degree to which the alternative behavior is effective in gaining the desired consequences. The importance of response efficiency on the efficacy of FCT interventions was investigated by Horner and Day (1991). In this influential study, three experiments were conducted with Peter, Paul, and Mary, who were labeled as having cerebral dysgenesis, autistic tendencies, and autism, respectively. The first of three experiments was conducted with Paul, who engaged in escape-motivated behaviors. This experiment was designed to evaluate whether the level of physical effort required to communicate would influence the effectiveness of the FCT intervention. To evaluate this, Paul was taught to gain a from work break by either (a) signing I WANT TO GO, PLEASE or (b) simply signing BREAK. Signing the phrase was considered to require high effort, compared to signing BREAK alone. These two conditions were presented using an ABC design that demonstrated that, as the authors predicted, the level of response effort influenced the effectiveness of treatment. During the high effort condition, Paul's aggression remained high and his use of the signed phrase was minimal, while during the low effort condition, Paul's aggression immediately decreased to near-zero levels as his use of the single sign for BREAK

increased. This research is consistent with other studies, including FET research, that have found the level of physical effort to influence an individual's use of functionally equivalent behaviors (e.g., Shore, Iwata, DeLeon, Kahng, & Smith, 1997)

The second experiment by Horner and Day (1991) investigated the role of schedule of reinforcement on FCT efficacy. This experiment was conducted with Peter, who engaged in escape-motivated SIB. Peter was taught to use the manual sign HELP to gain assistance and thereby escape a difficult task. To test whether the schedule of reinforcement would affect the effectiveness of the FCT intervention, the authors varied the ratio of reinforcement. During the high ratio condition, Peter was immediately given assistance each time he signed HELP. However, during the low ratio condition, Peter was only provided with the desired assistance every third time he signed HELP. The low ratio reinforcement condition was ineffective at decreasing Peter's SIB and increasing manual sign use, whereas the high ratio condition was effective at reducing Peter's SIB to zero-levels as he produced increasingly frequent requests for help.

In their third experiment, Horner and Day (1991) assessed whether delay of reinforcement would affect the effectiveness of an FCT intervention. For this experiment, Mary, who engaged in escape-motivated aggression, was taught to use a card with the printed phrase I want a break, please to gain a break from difficult tasks. Across sessions, the authors varied their responsiveness to Mary's use of the break card by providing her with a break after either a 1 second or a 20 second delay. When Mary was provided with breaks within 1 second after her use of the card, her aggressive behavior decreased to near-zero levels and her use of the break card increased. However, when the period of delay was increased to 20 seconds following her use of the card, Mary failed to use it and her problem behavior increased to baseline levels. Altogether,

Horner and Day's (1991) three experiments effectively demonstrated the importance of physical effort, the schedule of reinforcement, and reinforcement delay on the success of FCT interventions. These findings have been replicated across a number of subsequent studies (e.g., DeLeon, Fisher, Herman, & Crosland, 2000; Horner et al., 1990; Piazza et al., 2002, Zhou, Goff, & Iwata, 2000).

Response success, another component of response mastery, refers to whether or not other people respond to the alternative behavior. Factors that influence response success include *response recognizability* (i.e., the degree to which others are able to interpret the alternative behavior accurately) and *response acceptability* (the degree to which others find the alternative behavior socially acceptable). Both of these factors have received empirical scrutiny and have been shown to impact upon the success of FCT interventions. Durand and Carr's (1991) FCT study that was described previously provides a clear example of how response recognizability can influence response success. In this study, Durand and Carr effectively used FCT to teach Hal to say *"I don't understand"* in order to request adult rephrasing of complex directions. As noted previously, Hal's violent tantrums and SIB were significantly reduced during the first school-year after FCT implementation. However, during the second year following intervention, his problem behavior increased to baseline levels despite his persistent use of the phrase *"I don't understand"* because the intelligibility of his speech was poor. The authors decided to provide Hal with brief speech-language therapy that was designed to improve the intelligibility of the phrase *"I don't understand."* Following these booster sessions, Hal's teacher, who was now able to understand what he was saying, began to respond appropriately to Hal's requests for rephrasing and his problem behavior decreased dramatically.

Response acceptability. A final component of response mastery is response acceptability. Durand and Merges (2001) refer to response acceptability as the degree to which others find the alterative behavior acceptable. Although there is very limited research of response acceptability, Durand and Kishi (1987) provide two interesting examples of the importance of considering whether others find the alternative behavior to be satisfactory. The authors selected for the study, five individuals who had dual sensory impairments and severe to profound intellectual challenges. For three of the participants, the FCT intervention was immediately effective in reducing the problem behavior. However, for two participants, Lew and Kim, the FCT intervention failed to produce meaningful change at school and in the group home, respectively. This failure was evidenced despite the initial success of the intervention during training conducted by the researchers. Durand and Kishi reported that, for Lew, the staff failed to implement the FCT intervention at school: they refused to accept Lew's use of a token to gain preferred leisure objects and activities. Therefore, Lew continued to engage in self-injurious behavior to gain these items. Durand and Kishi were unable to persuade the school staff to accept Lew's alternative behavior.

For Kim, the group home staff initially refused to accept her gesture (hand raising) as a means to gain staff attention (i.e., a means to communicate the message "Come spend some time with me"). When interviewed, staff informed the authors that they often did not have time to stop doing chores in the group home in order to respond to Kim's request for attention (Durand & Merges, 2001). In response to this feedback from staff, the authors reframed the message communicated by Kim's hand raising and told Kim's group home staff that, when Kim raised her hand, she was communicating the message "Can I help you?" Thus, when she raised her hand, she was asking to help the staff with their onerous chores (Durand & Merges, 2001). The group

home staff universally accepted this reframed message and immediately began responding to Kim's raised hand by including her in chores thus providing her with attention. Following this, the FCT intervention resulted in dramatic reductions in Kim's problem behavior and increases in her use of the alternative clapping behavior. The two examples of Kim and Lew highlight the need for response acceptability: if the alternative behavior is not acceptable to all communication partners, it may not be consistently reinforced and may fail to produce meaningful behavior change.

Response milieu. Durand and Merges (2001) discussed environmental factors as a third important consideration when implementing FCT/FET interventions. Though they noted that only minimal research has been conducted on environmental factors that promote success, generalization, and maintenance of FET/FCT interventions, they identified three factors that seem to be important in this regard: (a) the level of control or choice available to the individual in the teaching environment, (b) whether individuals with disabilities in the environment are heterogeneously or homogeneously grouped, and (c) the level of direct support available to the individual. Durand and Merges argued that it is important for implementation environments to foster a high level of personal choice and control; to incorporate heterogeneous client groupings to avoid staff overload; and to offer adequate direct support, staff training, and cross-environmental collaboration.

Consequences for alternative and problem behavior. The fourth, and perhaps the most controversial, issue in the FET/FCT literature pertains to the consequences available following the child's demonstration of the alternative and problem behavior. In FET/FCT interventions, the consequences following the alternative and problem behavior are manipulated so that the individual becomes motivated to adopt the more acceptable alternative behavior rather than use

the problem behavior. Typically, researchers elect to implement interventions that utilize contingent functional reinforcement for alternative behaviors and either place the problem behavior on extinction or utilize lower-than-usual rates of contingent reinforcement. However, within the FET/FCT literature, a range of other options also exist regarding the consequences used for both the alternative and problem behaviors.

One option is to provide highly motivating but arbitrary reinforcement for the alternative behavior in addition to functional reinforcement in order to increase motivation. Such a combined reinforcement "cocktail" may be advantageous when (a) the alterative behavior is not as efficient as the problem behavior at eliciting the functional reinforcer and/or (b) extinction cannot be used as a response to the problem behavior. Arbitrary reinforcers can also be added to encourage more socially desirable alternative behaviors from a larger array of potential alternative behaviors. Although in the minority, a number of FET and FCT studies have used a combination of functional and highly preferred arbitrary reinforcers successfully (e.g., Clarke, Worcester, Dunlap, Murray, & Bradley-Klug, 2002; Healey, Ahearn, Graff, & Libby, 2001; Hoch et al., 2002; Vaughn, Wilson, & Dunlap, 2002).

As an example of this type of consequence, Hoch et al. (2002) attempted to change the escape-motivated self-injurious, aggressive, and disruptive behaviors of three children with autism by teaching them functionally equivalent behaviors. In addition to providing escape contingent on the desired alternative behaviors, the authors also provided the children with contingent, highly preferred tangible reinforcers (i.e., preferred activities). This combination was used because the authors felt that it was often not feasible to attempt to extinguish problem behaviors in natural settings. They reported substantial and sustained reductions in problem behavior and concurrent increases in alternative behaviors following the implementation of this

FET intervention. For two of the three participants, the authors then attempted to compare the effects of an FET intervention that employed only contingent escape with an FET intervention that used the combination of escape + tangible reinforcement. For both participants, the FET intervention with escape only produced results similar to baseline (i.e., a dramatic and sustained increase in problem behavior and concurrent decrease in alternative behavior), whereas the FET + combined reinforcement intervention produced results similar to those described above. With this study, Hoch and colleagues demonstrated the power of combining functional reinforcers with highly preferred arbitrary reinforcers.

Perhaps more contentious than the use of a functional + arbitrary reinforcement combination for alternative behavior is the use of punitive behavior reduction techniques to discourage problem behavior. The studies summarized in Tables 1 and 2 provide evidence that extinction has been used successfully in 60% of FCT studies and 33% of FET studies as the primary response to problem behavior. Although extinction is usually effective, some authors have found that the inclusion of punishment within FCT and FET treatment packages was needed (e.g., Bowman et al., 1997; Fisher et al., 2000; Fisher et al., 1994; Fisher et al., 1993; Grace, Kahng, & Fisher, 1994; Hagopian et al., 1998; Perry & Fisher, 2001; Peck-Peterson et al., 2002; Wacker et al., 1990). One example of an FET intervention that incorporated punishment procedures was Fisher et al. (1994). The study involved three children between 3 to 5 years of age who had severe to profound intellectual disabilities; two were also diagnosed with PDD. All three children had been admitted to an in-patient unit for treatment of severe pica, which included eating inedible objects such as feces, broken glass, insects, and cigarette butts. The authors first tested whether providing unrestricted access to preferred foods and reinforcing the children for eating under specific stimulus conditions would decrease pica. However, this FET

intervention was insufficient to reduce the children's problem behavior. Fisher and his colleagues then implemented an intervention that combined access to preferred food, reinforcement for eating the food, and a punishment procedure for pica. The punisher used for each child was facial screening (i.e., covering the child's eyes with an experimenter's hand) for 30 sec. The combined FET + punishment intervention effectively reduced pica to near zero levels in all three children. The results were maintained over a 9-month follow-up period, and generalized across environments and support persons.

A study that employed FCT and punishment was Wacker et al. (1990). The study involved three participants (Bobby, Barb, and Jim) who were exposed to various intervention packages designed to reduce SIB, stereotypy, and aggressive behavior, respectively. The authors conducted the requisite functional assessments to determine the consequences maintaining the problem behaviors. Barb's intervention, which was discussed previously, showed that FCT + extinction was sufficient in reducing her stereotypic rocking behavior to near-zero levels while increasing her use of an alternative communicative response. However, the combination of FCT + extinction failed to reduce Bobby's SIB and Jim's aggressive behavior. After a graduated guidance procedure was added to Jim's FCT intervention, his aggressive behavior decreased and his use of an alternative communicative response increased. FCT + a time-out procedure was required in order to reduce Bobby's SIB to near-zero levels, after which the authors reverted back to FCT + extinction. However, Bobby's SIB relapsed under this condition and, when FCT + time-out was again implemented, his SIB immediately decreased again.

The study by Wacker et al. (1990) appeared to demonstrate that FCT + extinction may not be sufficient to reduce problem behavior and teach alternative communication responses to some individuals with autism. Durand and Merges (2001) proposed that this may occur because

of insufficient "behavioral contrast" (p. 117) – that is, the extent to which the consequences that follow the new, alternative behavior are markedly different from those that occur after the problem behavior. A hierarchy of responses to problem behavior may include, from the smallest to the largest amount of behavioral contrast: (a) making problem behavior less efficient by requiring more than one instance of it before reinforcement is provided; (b) extinguishing problem behavior, and (c) providing punishment contingent on the occurrence of problem behavior. While the amount of contrast provided by extinction appears to be sufficient for most individuals, it may be insufficient for others who require a consequence that is more salient (e.g., Hoch et al., 2002; Lerman, Kelley, Vornadran, Kuhn, & LaRue, 2002; Worsdell, Iwata, Hanley, Thompson, Kaung, 2000). In accord with this logic, such individuals may require the use of a mild punishment procedure in order to more readily comprehend the change in contingencies. When an individual is provided with an intervention package consisting of FCT + punishment, the problem behavior not only ceases to be reinforced, it begins to function as the antithesis of what was desired by the individual (e.g., if the problem behavior originally served to gain attention, time-out from attention may be provided contingent on the problem behavior). Thus, the individual may be better able to comprehend the new contingencies because more dramatic differences exist between the consequences for problem and alternative behaviors.

As noted by Durand and Merges (2001), the use of punitive techniques with FET/FCT interventions is contentious. Although some individuals appear to respond better to FET or FCT interventions that are combined with punishment procedures to enhance behavioral contrast (e.g., Bowman et al., 1997; Fisher et al., 2000; Fisher et al., 1994; Fisher et al., 1993; Hagopian et al., 1998; Perry & Fisher, 2001; Wacker et al., 1990), PBS researchers and clinicians "eschew the use of aversive consequences" (Lucyshyn et al., 2002, p. 7) that result in physical pain, loss of

dignity, or humiliation (Horner et al., 1990). If the power of providing greater behavioral contrast is related to increasing an individual's *awareness* of the change in contingencies associated with FET/FCT interventions, there may be educative strategies that can be employed in conjunction with FET/FCT to better enhance this awareness. The present research is designed to test the utility of one such adjunct intervention, contingency mapping.

Contingency Mapping: An Alternative to Punitive Behavior Reduction Techniques with FET/FCT Interventions

As described in Chapter 1, contingency mapping is a method for graphically representing the complex environment-behavior relationships inherent in most positive behavior support plans. Contingency mapping is used to visually represent the changes in behavior-consequence relationships that are associated with behavior support interventions, and to teach a client how to use a new behavior to gain reinforcement. Contingency mapping graphically represents the desired behaviors, when they should be exhibited, and the positive outcomes that will result from their use. Simultaneously, contingency mapping depicts the undesired behaviors and the fact that previously reinforcing consequences will no longer be available following problem behavior.

Currently, no research exists with regard to the use of contingency mapping as an adjunct to FET/FCT positive behavior support plans. However, because contingency mapping is a visual support strategy, it is similar to other visual support strategies that have been used widely with children with autism, including within-activity schedules, between-activity schedules, and visually augmented social stories. The following section will present a brief review of these visual support strategies in order to garner insights regarding the potential use of contingency mapping with children with autism.

Visual Support Literature for Children With Autism

Visual supports may be defined as instructional aids designed to enhance comprehension and learning through the presentation of visual materials. The specific visual media used may take various forms, but the underlying concept is that they are used to facilitate learning and understanding. Wood, Lasker, Siegel-Causey, Beukelman, and Ball (1998), in their presentation of an input framework for augmentative and alternative communicatio*n*, referred to this as "augmenting the message" – assisting an individual to receive and make meaning of information more accurately and efficiently. Specifically, Wood et al. conceptualized strategies used to augment the message as enhancing the meaning, salience, and comprehension of a written or spoken message through the use of pictures, symbols, or other AAC techniques.

Within-activity schedules, between-activity schedules, and visually augmented social stories are all examples of strategies designed to augment the message. From Wood et al.'s (1998) perspective, one can understand these visual supports as AAC input techniques designed to increase an individual's comprehension of verbally conveyed messages, environmental expectations, and upcoming events. Because most individuals with autism are strong visual learners (Grandin, 1995; Hodgdon, 1995, 1996; Lincoln, Courchesne, Kilman, Elmasian, & Allen, 1988), use of the visual medium for instruction is likely to facilitate their ability to make sense of and provide meaning and order to the complex social world in which they live (Quill, 1995a). In so doing, visual support strategies appear to alleviate at least some of the confusion, anxiety, and frustration that most individuals with autism appear to experience when they encounter unexpected events. Such strategies may also facilitate their ability to understand social situations and cause-and-effect relationships, and facilitate their ability to learn new skills and alternative behaviors. The end result is often a reduction in problem behaviors that are used to

escape from confusing and novel situations. The research on the most commonly-used visual support strategies -- between-activity schedules, within-activity schedules, and visually augmented social stories -- will be reviewed in the sections that follow.

Between-Activity Schedules

It has long been noted by researchers and clinicians that individuals with autism often excel in highly structured environments (Dawson & Osterling, 1997; Quill, 1995a, 1995b). Early research focused on providing such individuals with a high degree of consistency and stability with regard to schedules, activities, staffing patterns, and physical space (Schopler, Brehm, Kinsgourne, & Reichler, 1971). Although this research concluded that positive behavior and learning outcomes could be achieved through a high degree of consistency (Olley, 1987), maintaining such consistency within real-world situations is extremely difficult for parents, teachers, and others to achieve. As a result, more recent research has attempted to uncover *why* individuals with autism seem to excel in highly structured environments (Flannery & Horner, 1994). This research has lead to an understanding that predictability and understanding is an important feature of such environments, and that many persons with autism seem to prefer environments and activities that afford the ability to predict future events accurately (Flannery & O'Neill, 1995). Because family, school, and community life is often impossible to arrange consistently from day-to-day, strategies are needed to help individuals with autism better understand and predict their ever-changing routines and schedules.

Between-activity schedules are interventions that pictorially represent a sequence of planned activities. Between-activity schedules were developed to provide individuals with autism with increased predictability and understanding regarding upcoming events. Often, these individuals are told of upcoming events and informed of their schedules verbally; however, they

may not comprehend the language used to describe the sequence of events. Visual aids in the form of between-activity schedules may be used to augment the verbal message and enhance understanding. Typically, picture symbols representing a series of activities are presented in sequential order to inform individuals of their scheduled activities across time. To cue a change in activities, the entire schedule may be depicted pictorially, with a problematic transition point and upcoming activity highlighted (e.g., Clarke, Dunlap, & Vaughn, 1999; Dooley, Wiczenski, & Torem, 2001; Flannery & Horner, 1994; Newman et al., 1995). Alternatively, a single picture from the schedule may be presented to depict the next activity in a sequence (e.g., Bryan & Gast, 2000; Krantz, MacDuff, & McClanahan, 1993; MacDuff, Krantz, & McLannahan, 1993; Schmit, Alper, Raschke, & Ryndak, 2000). Regardless, between-activity schedules ensure that salient cues related to transitions are provided. Figure 4 shows an example of a hand-drawn between-activity schedule representing the morning routine of a young child with autism.

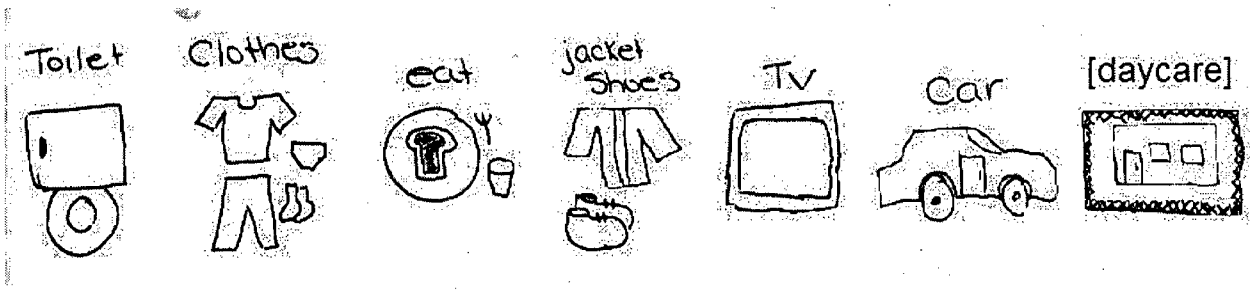

Figure 4. Between-activity schedule of a morning routine for a young child with autism.

There is growing body of research supporting the use of between-activity schedules with children with autism. In the past 10 years, over 12 studies investigating the effects of using scheduling systems with children with autism have been published. Table 3 presents a summary of these studies, including information about the participants, settings, problem behaviors, schedule types, symbol sets, and outcome measures for each study.

Table 3:

Summary of Selected Between-Activity Schedule Research Articles

Authors	Participants (age, diagnosis)	Setting	Problem behavior/ context	Schedule type (& concurrent intervention)	Outcome
Arntzen, Gilde & Pedersen, 1998	girl (14, autism)	classroom and kitchen of residential treatment centre	aggression & property destruction	photographs in binder (token economy R+)	GSI on-task behavior
Bryan & Gast, 2000	Alan (8, autism); Tim (8, autism); Jack (8, autism); Jenny (8, autism)	pull-out resource classroom	off-task behavior/ language arts	line drawings in small photo album, 1 photo per page	ISI in on-task & on-schedule behavior to near-100% levels
Clark et al., 1999	John (10, Asperger's syndrome)	family home, during morning routine	disruptive, tantrum, off-task behavior/ during verbal demands	Pictures & word labels Velcro®ed to a sheet (+ task modifications, & reinforcement)	ISR-PB to near-0 levels, ISR in time to complete routine, ISI in on-task behavior to near-100% levels, anecdotal GEN
Dettmer et al., 2000	Jeff (32 mo, autism, SMR); Josh (5, PDD)	community outings (Jeff); in-home 1:1 program (Josh)	non-compliance/ transitions between activities	line drawing attached to sheet (+ timer and written within-activity schedule for Josh)	ISR-PB to 30% of baseline, anecdotal GEN
Dooley et al., 2001	Chris (3, PDD)	half-day segregated special education preschool	disruptive & aggressive behavior/ verbally prompted classroom activity changes	line drawings sequenced on one page	ISR-PB to near-0 levels; ISI in transition compliance, anecdotal FU & GEN to end of school year
Dunlap & Fox, 1999	Mario (32 mo, PDD); Larry (37 mo, PDD); Noah (44 mo, PDD); Tom (29 mo PDD); Anthony (33 mo, PDD)	family home (and childcare setting for Tom)	tantrum behavior/ play routines with parent and support person	visual activity schedule (as part of a multi-component support plan)	GSR-PB to 0 or near-0 levels, GEN
Flannery & Horner, 1994	Aviv (16, autism, mild cerebral palsy & MMR)	self-contained special education classroom	property destruction & aggression/ instructional sessions with unpredicted sequence & duration	page with printed sequence of activities (and timer)	ISR-PB to near-0 levels; anecdotal GEN

Authors	Participants (age, diagnosis)	Setting	Problem behavior/ context	Schedule type (& concurrent intervention)	Outcome
Krantz et al., 1993	Jack (8, autism); Jay (6, autism); Mike (7, autism)	family home	disruptive & aggressive behavior/ transitions (reported for only one participant)	photograph schedule in three ring binder, 1 photo per page	ISR-PB to near-0 levels, ISI in on-task behavior to near-90% levels
MacDuff et al., 1993	Mike (9, autism); Walter (9, autism); Steve (11, autism); Roy (14, autism)	community-based teaching-family model group home	off-task behavior/ unstructured leisure & homework activities	photograph schedule in three ring binder, 1 photo per page	ISI-PB on-task & on-schedule behavior to near-100% levels
Newman et al., 1995	Scott (14, autism, MMR); Peter (16, autism, MMR); Alex (17, autism, MMR)	after-school program in a public school	prompt dependence/ unattended activities	list of sequenced activities and time (plus timer and self-monitoring)	GSI independent identification of transition to near-75% & 85% for Scott & Peter, variable improvement for Alex, 1-mo FU
Schmit et al., 2000	Alex (6, autism)	segregated early childhood special education class	disruptive & aggressive behavior/ transitions & physical guidance	photograph cueing of upcoming activity during transition	ISR-PB to near-0 levels for 2 environments, GSR-PB to near-0 levels for 1 environment

Note: FU = Follow-up; GEN = generalization of strategy and results to novel environment/situation; GI = gradual and sustained increase; GSR-PB = gradual and sustained reduction in identified problem behavior; ISI = immediate and substantial increase; ISR-PB = immediate (within 3 sessions/days) and substantial reduction in identified problem behavior.

A study by Dooley et al. (2001) exemplified the use of a between-activity schedule system. The authors developed the schedule for use in a special education preschool in order to reduce the tantrum and aggressive behavior of Chris, a 3-year-old boy diagnosed with pervasive developmental disorder. The authors first performed a functional assessment, consistent with the procedures recommended by O'Neill et al. (1997). Information obtained from the functional assessment indicated that Chris's behavior occurred in response to teacher-prompted transitions, and was maintained by (a) escape from the demands of the new activity, and (b) teacher attention that was provided during the tantrums. In order to better support Chris through transitions, a

picture-based schedule system was developed in which line-drawing symbols were presented sequentially on a schedule board. Chris was taught to review the schedule at the beginning of each day, and then proceed through his day by (a) removing the first activity symbol, (b) locating and matching the activity symbol to the actual activity, (c) engaging in the activity, (d) recognizing and responding appropriately to the transition cue of flickering lights or activity completion, (e) depositing the completed activity symbol in a container, and (f) returning to the schedule to get the next activity symbol. Within 3 days of implementing the schedule system, Chris' compliance with transition cues had dramatically increased, and his problem behavior had reduced to near-zero levels. These results remained stable for the rest of the school year, and generalized to both the community and to Chris' home following his family's implementation of the schedule system.

The positive results obtained by Dooley et al. (2001) are consistently demonstrated across the between-activity schedule studies presented in Table 3. Between-activity schedules have been effectively employed across a range of environments, including family homes, community settings, child-care settings, segregated classrooms, and integrated classrooms. These interventions have produced positive behavioral outcomes for children with autism across a range of ages, from toddlers (Dettmer et al., 2000; Dunlap & Fox, 1999) to adolescents and young adults (Flannery & Horner, 1994; MacDuff et al., 1993; Newman et al., 1995). Children with autism across the range of cognitive ability appear to benefit from between-activity schedules, including those with average intelligence (Clarke et al., 1999; Dettmer et al., 2000) as well as those with moderate to severe mental retardation (Dettmer et al., 2000; Flannery & Horner, 1994; Newman et al., 1995). Positive outcomes from these studies have included (a) increased ability to make independent transitions between activities and decreased prompt

dependency; (b) increased on-task behavior and decreased off-task behavior; (c) increased transition compliance; (d) increased speed of task completion; and (e) decreased disruptive, aggressive behavior, stereotypic, and/or destructive behavior. Although this breadth of change is impressive, the speed and magnitude of change is even more so: across the majority of studies, substantial behavioral changes were reported to be immediate, dramatic, and stable over time.

For the majority of the studies summarized in Table 3, the probability of positive outcomes was greatly enhanced through the use of functional assessment, functional analysis, or contextual analysis. Through these assessment techniques, the authors were able to hypothesize the relationships between a lack of predictability and participants' problem behaviors. Of the 11 studies presented in Table 3, 9 described the occurrence of problem behavior during transitions, unstructured activities, or activities that were unpredictable in duration and sequence. It appears that the between-activity schedules provided a means through which the researchers were able to enhance participants' understanding and ability to predict upcoming events, while simultaneously alleviating the distress and problem behaviors associated with uncertainty.

Within-Activity Schedules

Within-activity schedules are interventions that pictorially represent a sequence of steps within an activity or task. Although within-activity schedules are similar to between-activity schedules in form, they differ considerably in their function and focus. Between-activity schedules typically span several hours within a day and, as noted previously, are usually intended to enhance predictability and reduce problem behavior associated with transitions from one activity to the next. In contrast, the focus of within-activity schedules is on *one* activity rather than several in a sequence. The goal of within-activity schedules is to increase an individual's independence within a single activity, by depicting the series of discrete steps or skills required.

Pictures or other symbols representing a series of steps within a task or activity are presented in sequential order. The individual is taught to refer to the within-activity schedule after completing each step in the sequence, and to use the pictures as reminders of the steps that follow. Figure 5 presents an example of a within-activity schedule for taking a shower that was created for an adolescent with autism. Prior to his use of the within-activity schedule, this young man required constant assistance in the form of verbal and physical prompting in order to complete the task. However, by using the within-activity schedule, he was able to shower independently.

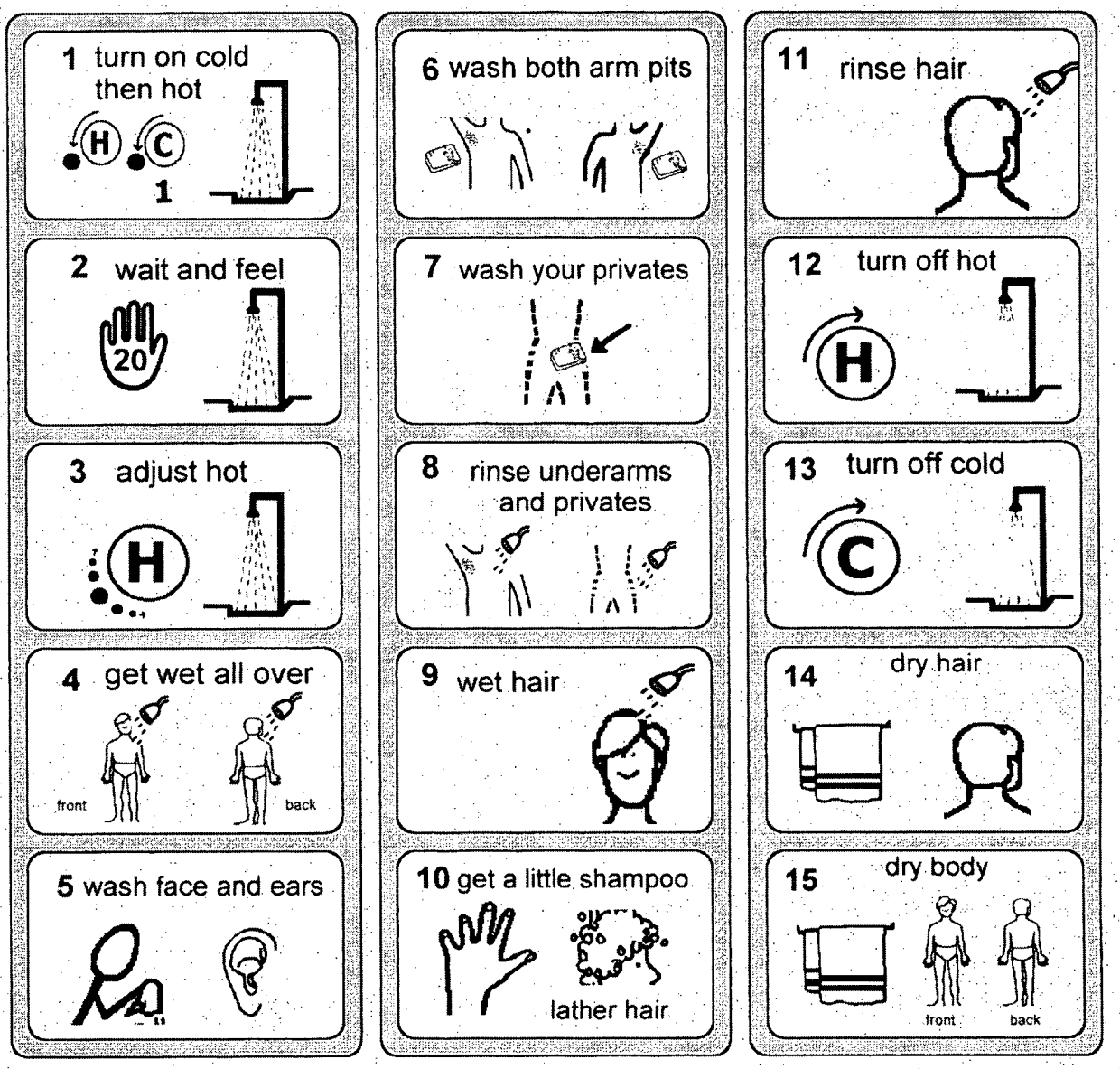

Figure 5. Within-activity schedule for showering routine.

A published example of a within-activity schedule was provided by Hall, McClannahan, and Krantz (1995). Three children enrolled in integrated classrooms participated in this study. One participant was diagnosed with hyperactivity and a cognitive impairment and will not be discussed here. Two other participants, Larry and Sam, were labeled as having autism and Fragile X syndrome, respectively. Both Larry and Sam were extremely dependent on adult

assistance in order to complete tasks. For each child, one activity was selected for intervention -- toileting for Sam and writing for Larry. For each activity, the steps from initiation to completion were represented in sequential order by photographs in small photo albums. For example, Larry's photo album consisted of a sequence of photographs depicting (a) the activity immediately before writing, (b) Larry going to his desk, (c) Larry taking out his pencil case, (d) Larry finding his pencil in the case, (e) Larry removing his pencil from the case, and so forth. Classroom assistants for both children were instructed in the use of the within-activity schedules and were encouraged to resist using verbal and gestural prompts to guide the students through the two tasks. Both Sam's and Larry's independence and successful completion of their respective tasks increased dramatically when the within-activity schedules were provided and verbal and gestural prompts were removed.

As can be seen from Table 4, several additional studies have also shown within-activity schedules to be effective in promoting independence across a wide array of tasks, including meal preparation (Arntzen et al., 1998), occupational tasks (Copeland & Hughes, 2000), and educational tasks (Dettmer et al., 2000). This research demonstrates that such schedules may be effectively employed to teach individuals with autism a variety of new tasks.

Table 4:

Summary of Selected Within-Activity Schedule Research Articles

Authors	Participants (age, diagnosis)	Setting	Problem behavior/ context	Schedule type (& concurrent intervention)	Outcome
Arntzen et al., 1998	girl (14, autism)	classroom and kitchen of residential treatment centre	aggression & property destruction	photographs in binder (token economy R+)	GSI on-task behavior & near 100% independence in tasks
Clark et al., 1999	John (10, Asperger's syndrome)	family home, during dressing routine	off-task, disruptive, tantrum behavior/ during verbal prompts	Pictures & word labels Velcro®ed to a sheet (+ task modifications, reinforcement, & between-act. schedule)	ISR-PB to near-0 levels, ISR in time to complete routine, ISI in on-task behavior to near-100% levels, anecdotal GEN
Copeland & Hughes, 2000	Charles (15, autism)	employment training: faculty lounge	prompt dependent / cleaning routine	small photo album	ISI in independent completion of task (near 100%)
Dettmer et al., 2000	Josh (5, PDD)	in-home 1:1 program	non-compliance/ transitions between activities	line drawing & written words attached to sheet (+ timer and between-activity schedule)	ISR-PB to 30% of baseline, anecdotal GEN
Hall et al., 1995	Larry (7, autism) Sam (8, Fragile X)	regular integrated classroom	off-task & prompt dependent / initiating writing (Larry) toileting routine (Sam)	small photo album (& decrease in verbal & gestural prompts)	GI in independent initiation of activities (Larry) & on-task behavior (Sam)

Note. FU = Follow-up; GEN = generalization of strategy and results to novel environment/situation; GI = gradual and sustained increase; GSR-PB = gradual and sustained reduction in identified problem behavior; ISI = immediate and substantial increase; ISR-PB = immediate (within 3 sessions/days) and substantial reduction in identified problem behavior.

Visually Augmented Social Stories

A social story is an intervention designed to encourage appropriate social behavior through the use of short narratives that describe social situations in terms of relevant cues and appropriate responses. The narratives are meant to be used proactively with individuals with autism to explain upcoming events, so that misinterpretations, confusion, and unpredictability do not lead to inappropriate behavior. Although Carol Gray, the developer of social stories,

originally discouraged the use of visual aids in their execution (Gray & Garand, 1993), few authors or researchers have heeded this advice (viz., Backman & Pilebro, 1999; Rogers & Myles, 2001; Rowe, 1999) and most have augmented the text of social stories with visual aids (Chapman & Towbridge, 2000; Hagiwara & Myles, 1999; Kuoch & Mirenda, 2003; Kuttler, Myles, & Carlson, 1998; Lorimer, Simpson, Myles, & Ganz 2002; Norris & Dattilo, 1999; Swaggart et al., 1995; Thiemann & Goldstein, 2001). Typically, visual aids have been used to facilitate participants' comprehension and retention of the information presented within the social story. Table 5 summarizes the visually-supported social stories discussed within this section, along with participant information, settings, target behaviors, and outcomes.

Table 5:

Summary of Selected Visually Augmented Social Story Research Articles

Study	Participants (age, diagnosis)	Setting	Problem Behavior / Context	Assessment Method (and Function of Behavior)	FA-Intervention Fit	Concurrent Interventions	Symbol Set	Outcome(& Study Design)
Chapman & Towbridge, 2000	name not provided (14, autism)	camping trip	unsettled behavior & repeated questioning / during novel outings	no functional assessment (presumed avoidance of unpredictable events)	n/a	no other intervention reported	PCS line drawings & text	no inappropriate behavior was reported post intervention (case study)
Hagiwara & Myles, 1999	participant 1 (7, autism) participant 2 (9, autism) participant 3 (7, autism)	general education classroom & resource room	non-compliance with hand-washing / before snack and meal; off-task behavior / during academic activity in resource room or integrated classroom	MAS (participant 1 & 3: primarily sensory; participant 2: primarily escape)	low	task analysis of hand washing (during intervention)	computer presentation of story with text, photos, video, and audio narration	marginal increase in hand washing and on-task behavior (multi-element across settings)
Kuttler et al., 1998	Jon (12, autism, Fragile X, & intermittent explosive disorder)	segregated classroom	precursors to tantrum (inappropriate vocalizations and dropping to floor) / in class during unexpected transitions, wait time, and free time	antecedents and consequence listed (suggesting escape from unpredictable & unstructured times/situations)	high	token reinforcement	text read to participant and PCS	ISR to near 0 levels across environments (ABAB)
Lorimer et al., 2002	Gregg (5, autism)	self-contained special education classroom	pre-tantrum interruptions & tantrum / when preferred activity not scheduled and when preferred adult attending to others	MAS (attention & tangible)	high	mini-schedule, timer and emotion worksheet (during both baseline and intervention)	text read to participant with PCS	ISR-PB to near-0 levels (ABAB)

Study	Participants (age, diagnosis)	Setting	Problem Behavior / Context	Assessment Method (and Function of Behavior)	FA-Intervention Fit	Concurrent Interventions	Symbol Set	Outcome(& Study Design)
Norris & Dattilo, 1999	Jennifer (8, autism)	integrated elementary school cafeteria during lunch	inappropriate noises & bizarre verbalizations / during lunch	no functional assessment	n/a	no other intervention reported	color PCS	marginal decrease in problem behavior, no increase in appropriate behavior. (AB)
Swaggart et al., 1995	Adam (7, PDD); Darrell (7, autism); Danielle (11 autism)	self-contained laboratory classroom	aggressive behavior, inappropriate touching, grabbing and screaming / during greetings and structured play with strangers and peers	no functional assessment	n/a	social skills training, response-cost with one participant,	line drawings & photos	reduction in problem behavior & increase in appropriate behavior (data presentation did not show speed of effect for 2 of 3 participants -- AB).
Thiemann &Goldstein, 2001	Greg (7, autism); John (8, autism on CARS); Casey (6, autism); Ivan (12, autism on CARS)	integrated small-group room in library	impaired communication skills / in small group training session with peers	no functional assessment	n/a	visual cueing, video-feedback	text and PCS or photographs	ISI communication skills taught, maintenance generally demonstrated; minimal generalization to new environment (multiple baseline across skills taught)

Study	Participants (age, diagnosis)	Setting	Problem Behavior / Context	Assessment Method (and Function of Behavior)	FA-Intervention Fit	Concurrent Interventions	Symbol Set	Outcome(& Study Design)
Kuoch & Mirenda, 2003	Andrew (3, autism); Henry (5, autism); Neil (6, PDD-NOS)	home (Andrew), summer pre-school (Henry), summer school (Neil)	aggression, crying, yelling / when asked to share toy (Andrew); inappropriate vocalizations, regurgitation, touching genitals / during meal times (Henry); cheating, inappropriate & negative comments / when playing games with peers (Neil)	no functional assessment	n/a	no other intervention	text and PCS or cartoon pictures	ISR-PB to near-0 levels for Henry& Neil (ABA); ISR-PB for Andrew (ABACA)

Note. FU = Follow-up; GI = gradual sustained increase; GNE/S = generalization of strategy and results to novel environment/situation; GSR-PB = gradual sustained reduction in identified problem behavior; ISI = immediate substantial increase; ISR-PB = immediate (within 3 sessions/days) substantial reduction in identified proble behavior.

One good example of a social story intervention that utilized visual supports was reported by Lorimer et al. (2002). For this study, the participant was Gregg, a 5-year-old boy with autism who had average to above average intelligence. Gregg participated in an early childhood special education classroom in which he demonstrated tantrums that consisted of screaming, hitting, kicking, and throwing objects. In order to reduce these problem behaviors, Lorimer and colleagues first conducted a functional assessment using the Motivation Assessment Scale (MAS; Durand & Crimmins, 1992). Data from the MAS suggested that Gregg's problem behavior served to gain attention and tangible reinforcement. Direct observations confirmed these functions. In addition, the observations suggested that Gregg consistently attempted to communicate his wants and needs prior to engaging in problem behaviors through ineffective and somewhat inappropriate verbalizations (e.g., Gregg would repeatedly yell *"Stop talking!," "Listen to me!," or "You are too loud!"*). Following the functional assessment, the authors developed a social story intervention designed to reduce the tantrum behavior by (a) teaching Gregg more effective and appropriate ways to communicate his desires and (b) teaching Gregg what to do if he had to wait for what he wanted. Specifically, Gregg's social story was used to teach him to raise his hand or say *"Excuse me"* to gain the attention of an adult, and then wait his turn to talk. Gregg's social story also contained several suggestions of activities he could do if he had to wait, including watching a video, listening to an audio book, looking at a book, or playing a game. Figure 6 provides an example of one of Gregg's social stories (Lorimer et al., 2002).

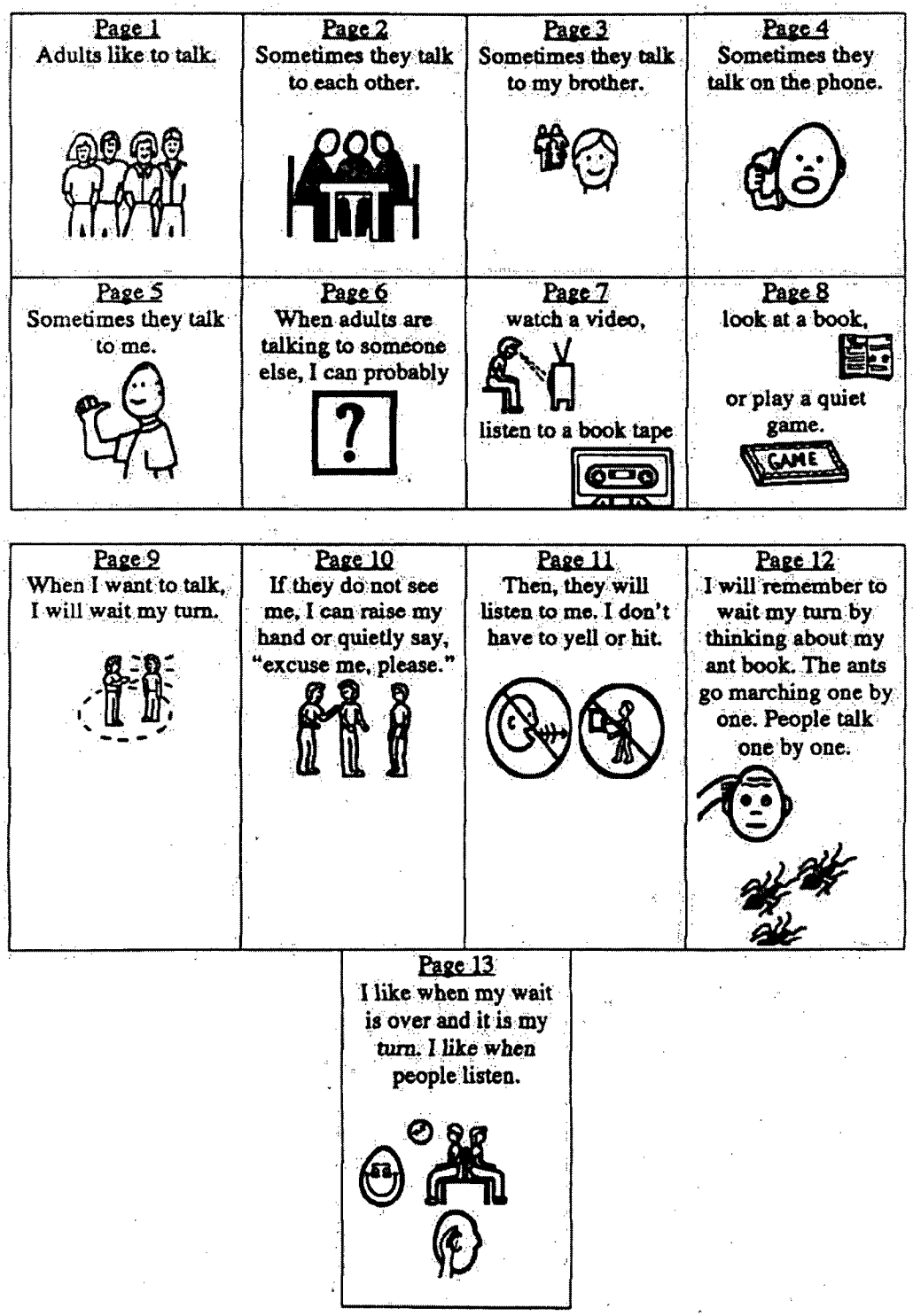

Figure 6. Gregg's "Talking with Adults" social story (Lorimer et al., 2002, p. 56).

Because Gregg was a pre-reader, line drawings were paired with the written text of the social stories and the stories were read to him. An ABAB design was used to evaluate the success of the intervention. Immediately following the implementation of the social stories, Gregg's inappropriate verbalizations reduced dramatically, and his tantrums reduced to near-zero levels. This effect was repeated after the second baseline condition, and the authors concluded that the visually augmented social story intervention was effective in reducing both the pre-tantrum and tantrum behavior.

Table 5 indicates that a variety of symbol sets have been employed with social stories, including line drawings, photographs, and full motion videotapes. In addition, it appears that visually augmented social stories can be used to remediate a variety of behaviors across a range of situations. Although 2 of the 8 studies reported only marginal outcomes (Hagiwara & Myles, 1999; Norris & Dattilo, 1999), 5 reported significant reductions in problem behavior and/or increases in appropriate behavior (Chapman & Towbridge, 2000; Kuoch & Mirenda, 2003; Kuttler et al., 1998; Lorimer et al., 2002; Swaggart et al., 1995; Thiemann & Goldstein, 2001).

It is interesting to note that, of the 8 studies listed in Table 5, only 3 appeared to be based on functional assessments of the problem behaviors (Hagiwara & Myles, 1999; Kuttler et al., 1998; Lorimer et al., 2002). Two of these three studies involved social stories that were designed to teach alternative behaviors within the same functional class as the target behavior (Lorimer et al., 2002; Kuttler et al., 1998); both of these studies showed positive results. The third study (Hagiwara & Myles, 1999) employed a social story intervention that failed to match the function of the target behavior with the new replacement behavior being taught. As might be predicted, this study demonstrated only marginal decreases in problem behavior and no increase in appropriate behavior. The disparate results across the three studies that provided information

regarding the function of the problem behavior suggests that the principles of functional equivalence pertain to social stories as much as to other types of visually-supported interventions.

Of the three types of visual support strategies reviewed so far, visually augmented social stories appear to be the most comparable to contingency mapping, the experimental intervention of interest. As described previously, Lorimer et al. (2002): (a) presented Gregg with visual representations of the antecedents for his problem behavior, (b) provided visual representations of alternative replacement behaviors, and (c) provided pictures depicting the contingency for alternative behaviors (i.e., adult attention). All three of these depictions are core components of contingency maps. However, a contingency map would also include a visual representation designed to show Gregg that his problem behavior would no longer serve to gain him adult attention. In addition, a contingency map would be formatted quite differently than a social story. The social stories used for Gregg contained one idea per page (e.g., page 9 of Gregg's "Talking with Adults" social story consisted of a symbol and the phrase "When I want to talk, I will wait my turn"). As a result, Gregg's "Talking with Adults" social story spanned 13 pages in total. Although this intervention was successful for Gregg, children with sequencing or memory impairments may find it difficult to link the concepts contained in the picture-book presentation that is often used for visually augmented social stories. Because the aim of contingency mapping is to teach children new antecedent-behavior-consequence (ABC) relationships, contingency mapping graphically represents the relationships between each of these elements on one page. This distinguishes contingency mapping from many of the social stories published in the research literature.

Visual Strategies with a Limited Research Base

Although within-activity schedules, between-activity schedules, and social stories comprise the most well-researched visual support strategies for children with autism, a number of other strategies also exist, albeit with a less well-developed research base. Because some of these are similar to contingency mapping, they will be reviewed briefly in this section. These strategies include rule scripts, rule charts, and cognitive picture rehearsal.

Rule scripts and rule charts. A visual support strategy similar to contingency mapping has been referred to as a rule script (Mirenda, MacGregor, & Kelly-Keough, 2002) or rule chart (Hodgdon, 1995). Rule scripts depict problem situations and their associated social rules, and may be used to rehearse, clarify, prompt, and review rules during target activities. Mirenda et al. provided a case example in which twin girls with pervasive developmental disorders and profound deafness were provided with a simple pictorial rule script that informed them of the rules for watching TV in the morning (i.e., TV was not allowed during school mornings, but was allowed during weekend mornings). Mirenda et al. reported that, within 2 weeks of implementing this rule script, the twins' tantrums associated with being denied television on school mornings had been reduced to near-zero levels.

Mirenda et al.'s (2002) rule script is very similar to the rule chart promoted by Hodgdon (1995, 1999) to teach rules and new behavior routines. Hodgdon described rule charts as visually representing the guidelines for acceptable behavior by depicting what to do, what not do to, and the consequences related to a person's actions. Although the examples provided by Hodgdon do not include all of the components of contingency maps, they stress the need for representing acceptable alternative behaviors in addition to undesired, problem behaviors. Although Hodgdon did not present empirical evidence related to their use, she described rule charts as powerful

techniques for promoting behavior change and suggested that much of this power comes from presenting the rules in a format easily understood by children with autism. Hodgdon also postulated that the power of rule charts to promote behavior change is related to (a) the "authority" many children appear to grant visual aids, (b) the ability of rule charts to clarify the behavioral expectations held by adults, and (c) the fact that visual depictions of events may serve to increase consistency both within and between caregivers. If Hodgdon is correct, these postulations could also be extended to contingency maps.

Cognitive picture rehearsal. Cognitive picture rehearsal (CPR) is another visual support strategy that is similar to contingency mapping. CPR is an "*instructional strategy that uses repeated practice of a sequence of behaviors by presenting the sequence to the child in the form of pictures and an accompanying script*" (Groden & LeVasseur, 1995). CPR combines the principles of learning theory with the technology of visual support, and is based on the imagery-based procedures termed covert conditioning. Covert conditioning involves a set of procedures that manipulate imagery to modify covert and overt behavior (Cautela, 1979). Covert conditioning procedures were based on the assumption that covert events, such as imagining, follow the same laws as observable behaviors (Cautela, 1979). Thus, it was assumed that the manipulation of imagined events that follow imagined actions would serve to change overt and covert behavior. Although a number of studies have demonstrated the utility of covert conditioning procedures, the majority have involved adults or children with no cognitive impairments (Mirenda, 1986). Because of the limited ability of persons with disabilities to utilize this set of imagery-based procedure, Groden and LeVasseur (1995) proposed that pictures could be used to facilitate the process, and referred to this procedure as cognitive picture rehearsal (CPR). The techniques involved in CPR include the sequential presentation of photographs or

line drawings depicting antecedents, alternative behavior(s), and positive consequences related to a problem behavior – again, three of the core components of contingency maps. However, CPR differs significantly from contingency mapping in that (a) no actual consequences are manipulated in the real world, (b) the function of the alternative behavior depicted is not necessarily matched to the problem behavior, (c) the reinforcement depicted is not necessarily matched with regard to function, and (d) CPR does not mention either problem behavior or the consequences for problem behavior. Despite the lack of empirical evidence supporting this technique, the anecdotal evidence provided by its authors (Cautela & Kearney, 1993; Groden & LeVasseur, 1995) and the existence of empirical support for covert conditioning with other populations (Mirenda, 1986; Upper & Joseph, 1979) suggest that it may be useful as a visual support strategy under some circumstances.

Summary

Behavioral support interventions often involve many components and require a child to learn new behaviors, applied in specific situations, for specific gains – in short, to learn new behaviors as well as when, where, and why to use them. In this chapter, functional equivalence training and functional communication training were described as two related strategies that can be used to reduce problem behavior through the teaching of alternative behaviors or communication skills. Several important considerations for designing these interventions include (a) functionally matching the consequences for the alternative behavior with that of the problem behavior, (b) ensuring that the alternative behavior will achieve the desired outcomes for the individual, (c) creating environments that are conducive for learning alternative behaviors, and (d) deciding on a therapeutic response for the problem behaviors.

Although the success of FET/FCT interventions is generally well documented, a number of published interventions that appear to be technically, methodologically, and theoretically sound have nonetheless failed to produced positive outcomes without the addition of punitive behavior reduction techniques (e.g., Bowman et al., 1997; Fisher et al., 2000; Fisher et al., 1994; Fisher et al., 1993; Hagopian et al., 1998; Perry & Fisher, 2001; Wacker et al., 1990). One possible reason for the occasional need for punitive behavior reduction techniques was provided by Durand and Merges (2001) who postulated that, in some situations, the degree of behavioral contrast inherent in most FET/FCT interventions may be insufficient to produce behavior change. In such situations, the consequences for appropriate versus problem behavior may not be sufficiently different for participants to comprehend the changes in contingencies associated with the introduction of the behavior support plans. Therefore, the power of a FET/FCT plan could be undermined if participants failed to recognize the altered contingencies. In these situations, the highest degree of behavioral contrast – achieved through the pairing of punishment for problem behavior and reinforcement for alternative behavior – might be required.

Because of the undesirable nature of punitive behavior reduction techniques, additional strategies designed to highlight the change in contingencies associated with FET/FCT interventions are sorely needed. One strategy to increase behavioral contrast, adding a highly motivating arbitrary reinforcer in combination with the functional reinforcer for the alternative behavior, has been used only occasionally (e.g., Clarke et al., 2002; Healey et al., 2001; Hoch et al., 2002; Vaughn et al., 2002). Research is needed to further test the utility of this approach. Another strategy, contingency mapping, was proposed as an additional intervention that can be used to enhance the salience of less extreme behavioral contrasts. Because no research currently exists with regard to contingency mapping, three similar visual support strategies with empirical

support were reviewed -- between-activity schedules, within-activity schedules, and visually augmented social stories. The positive results obtained through these similar visual support strategies lend credence to the potential of contingency mapping as a strategy to increase children's comprehension of FET/FCT interventions. Additional support for contingency mapping was found in the literature describing less well-researched visual support strategies as well, including rule scripts, rule charts, and cognitive picture rehearsal.

Purpose and Research Questions

The purpose of the proposed study was to test the effectiveness of contingency mapping as an adjunct to behavior support plans that involve FET/FCT. The specific research questions addressed were (a) is there a functional relationship between the use of a contingency mapping intervention and decreases in a child's problem behavior?, and (b) is a contingency mapping intervention more effective at reducing behavior problems than a verbal contingency intervention? The hypotheses were (a) there will be a functional relationship between a contingency mapping intervention and a reduction in a child's problem behavior and (b) a contingency mapping intervention will be more effective than a verbal contingency intervention in reducing the problem behavior.

CHAPTER 3

Method

Ethics Approval

Approval for this study was obtained on July 3rd, 2003 from the Behavioral Research Ethics Board of the Office of Research Services and Administration at the University of British Columbia (reference #B03-0297).

Participant Recruitment

One school board and two preschools distributed recruitment letters to parents of children with autism who were enrolled in their programs. Parents who responded to the letter were contacted for a brief phone interview (Appendix A). The researcher then met with the parents of all children who fit the initial screening criteria. At this meeting, the investigator described the study in detail and asked the parents to sign a consent form (Appendix B) indicating their willingness to have their child participate in the study. Three children's families completed all of these procedures.

After the participants' parents signed the consent form, the investigator completed a brief interview (Appendix C) with their school staff, consisting of questions related to their learning style and problem behavior. Finally, the researcher completed additional child assessments, including a symbol assessment (Beukelman & Mirenda, 1998; Appendices D and E) and a functional assessment of behavior (O'Neill et al., 1997). Following these procedures, two children were eliminated from participation in the study. One child was eliminated because his problem behavior did not meet the requirement of resistance to traditional, proactive and positive contingency interventions, while another child was eliminated because his problem behavior did not meet the requirement of being socially motivated. Thus, one child was included in the study.

Participant

Kirk (a pseudonym), age 12, participated in this research project. Kirk had been diagnosed with autism by a multidisciplinary team when he was three years old. His hearing and vision had been assessed within 36 months prior to the study and was found to be within the normal range. Kirk attended his neighborhood school in an upper class suburban neighborhood. He was enrolled as a grade 6 student and was integrated into a split grade 6-7 class with the assistance of a full time education assistant (EA). At school, Kirk received a modified academic curriculum in the morning and community education activities in the afternoon.

Kirk was selected for participation because he demonstrated problem behavior that had been resistant to numerous prior attempts at remediation in the school setting and that was identified as a high priority behavior by both his school staff and his parents. The problem behavior was prompt dependency, which was especially pronounced during transitions from one activity to another. After completion of an academic or break activity, Kirk would sit at his desk idly until he was verbally prompted to begin to the next activity. His school support staff indicated that Kirk would sit for longer than 30 minutes if permitted to do so. They believed that Kirk had considerable academic ability but stated that both his independence and learning were hampered by his dependency on others to prompt him throughout the day. School district staff indicated that Kirk's prompt dependency had been a concern since kindergarten and that strategies such as prompt fading, visual scheduling, providing additional reinforcement for independent transitions, and social stories had all been used with minimal success to treat it. Kirk's parents stated that the problem was getting worse at home, noting that Kirk used to be able to initiate trips to the washroom by himself but that he now waited for them to prompt him to use the washroom throughout the day.

Kirk's resource teacher indicated that Kirk was primarily a visual learner and that strategies such as visual schedules and visual cuing with Picture Communication Symbols (PCS) were used to help him understand various time sequences and language concepts at school. Since this skill was required for the study, Kirk participated in a symbol assessment (Beukelman & Mirenda, 1998; Franklin, Mirenda, & Phillips, 1996) to confirm that he understood the relationship between objects and the PCSs used to represent them prior to initiation of the study. During this assessment, Kirk successfully matched 10 PCS to familiar objects (Appendix F) achieving a score of 100% correct.

Setting

The research was conducted in Kirk's school during regular academic programming times in the morning. The investigator asked school staff to identify the three types of tasks in which Kirk's prompt dependency was most pronounced; they identified math, keyboarding, and printing tasks.

With two exceptions, all probe sessions were conducted in Kirk's integrated grade 6-7 classroom. All of the math probes and all but two of the printing probes were conducted at Kirk's desk, which was positioned beside a peer throughout the study. The peer seated beside Kirk changed weekly in accordance with class seating arrangements. During two printing probes, Kirk completed the tasks in two different but familiar classrooms because his classmates were involved in provincial exams. All keyboarding probe sessions were conducted at a computer workstation located at the back of Kirk's classroom.

Interventionist

The interventionist for this study was Kirk's full time education assistant (EA), who had worked with him for 3 months prior to the study. She had no additional training or experience in

autism, positive behavior support, or educational practices for inclusive education prior to the start of the study, but was attending a night school course that was required as a condition of her employment.

Training. Immediately prior to the initiation of the first intervention probe, the researcher trained the EA in the procedures to be used. She was first provided with an instruction sheet that detailed the procedures (Appendix G). After reviewing the instructions, she role-played the procedures and the researcher provided feedback. The initial training session lasted less than 10 minutes and was terminated by the EA. In addition, ongoing support was provided throughout the first phase of intervention and for a short period of time during second phase as well. This ongoing support included daily or biweekly role-playing, prompting, feedback, video feedback, and use of a diagram depicting the verbal script that the EA was to use during each phase.

Materials

Task Materials

The keyboarding, math, and printing tasks used during the study were developed by Kirk's school team as part of his educational program. The materials used for the printing task were a pencil, a photocopied grade 2 reader, and an adapted sheet of lined paper. The lines on the sheet of paper were accentuated with blue and red felt markers in an alternating pattern down the page in order to provide a reference for the height of Kirk's printed letters. For the math task, a variety of math worksheets were used, each consisting of between 5 to 20 addition or subtraction problems that involved whole numbers from 1 to 20. Kirk used a number line from 0 to 20 and a wet erase marker to aid him in the task. For the keyboarding task, an IBM compatible computer with Writing with Symbols 2000 software (Mayer Johnson, Inc., 2000) was used. The target text (which Kirk was to copy) was printed on a large 11" x 17" dry-erase board by Kirk's EA, and

typically consisted of several sentences of personal information and/or information about the previous day's events (e.g., "I have a dog named Scotty and a cat named Spock", "I went to the planetarium yesterday").

Contingency Maps

Three different contingency maps were created for this study, one for each of the target tasks. The contingency maps were printed on 8.5" x 11" laminated paper. Each contingency map contained seven 1.75" x 1.75" square cells with PCS line drawings or modifications thereof. Printed text containing a description of the PCS appeared above each cell. The contingency maps were organized in a fashion similar to O'Neill et al.'s (1999) Competing Behavior Diagram (Figure 1), whereby the first cell on the center left of the page represented the antecedent for problem/alternative behavior. Branching from the antecedent cell were (a) three cells representing the problem behavior and the consequences for problem behavior, and (b) three cells representing the alternative behavior and the consequences for engaging in the alternative behavior. The three contingency maps differed only with regard to the first cell, which depicted the completion of the respective task (see Figures 6, 7, and 8). The printing and math contingency maps were placed on a triangle stand so that they could stand semi-vertically on Kirk's desk and occupy minimal desk space. The keyboarding contingency map was affixed to the bottom of Kirk's computer monitor with Velcro®.

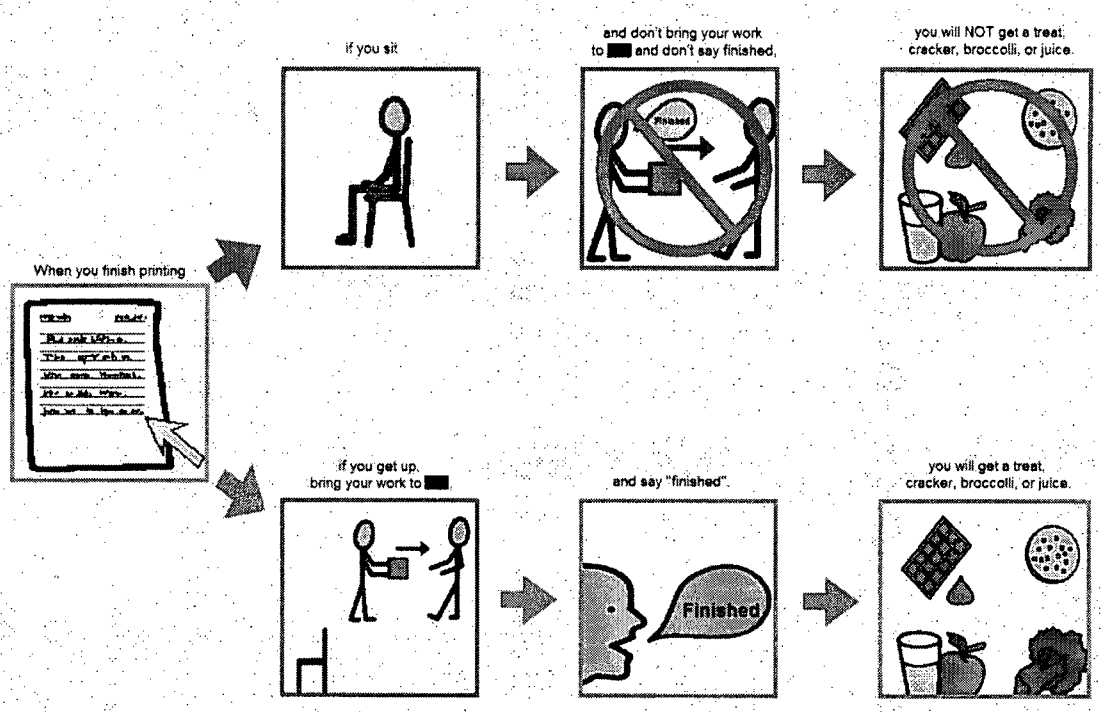

Figure 7. Contingency map for printing. Images created from Boardmaker (1994) computer software using Picture Communication Symbols (Mayer Johnson, Inc., 1991-1994). Some Picture Communication Symbols were modified using MS Paint (1998) computer software.

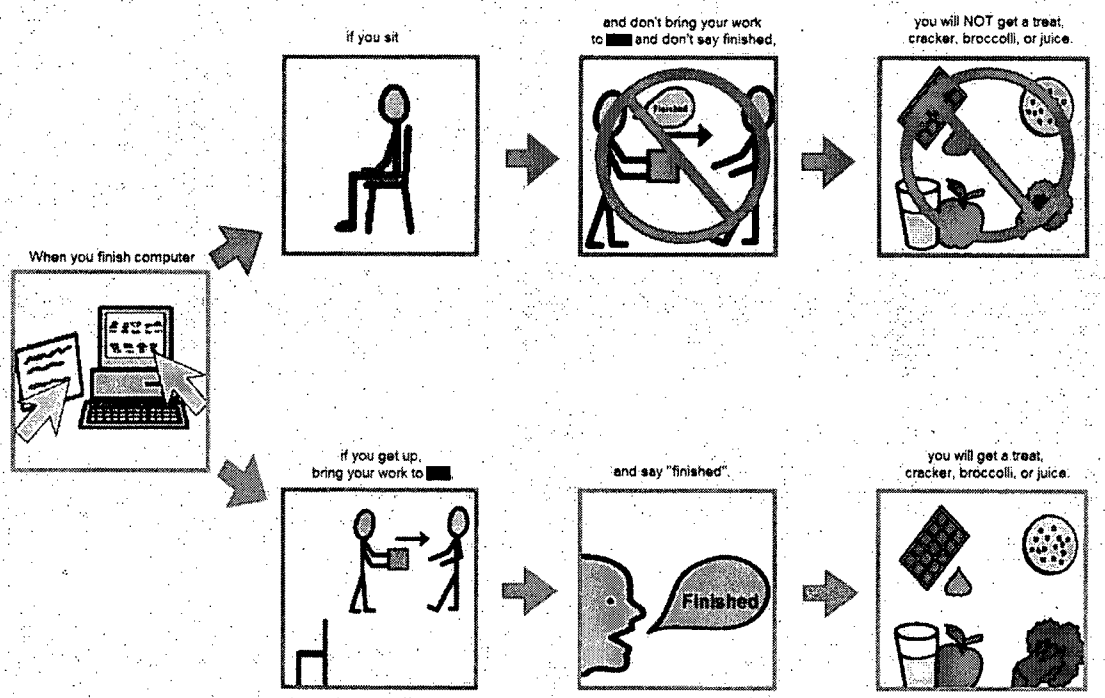

Figure 8. Contingency map for keyboarding. Images created from Boardmaker (1994) computer software using Picture Communication Symbols (Mayer Johnson, Inc., 1991-1994). Some Picture Communication Symbols were modified using MS Paint (1998) computer software.

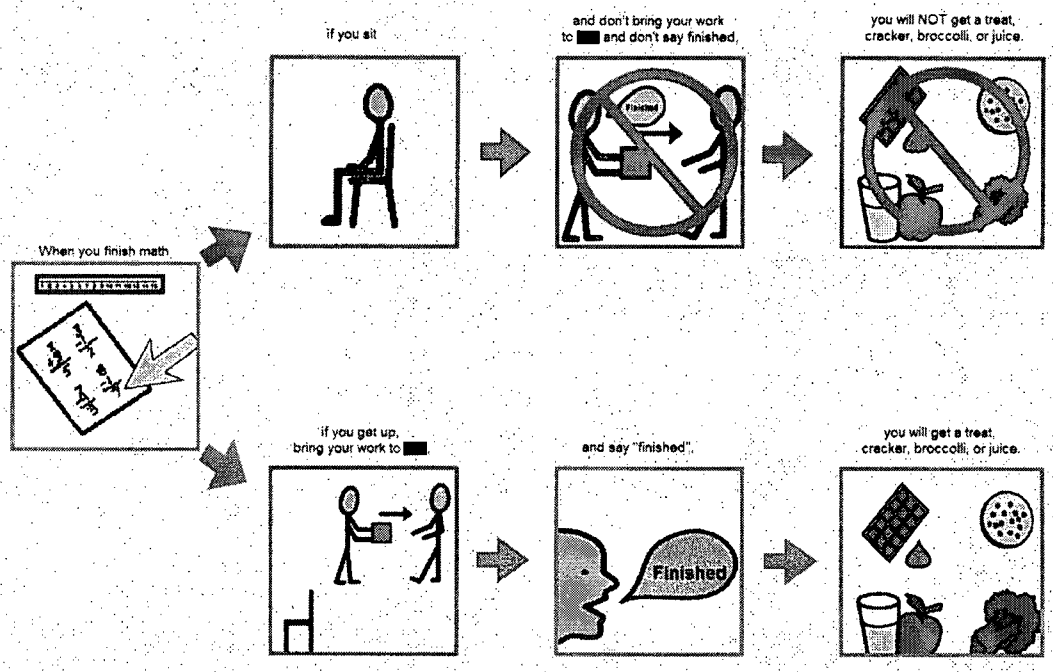

Figure 9. Contingency map for math. Images created from Boardmaker (1994) computer software using Picture Communication Symbols (Mayer Johnson, Inc., 1991-1994). Some Picture Communication Symbols were modified using MS Paint (1998) computer software.

Measurement

Dependent Measures

Participant behavior. The dependent variable, prompt dependency, was defined as a failure to initiate the next behavior in a familiar sequence; in this case, this meant failing to initiate a target completion routine following task completion. Prompt dependency was measured as latency (in seconds) between task completion and initiation of the target completion routine. Completion of the math and printing tasks was defined as the point at which Kirk moved his pen or pencil off of the page after printing the last character of the task. Completion of the keyboarding task was defined as the point at which Kirk removed his hand from the keyboard after typing the last keystroke. Initiation of the target completion routine (the alternative

behavior) was defined as the first muscle movement or first vocalization following task completion that culminated in Kirk (a) bringing his completed work to the EA, (b) telling the EA that he was finished, or (c) requesting a reinforcer for finished work.

Social validity. A secondary dependent variable was the social validity of the behavior support plan, as rated by the EA. This was assessed by having the EA complete a questionnaire (Appendix H) that consisted of six questions using a Likert-type response format from 1 to 5. The questions asked her to evaluate (a) the acceptability, convenience, and ease of administration of the intervention; (b) the extent of target problem behavior reduction; (c) the extent of target alternative behavior increase, and (d) the extent to which the participant could participate better in school activities following intervention. The investigator administered the social validity questionnaire immediately after the completion of each intervention phase, and again immediately after completion of the follow-up phase.

Design

The goal of the study was to assess the functional relationship between a contingency mapping intervention and a reduction in problem behavior, and to compare the effectiveness of a contingency mapping and a verbal contingency intervention. A multiple baseline, multiple probe design (Horner & Baer, 1978) across three tasks (printing, keyboarding, and math) was used in this regard. The design included four phases across each of the three tasks: baseline (A), verbal contingency (B), contingency mapping (C), and follow-up (D). Consistent with multiple baseline procedures, baseline (A) was initiated simultaneously across the three tasks. Once a stable pattern emerged within the first task (printing), the verbal contingency condition (B) was initiated for this task, while the two other tasks remained in baseline. After a stable pattern of behavior was achieved in the first task within the verbal contingency condition, the contingency

mapping condition (C) was initiated in this task, while the verbal contingency condition was initiated in a second task (keyboarding) and the third task (math) remained in baseline. This staggered progression of tasks through conditions proceeded until a stable pattern of behavior emerged across all three tasks within the contingency mapping intervention. Follow-up (D) occurred 1 and 2 weeks after completion of the multiple baseline component of the study, across the three tasks.

Procedure

Functional Assessment

The Functional Assessment Interview (FAI) and Functional Assessment Observation (FAO) (O'Neill et al., 1997) were used to assess the function of Kirk's problem behavior. First, the investigator interviewed school staff using the FAI over approximately 90 minutes. The FAI results indicated that Kirk's prompt dependency (i.e., failure to initiate a completion routine following work completion) was motivated by either attention from the EA, tangible reinforcement (in the form of the next activity), or both. Next, observations using the FAO were conducted over 2 days. These observations failed to differentiate between the two possible functions or combination thereof. In response to Kirk's sitting idle following task completion, the EA consistently approached him, asked him if he was finished, and verbally prompted him to begin his next activity. Thus, in response to Kirk's failure to initiate his completion routine, the EA provided both attention and a prompt to begin the next activity (tangible). To examine the function more closely, the investigator conducted a brief functional analysis. The EA was asked to approach Kirk and talk to him (i.e., provide him with verbal attention) when he completed a task, but to <u>avoid</u> prompting him to engage in any specific behavior, including the next activity. When this occurred over several sessions, Kirk's response was to tell the EA repeatedly that he

was finished with the activity in an attempt to cue her to prompt him to begin the next activity. Since attention alone did not appear to satisfy Kirk, his response was interpreted as indicating that his problem behavior was maintained by tangible reinforcement rather than attention alone. It appeared that Kirk's prompt dependency was reinforced by the provision of a prompt that directed him to initiate the next activity. This information was used to guide the development of an individualized behavior support plan for Kirk.

The behavior support plan was presented to Kirk's parents and school staff for approval prior to its initiation. The plan focused on teaching Kirk an alternative behavior that was functionally equivalent to his problem behavior of sitting idly and waiting for the EA to prompt him to begin the next activity. The functionally equivalent behavior was Kirk getting up from his seat, giving his work and/or work materials to the EA, and saying "finished." Contingent on Kirk demonstrating the target alternative behavior, the EA was to provide Kirk with a tangible (i.e., food) reinforcer and the desired verbal prompt to begin the next activity.

Baseline (A)

During baseline, the investigator videotaped Kirk engaging in the problem routines on pre-arranged days that accommodated the school schedule. In order to minimize the impact of videotaping, a small camcorder was set up approximately 10 minutes before the initiation of each baseline session, on a tripod at least 2 meters away from the participant.

During baseline, the EA was instructed to interact with Kirk and the other children as she did normally. Kirk's existing PCS schedule was used during this phase, but no verbal contingencies or contingency maps were added. For printing, Kirk was asked to copy the text of a reader onto an adapted sheet of line paper. For keyboarding, Kirk was asked to type a number of sentences that were printed on a dry-erase board. For math, Kirk was asked to complete a

series of addition and/or subtraction questions on a worksheet. Following task completion, if Kirk did not initiate the target completion routine within 3 minutes (180 sec), the EA verbally prompted him, as she usually did, to begin his next scheduled activity. Once a stable baseline was established for the first task, the verbal contingency intervention was initiated for that task.

Verbal Contingency (B)

The first task selected for intervention was printing, which was selected at random from the three options. The second task selected was keyboarding; this was selected as the second task by the EA for logistical reasons. The third and final task was math.

During the verbal contingency condition, the EA first indicated that it was time to start one of the target tasks, using Kirk's already-existing PCS schedule, as usual. She then verbally stated the contingencies associated with both the problem and alternative behaviors. She first informed Kirk of the desired path of action, including the antecedent, desired alternative behavior, and positive consequences for engaging in the alternative behavior (e.g., "You finish printing when you get here [pointing to the last line on the page]. When you finish printing, if you get up, bring your work to me, and tell me that you are 'finished', you will get a treat"). She next informed him of the undesired path of action, engaging in the problem behavior (e.g., "When you are finished your printing, if you stay sitting, don't bring your work to me, and don't tell me that you are finished, you will not get a treat."). Finally, she reviewed the positive path a second time, to insure that Kirk focused on and remembered the target alternative behaviors he was expected to perform. Following completion of the verbal contingency presentation, the EA instructed Kirk to begin his work and provided him with whatever initial support was needed to engage in the task. Once he was engaged, the aide sat at least 2 meters away from Kirk and engaged in quiet seatwork. The EA never sat directly within Kirk's visual field; typically, she

was positioned behind Kirk. The EA was also instructed to avoid conspicuous movements, gestures, activities, and vocalizations both while Kirk was working and after he completed each work task.

If Kirk initiated and completed the target completion routine within 3 minutes after finishing a task, the EA praised him for good work, offered him his choice of tangible reinforcers, and prompted him to begin his next activity. The tangible reinforcers were selected by Kirk's parents and school team as preferred foods and consisted of small, sugarless pieces of chocolate, broccoli florets, crackers, and apple juice. If Kirk engaged in the problem behavior (i.e., sitting and waiting for a prompt) for 3 minutes or longer after task completion, the EA prompted him to say that he was finished, praised him for good work, and prompted him to begin the next task.

During this phase, the investigator used data collection procedures identical to those described in baseline. For each of the three tasks, this phase continued for a minimum of three data points, and until a stable behavior pattern emerged. The first task, printing, was extended for five additional data points (for a total of eight) in order to provide Kirk with ample opportunity to respond to the verbal contingency condition. Following the conclusion of this condition for each of the three tasks, the EA completed the social validation questionnaire (Appendix H).

Contingency Mapping (C)

During this phase, the EA showed Kirk the contingency map associated with each task as she verbally reviewed the positive (i.e., desired), undesired, and positive pathways using the same scripts as during the verbal contingency phase. Thus, the only difference between this phase and the previous one was that the EA pointed to each symbol on the contingency map as she reviewed the contingencies. In addition, when she completed her review of the contingency

map, she left the contingency map on Kirk's desk or computer monitor while he completed the target task.

During this phase, the investigator used data collection procedures identical to those described in baseline and the previous intervention phase. Across tasks, this phase continued for at least three data points, and until a stable behavior pattern emerged. Following completion of this phase across tasks, the EA completed the social validation questionnaire.

Follow-up (D)

Follow-up data were collected 1 and 2 weeks after termination of the contingency map phase in the final task, math. Kirk's school year ended shortly after the collection of the last follow-up session; therefore, no additional data collection was possible. During this phase, the EA used procedures identical to those in the contingency mapping condition; no additional EA training support was provided. The investigator used data collection procedures identical to those described in baseline and the previous intervention phases. Following completion of this phase across tasks, the EA again completed the social validation questionnaire.

Data Collection

A digital video camcorder (Canon NTSC ZR60) mounted on a tripod was used for all data collection throughout the study. Data were recorded from the videotaped probe sessions after they were converted to a HighMAT format (Microsoft, Windows Movie Maker, Version 5.1, 1981-2001). The converted tapes were then saved onto a CD-ROM so they could be viewed on a laptop computer. Microsoft Windows Media Player software program (Version 9, Microsoft, 2002) and two IBM compatible computers were used for data recoding. Latency to the nearest second was calculated from task completion to the initiation of the completion routine

using the definitions described previously. Latency was recorded by subtracting the time of task completion from the time when Kirk initiated his completion routine.

Training

A research assistant (RA) was trained to assess inter-observer agreement for both participant behavior and staff implementation fidelity of the behavior support plan. The investigator provided training in the use of the computer software and the procedures for recording child and EA behavior. For training purposes, the investigator videotaped several examples of tasks identified during the functional assessment as being most likely to elicit Kirk's prompt dependent behavior. The RA was trained to 90% accuracy across 10 videotaped sessions before data recording for the study commenced.

Inter-observer Agreement

The investigator and the RA independently coded a minimum of 33% of all videotaped baseline, intervention, and follow-up probe sessions balanced across the three tasks. The probes selected for inter-observer agreement were selected at random. A tolerance of $\pm$ 3 seconds was considered acceptable in the calculation of latency agreement. Inter-observer agreement for participant behavior was calculated by dividing the number of agreements by the number of agreements + disagreements, multiplied by 100. Inter-observer agreement scores for participant behavior were as follows: 100% agreement in baseline across tasks, 100% agreement in the verbal contingency condition across tasks, 83% agreement in the contingency mapping condition across tasks, and 100% in the follow-up condition across tasks. Table 7 presents a summary of the inter-observer agreement scores.

Table 6:

Inter-observer Agreement Data

	Variable	Condition			
		Baseline	Verbal Contingency	Contingency Map	Follow-up
Child Behavior (Latency to Completion Routine)	% of sessions used	40%	33%	33%	33%
	Agreement range (difference)	0 – 3 seconds	0 – 1 second	0 – 6 seconds	0 – 1 second
	Mean agreement	100%	100%	83%	100%

Staff Implementation Fidelity

Staff implementation fidelity was recorded by viewing the videotaped sessions that had been previously converted to HighMAT format and saved onto a CD ROM, as described previously. Two measures of staff implementation fidelity were used for this research. The first measure was *Total Implementation Fidelity*, which was defined as the accurate implementation of all critical components of Kirk's behavior support plan for each phase of intervention (see Appendix G for instructions provided to the EA). The second measure of implementation fidelity was *Contingency-Only Implementation Fidelity*, which was defined as the accurate implementation of the steps involved in informing Kirk about the contingencies associated with the behavior support plan (these steps varied depending upon the phase of intervention). The Contingency-Only Implementation Fidelity score was one specific component of the behavior support plan.

A checklist of critical implementation steps for both the Total Implementation Fidelity Score and the Contingency-Only Implementation Fidelity Score was developed from the typed behavior support plan that was provided to the EA at the start of each intervention phase. The researcher scored the EA's behavior across 100% of probe sessions. The RA independently rated both fidelity scores across a minimum of 33% of the probe sessions. Because the number of steps varied across interventions, the two measures of staff implementation fidelity are presented as a percentage.

Fidelity scores were calculated by dividing the number of steps that the EA accurately administered by the total number of steps, multiplied by 100. The mean score for Total Implementation Fidelity across tasks and conditions was 96% (range = 67% - 100%). The mean score for Contingency Only Implementation Fidelity across tasks and conditions was 94% (range = 50% - 100%). Inter-observer agreement for both fidelity scores was 99% (range = 93% - 100%).

Data Analysis

The effect of the two interventions was analyzed via visual inspection of the multiple baseline graph. The level of child behavior change was assessed by comparing mean latency of initiation of the completion routine across phases. Data points were graphed and analyzed according to the level, trend, and variability both between and within conditions. A reliable determination of experimental control was enabled through the critical analysis of these properties of the data

CHAPTER 4

Results

The objective of this study was to evaluate the impact of a contingency mapping intervention on the participant's problem behavior. The first hypothesis was that there would be a functional relationship between the use of a contingency mapping intervention and decreased problem behavior. The second hypothesis was that a contingency mapping intervention would be more effective than a verbal contingency intervention in reducing the problem behavior. A multiple baseline design across tasks using a multiple probe strategy was used to test these hypotheses. Three tasks, printing, keyboarding, and math were used within this design.

Analysis of the data confirmed that a functional relationship existed between the contingency mapping intervention and a decrease in problem behavior. Moreover, the data confirmed that the contingency mapping intervention was more effective than the verbal contingency intervention in reducing the target problem behavior. In addition, a social validation measure suggested that the contingency mapping intervention was viewed more positively than the verbal contingency intervention by the EA, who acted as the interventionist.

Participant Behavior Change

Figure 9 shows the latency from task completion to the initiation of the desired completion routine across tasks and conditions. Figure 9 depicts a stable pattern of behavior across all three tasks during baseline: the latency from task completion to initiation of the completion routine exceeded the 180-second ceiling during every probe session across all three tasks. For the printing and the keyboarding tasks, there was no decrease in latency to initiation of the completion routine during the verbal contingency intervention. Although there was a one-

time reduction in latency with the verbal contingency intervention in the math task (session 23); this did not recur over four subsequent trials in this condition.

The pattern was very different for the contingency mapping condition. For the printing task, a significant reduction in Kirk's latency to completion routine can be seen following the second session of this condition (session 18), and a stable pattern emerged from the fourth to sixth data point after the introduction of the contingency map (sessions 21-23). For both the keyboarding and math tasks, there was an immediate, substantial, and sustained reduction in latency to the initiation of the completion routine following the implementation of the contingency mapping intervention. The results across tasks were maintained across 2 weeks of follow-up.

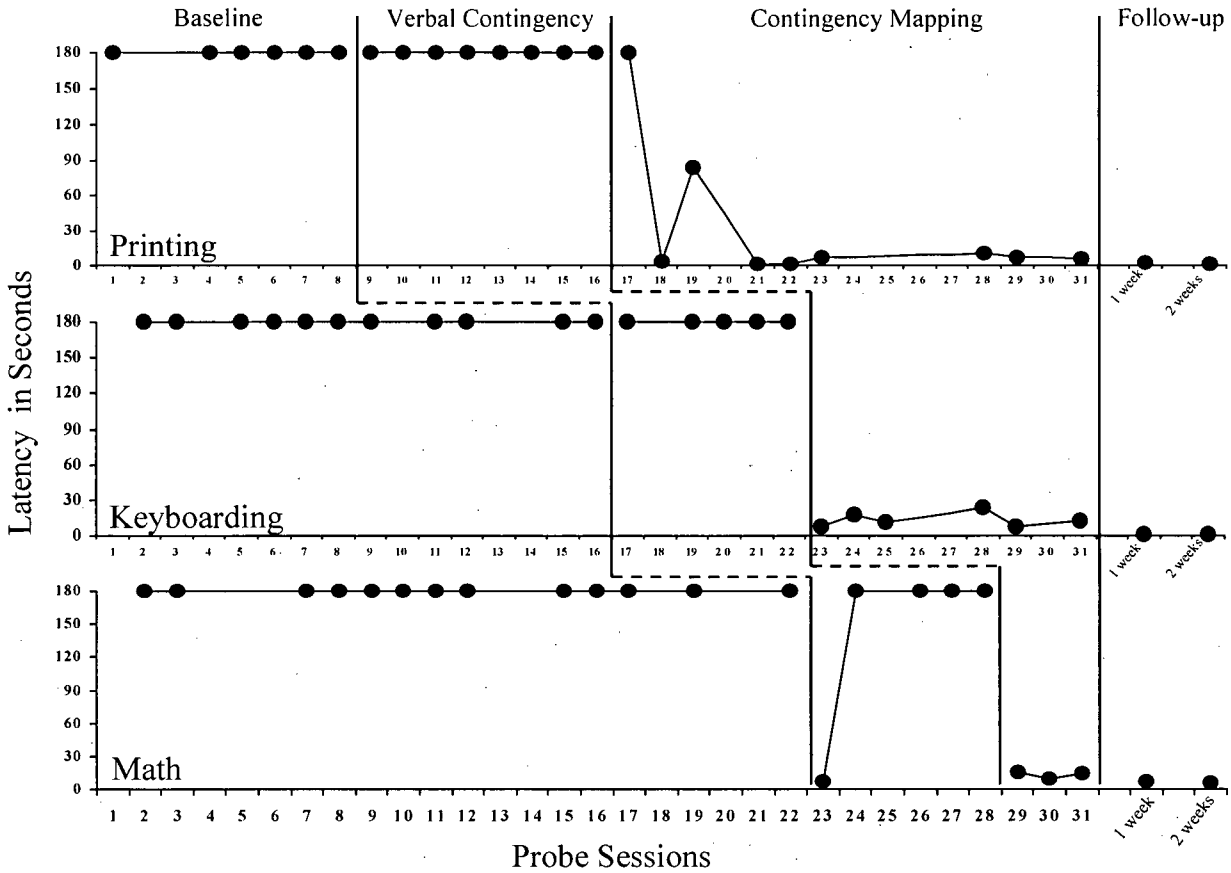

Figure 10. Latency from task completion to initiation of completion routine across probe sessions. Data points indicate the days when probes were administered.

From a visual inspection of Figure 9, it seems clear that experimental control was demonstrated. Although there was some experimental drift during session 23 in the math task, no sustained change in level and trend occurred until the contingency map intervention was implemented in each task. In addition, a clear functional relationship was established between the contingency mapping intervention and a reduction in latency to initiation of the completion routine. Finally, the contingency mapping intervention was clearly more effective than the verbal contingency intervention at reducing Kirk's problem behavior.

An inspection of the table of means (Table 7) confirms these conclusions. For all tasks during baseline, the mean latency to initiation of the completion routine was 180 seconds. Within the verbal contingency condition for printing, keyboarding, and math, the mean latency to initiation of the completion routine was 180 seconds, 180 seconds, and 146.2 seconds, respectively. Within the contingency mapping condition across printing, keyboarding, and math, the mean latency to initiation of the completion routine decreased to 33.3 seconds, 13 seconds, and 12.6 seconds, respectively. This drop in latency to initiation of the completion routine held stable during follow-up with mean scores of 1.5, 1.5, and 6.5 seconds for printing, keyboarding, and math tasks, respectively.

Table 7:

Summary of Means and Ranges of Latency to Initiation of the Completion Routine Measured in Seconds

		Condition			
	Variable	Baseline	Verbal Contingency	Contingency Map	Follow-up
Printing	Mean	180 sec	180 sec	33.3 sec	1.5 sec
	Range	no variability	No variability	1 –180 sec	1 – 2 sec
Keyboarding	Mean	180 sec	180 sec	13 sec	1.5 sec
	Range	no variability	No variability	7 – 24 sec	1 – 2 sec
Math	Mean	180 sec	146.2 sec	12.6 sec	6.5 sec
	Range	no variability	11-180 sec	9 – 15 sec	6 – 7 sec

Note: sec = seconds.

Social Validation

Table 8 shows the results from the social validation survey administered to the EA. The scale ranged from 1 to 5, with the higher scores representing higher levels of satisfaction. The scores presented in Table 8 are averaged across the tasks. This was done because, with one exception noted below, the scores were consistent across the three tasks.

The EA rated both the verbal contingency and the contingency mapping interventions as equally acceptable, convenient, and easy to administer. The EA indicated that the neither the reduction in problem behavior or the increase in alternative behavior achieved during the verbal contingency condition were satisfactory. On the other hand, she indicated that the reduction in problem behavior and increase in alternative behavior following the contingency mapping condition were both highly acceptable. Across the contingency mapping and follow-up conditions, the EA assigned overall neutral ratings regarding the statement that Kirk's ability to participate in school increased as a result of the intervention. Specifically, she assigned scores of 5, 3, and 3 to this statement across the three tasks (printing, keyboarding, and math). Overall, her ratings for this item were higher for contingency mapping than for the verbal contingency intervention.

Table 8:

Summary of Means for Social Validation Scores Across Tasks

Statement	Score (1-5)		
	Verbal Contingency	Contingency Map	Follow-up
1. The intervention was acceptable to me.	5	5	5
2. The intervention was convenient to implement.	5	5	5
3. The intervention was easy to implement.	5	5	5
4. There was an acceptable reduction in the targeted problem behavior.	1	5	5
5. There was an acceptable increase in the targeted alternative behavior.	1	5	5
6. The student's ability to participate in school increased as a result of the intervention.	1	3.7	3

Note: 1 = strongly disagree; 3 = neutral; 5 = strongly agree.

Summary of Results

The hypothesis regarding the first research question was supported by the data: a functional relationship between contingency mapping interventions and a reduction in problem behavior was demonstrated. These results were maintained during data collection at 1 and 2 weeks follow-up and were supported by social validation data indicating that the EA believed the contingency mapping intervention resulted in an acceptable decrease in problem behavior and an acceptable increase in alternative behavior.

The hypothesis regarding the second question was also supported: the contingency mapping intervention was shown to be more effective at reducing Kirk's problem behavior than the verbal contingency intervention. Visual inspection of the data revealed that, within the verbal contingency intervention across tasks, there was no change in behavior from baseline, with the exception of one data point. On the other hand, the contingency mapping intervention showed a substantial and sustained reduction in problem behavior across all three tasks. Social validation data supported these findings; the EA indicated that she found the reductions in problem behavior and increase in alternative behavior to be acceptable for the contingency mapping intervention only.

CHAPTER 5

Discussion

This study was the first to examine and provide empirical support for the use of contingency mapping with children with autism. Across three tasks identified by the participant's school team as most problematic for him (printing, keyboarding, and math), he responded to a contingency mapping intervention by initiating a completion routine after finishing his work. Immediate and substantial behavior change within the contingency mapping intervention followed minimal to no behavior change in a matched verbal contingency condition.

The results will be discussed in the sections that follow. First, the implications of the study for Kirk will be summarized. Second, the study will be discussed in the context of the existing literature of functional equivalence training (FET). Next, discussions of the broader implications of the study in clinical and education settings, the limitations of the research, and directions for future research will be highlighted. Finally, a summary of how contingency mapping as used in this study fits into a positive behavior support (PBS) paradigm will be provided.

Implications for Kirk

The target behavior identified in this study, prompt dependency, was a long-standing problem for Kirk that had been resistant to intervention at school over several years. Compared to behaviors such as aggression or self-injury, prompt dependency may not be seen as a "severe" problem behavior. However, this behavior had had a considerable negative impact on Kirk's independence and learning over several years. If his dependence on others to prompt transitions and activities were to persist throughout his school years and into adulthood, Kirk's ability to lead even a semi-independent lifestyle would be greatly diminished. Thus, for Kirk, finding a

solution to prompt dependence was essential to improving the present and future quality of his life. This study provided a beginning step toward achieving this goal through the use of a contingency mapping intervention that resulted in decreased prompt dependence across three of the most problematic routines in Kirk's school day. The intervention provides a framework that Kirk's parents, educators, and paraprofessionals might continue to use to increase his independence across a variety of transitions and tasks.

Comparison with Previous Research

This study builds on the extant PBS and FET literature in a number of important ways, including extending FET to the analysis and treatment of prompt dependency and providing an example of the use of adjunct positive reinforcement within an FET intervention. In addition, it furthers our understanding of the utility of visual support strategies to teach functionally equivalent behaviors to individuals with autism.

Treating Prompt Dependency Within a Positive Behavior Support Framework

The problem behavior selected for this study, prompt dependency, was somewhat unconventional, in that it did not involve either acting out or self-injurious behavior, both of which have been the focus of the majority of published PBS interventions to date (Carr et al., 1999). Dependence on irrelevant stimuli, such as the extra-stimulus prompts delivered by others, is often considered a learning characteristic of individuals with autism and is referred to as "stimulus overselectivity" (Koegel & Koegel, 1996; McClannahan & Krantz, 1997, Schreibman, 1997). Several researchers have emphasized the need for precise, systematic instructional procedures such as the use of careful prompt fading techniques to overcome overselective responding (Committee on Educational Interventions for Children with Autism, 2003; Koegel & Koegel, 1996; Smith, Groen, & Wynn, 2000). The approach taken in the present study was quite

different from previous literature on stimulus overselectivity in that prompt dependency was conceptualized as a problem behavior that could be remediated with PBS strategies. Kirk's prompt dependency was assessed as functional for him rather than as merely a symptom of the disability with which he had been labeled. Thus, prompt dependency was deemed a behavior that might be amenable to an FET intervention.

Building on the FET literature.

Durand and Merges (2001) noted that, in FET interventions, it is critical to create sufficient "behavioral contrast" (p. 117) between the consequences that follow the new, alternative behavior and those that occur after the problem behavior. A hierarchy of responses to problem behavior would include, from the smallest to the largest amount of behavioral contrast: (a) making problem behavior less efficient by requiring more than one instance of it before reinforcement is provided, (b) extinguishing problem behavior, and (c) providing punishment contingent on the occurrence of problem behavior. In the present study, the first of these responses was not applicable, given the nature of Kirk's problem behavior. The second response, extinction, was also not viable because, at least initially, placing Kirk's prompt dependent (i.e., waiting) behavior on extinction would have likely resulted in long periods of time during which he sat idle and unengaged in school work, which was deemed unacceptable by his school team. The third response, using a mild punishment procedure contingent on prompt dependent behavior, was not ecologically valid or socially appropriate in the classroom setting in which Kirk's behavior occurred. Thus, some other procedure was required in order to create sufficient behavioral contrast between the problem behavior and its functional alternative.

In this study, Kirk's prompt dependency was assessed as being maintained through tangible reinforcement in the form of the presentation of the next activity in his school routine.

Kirk's prompt dependency was treated by teaching him an alternative behavior that served the same tangible function -- namely, presenting his finished work to the EA and/or telling the EA that he was "finished", in order to gain access to the next activity. In order to create sufficient behavioral contrast, additional reinforcement (i.e., a preferred food item) was added to the functional reinforcer (i.e., provision of the next activity) whenever Kirk engaged in the new, alternative behavior. Thus, rather than reducing the reinforcement available for the problem behavior, as suggested by Durand and Merges (2001), this approach effectively "doubled" the amount of reinforcement available following the alternative behavior and thus created the desired behavioral contrast. This study adds to the small number of studies in which behavioral contrast was created though the use of non-punishment-based procedures in combination with FET (e.g., Clarke et al., 2002; Healey et al., 2001; Hoch et al., 2002; Vaughn et al., 2002). In all of these studies, arbitrary reinforcers were combined with functional reinforcers in order to encourage the adoption of an alternative behavior.

Building on the visual support literature.

Many authors have noted that individuals with autism tend to be strong visual learners and relatively poor processors of verbal language (Grandin, 1995; Hodgdon, 1995, 1996; Lincoln et al., 1988; Quill, 1995a). In response to this, a wide array of visual support strategies have been developed for persons with autism to augment their comprehension of verbally conveyed messages (Wood et al., 1998). A number of these visual support strategies (e.g., visual schedules) have received considerable empirical support (Bopp, Brown, & Mirenda, 2004). However, few studies have compared the use of verbal vs. visual strategies to present messages or provide information to persons with autism (cf., Vaughn & Horner, 1995; Peterson, Bondy, Vincent, & Finnegan, 1995). This study extends the literature on the use of visual support

strategies by providing such a comparison. The results provide empirical support for the assertion that individuals with autism have relative strengths in visual compared to verbal processing, as demonstrated by the effectiveness of the contingency mapping intervention over the verbal contingency intervention.

Out of all of the visual support strategies described in the literature to date, three are somewhat similar to contingency maps. Two of these, rule scripts (Mirenda et al., 2002) and rule charts (Hodgdon, 1995, 1999) have been described anecdotally or in case study reports only. The third, the social story approach described by Carol Gray (Gray & Garand, 1993), has been the subject of several research studies (see Table 5). However, in both application and purpose, contingency maps differ from these interventions in several important ways: (a) contingency maps provide a graphic representation of the "if-then" contingencies associated with PBS plans, (b) contingency maps are more directive than social stories, and (c) contingency maps focus equally on both the desired and the undesired behavioral pathways that are inherent in all PBS plans. Thus, contingency mapping adds a new alternative to the existing visual support literature in the form of an intervention that can be used to teach individuals why and under what conditions they should use an alternative replacement behavior.

Educational and Clinical Implications

Several features of contingency maps make them potentially effective and efficient tools that can be used in school, home, and community settings. First, contingency maps conform to the framework of the Competing Behavior Pathways model (O'Neill et al., 1997), one of the most commonly-used approaches to functional behavior assessment. Thus, many individuals who are responsible for designing behavior support plans may already be familiar with the framework inherent in the contingency mapping approach. Second, even without this frame of

reference, contingency maps are relatively easy to create and implement. Once the desired and undesired pathways are depicted clearly using pictures of some type, the interventionist simply reviews the contingencies with the person using the map and then insures adherence to the plan as depicted. The contingency map acts a reminder to *both* the target individual and the interventionist about the contingency "rules" inherent in the behavior support plan. When reviewing the contingency map with the target person, the interventionist is, in effect, self-priming for many of the behaviors that are required of him or her in order to carry out the behavior support plan. This dynamic was seen clearly in the present study, in which the interventionist (i.e., the EA) had no prior behavioral, educational, or disability-related experience. During the study, the EA experienced numerous conflicting pressures: while learning a new and challenging job, she was torn between parental concerns that Kirk's coping abilities not be overtaxed, employer concerns that Kirk complete his assigned curricular activities, and researcher concerns that she participate in intervention training and adhere to the intervention protocol. These pressures, combined with the EA's inexperience, might have threatened the integrity of the research had the contingency map intervention itself not been easy to use and straightforward to implement accurately. The high scores related to treatment integrity clearly demonstrate that, despite, her reluctance to participate in training and to adhere to the contingency mapping protocol, the EA was able to implement both the verbal contingency and the contingency mapping interventions at a level that affected dramatic behavior change for Kirk. These results, in the face of such difficult circumstances, attest to the robust nature of contingency mapping interventions.

Limitations of the Study

Multicomponent Intervention

For Kirk, the addition of contingency maps to the verbal contingency resulted in significant behavior change. However, the multicomponent nature of the intervention did not permit analysis of the relative contributions of the arbitrary (i.e., food) reinforcer, the functional reinforcer, and the contingency maps themselves. Furthermore, while the results clearly show that the contingency maps exerted stimulus control over Kirk's initiation of the completion routine, it is not clear which component(s) of the maps were primarily responsible for this. A contingency map represents each of, and the relationships between, the following components: (a) the antecedents and/or setting events for the problem and alternative behaviors, (b) the topographies of both the problem and alternative behaviors, (c) the reinforcer(s) that will occur contingent on a functionally alternative behavior, and (d) the consequences that will occur contingent on problem behavior. Hypothetically, any single component or combination of components in the contingency map could be the source of stimulus control. For example, perhaps a visual depiction of the reinforcer available for the functionally alternative behavior would exert sufficient influence over the behavior to result in behavior change, without any of the other components. In the present study, the assumption was made that depicting the relationships between *all* of the component parts of the contingency map was essential. Future research is needed to investigate this issue, so that contingency maps can be designed in ways that are most effective for the individual with whom they are used as well as minimally time consuming for those who create and implement them.

Order Effect

Although the multiple baseline design used for this research was essential for demonstration of experimental control, it did not control for an order effect across interventions. It is possible that the positive effect of the contingency mapping condition was influenced by the presentation of the verbal contingency condition that directly preceded it. This concern would have been lessened through the use of a multiple baseline ABACD design, in which a return to baseline phase separated the verbal contingency and contingency mapping interventions. However, because this study commenced toward the end of Kirk's school year, inclusion of the extra probe sessions that would have been needed for the return-to-baseline phase between interventions could have jeopardized the completion of the study. As a result, the second baseline condition was sacrificed in favor of the entire study.

Complexity of Message

An additional limitation of this study pertains to the message that was conveyed to Kirk during the verbal contingency and contingency mapping conditions. Formal tests of Kirk's receptive language ability and/or intellectual functioning were not available for this research, and an archival search yielded no recent tests related to either of these constructs. The majority of Kirk's school team believed that the verbal messages conveyed to Kirk were well within his receptive language and cognitive abilities. The one exception was a team member who was hesitant to affirm that Kirk could comprehend the negative statements that were related to the undesired behavior path of the script (i.e., "If you <u>don't</u> give me your work.... you will <u>not</u> get a treat..."). It is possible that the complexity of this message may have impacted Kirk's ability to comprehend the information presented in the verbal contingency condition, which would have then favored the contingency map condition. Future research is needed to explore this issue.

External Validity

Only one child participated in this study, thus limiting its external validity. In addition, several unique characteristics of Kirk, the school environment, the tasks, and the problem behavior further limit the generalizability of these findings to other individuals with autism in other settings. For example, Kirk had had previous exposure to a PCS-based scheduling system and to PCS cueing. His existing abilities and familiarity with PCS may have increased the speed with which he responded to the contingency maps. The tasks selected for this study all had overt, clearly defined beginning and end points that made it easy to label and visually represent the antecedents. For behavioral pathways that are not as easily labeled and represented pictorially, contingency maps may be less effective. In addition, the alternative replacement behaviors that were taught to Kirk were all within his behavioral repertoire; he was already quite capable of bringing his work to the EA and telling her that he was finished. Thus, Kirk did not have to learn any new skills for this study -- he had only to learn to apply, without prompting, existing skills to new situations. The effectiveness of contingency maps for teaching brand new skills requires additional research.

It is also important to note that Kirk's problem behavior of sitting and passively waiting for a prompt, although always easy for him, was not always *efficient* at enabling him to gain access to the desired reinforcer (i.e., information about the next activity). During initial observations, Kirk sometimes sat for extended periods of time before his EA noticed that he was finished and prompted him to begin his next activity. Had Kirk's problem behavior been more efficient at achieving the desired outcome, his acceptance of the more difficult-to-execute alternative behavior may have been hampered. In addition, the problem behavior also occurred at a relatively high frequency across Kirk's school day; in fact, it occurred at the completion of

100% of all tasks assigned to him. One advantage of this was that, during the contingency mapping intervention, Kirk had numerous opportunities to utilize the alternative replacement behavior and receive the associated reinforcers. The results may not have been as dramatic had Kirk had fewer opportunities to practice the alternative behavior. Future research is required to examine the effectiveness of contingency maps for low-frequency problem behaviors.

Future Research

In addition to the considerations for future research noted previously, several other issues related to the use of contingency maps also require investigation. No attempt was made in the present study to assess generalization of the contingency maps used with Kirk across new people, settings, or tasks. Furthermore, due to time constraints, the impact of the intervention was not assessed formally after the two-week follow-up probe. Anecdotal reports by Kirk's EA (who was also the interventionist) indicate that Kirk continued to initiate his completion routine, albeit more sporadically, even after the contingency maps and the arbitrary reinforcers were discontinued upon completion of the study. This suggests that a transfer of stimulus control spontaneously occurred from the contingency maps to relevant task-related stimuli (e.g., reaching the end of a page or typing/printing the last character on a page). Future research is required to investigate the point at which use of a contingency map should be faded in order to promote this transfer, as well as to investigate issues related to generalization.

In addition, it was beyond the scope of this study to compare contingency mapping to other interventions designed to reduce prompt dependency, such as within-activity schedules (Clarke et al., 1999) or systematic within-stimulus prompting and fading techniques (Koegel & Koegel, 1996). Future research comparing the utility and social validity of contingency mapping with other behavior support strategies for prompt dependency is also needed.

Conclusion

The purpose of this study was to test the effectiveness of contingency mapping interventions for reducing the frequency of problem behavior. The results clearly demonstrated a functional relationship between a contingency mapping intervention and reduced problem behavior in the form of shortened latency to initiation of a completion routine. Across all three tasks in a multiple baseline design, the contingency mapping condition resulted in immediate, substantial, and sustained reductions in Kirk's problem behavior. The results also demonstrated that the contingency mapping intervention was more effective than a verbal contingency intervention that was identical except for the use of visual supports. This strongly suggests that the visual component of the contingency mapping intervention was largely responsible for the outcome.

This research contributes to both the visual support literature and the FET literature in several meaningful ways. First, it adds to the growing body of literature that supports the use of visual strategies with persons with autism. More specifically, this study provides a somewhat unique comparison of the impact of verbal-alone and visual + verbal interventions, and contributes empirical support to similar clinical strategies that have been described previously (e.g., Hodgdon, 1995, 1999; Mirenda et al., 2002). The study also builds on the existing FET literature by providing (a) further empirical support for the use of combined arbitrary and functional reinforcers in situations when extinction and/or mild punishment procedures cannot be used to create behavioral contrast, (b) an effective and efficient visual strategy that can be used to teach the contingencies associated with PBS plans to persons with autism, and (c) support for the notion that prompt dependency can be effectively assessed and treated within a PBS approach.

It seems clear that contingency mapping interventions fit well within the framework of PBS. Carr et al. (2002) detailed nine characteristics or critical features (presented in italics below) of the PBS approach. Consistent with Carr et al.'s framework, the innovative use of contingency maps represents *flexibility with respect to scientific practices* as well as the use of a *multicomponent* approach to intervention. The ease of use of contingency maps in the present study demonstrated, at least in the school setting, *ecological validity*; and the positive scores obtained from the EA who delivered the intervention provided evidence of *social validity.* Contingency mapping embodies the *multiple theoretical perspectives* of both applied behavior analysis and augmentative and alternative communication (Bopp et al., 2004). The components of skill building and teaching environmental relationships through the use of contingency mapping fit well within PBS's *emphasis on prevention.* In this study, the *participation of stakeholders* as active and valued team members was evident in their identification of problem routines as well as their involvement in planning, developing, and implementing the interventions. Finally, contingency maps have the potential of contributing to a *life span perspective* and *comprehensive lifestyle change and quality of life* within a larger, comprehensive PBS support plan. As part of a PBS plan, contingency maps have the potential to provide parents, teachers, and others who support individuals with autism with an easy, convenient, and socially acceptable means for promoting positive behavior change and enhanced quality of life.

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Appendix A:

Screening Form – Parent Phone Interview Form

PARTICIPANT NUMBER:

REPORTING PARENT: MOTHER / FATHER / GUARDIAN	

DIAGNOSIS

Has your child been diagnosed by a multidisciplinary team as having autism, Asperger's syndrome, or PDD-NOS (circle appropriate)?	YES	NO

HEARING / VISION

Has your child's hearing been assessed within the past 3 years?	YES	NO
Does your child possess an uncorrected hearing difficulty?	NO	YES
Has your child's vision been assessed within the past 3 years?	YES	NO
Does your child possess an uncorrected vision difficulty?	NO	YES

BEHAVIORAL HISTORY

Has your child demonstrated serious self-injurious behavior within the past 2 years (i.e., self-injurious behavior that resulted in tissue damage or changes to your child's appearance)?	YES	NO
Has your child demonstrated serious aggressive behavior within the past 2 years (i.e., aggressive behavior that resulted in tissue damage or property damage)?	YES	NO

PARENT WILLINGNESS

Are you willing to have the investigator perform screening interviews and observations in your child's school/preschool?	YES	NO

⇧

Parents whose responses are checked in the first response column will meet the initial criteria. These parents will be asked questions from the *Participant Identification Form.*

Consent:
I understand that my child's participation in this study is entirely voluntary and I may refuse to have him/her participate or withdraw from the study at any time without jeopardy to current or future services provided through the University of British Columbia or **[name of preschool/school].**

Please check ✓ one box below:

- I have received a copy of this consent form.
- I have **not** received a copy of this consent form.

Please check ✓ one box below:

- I consent to my child's participation in this study.
- I do **not** consent to my child's participation in this study.

If you consent to having your child participate in this study, please print your child's name, print your name, and sign the appropriate sections below.

_____ _____
Child's name (please print) Date

_____ _____
Parent/Guardian's name (please print) Date

_____ _____
Parent/Guardian's signature Date

_____ _____
Signature of a witness Date

Appendix C:

Screening Form – Agency Interview Form

PARTICIPANT NUMBER:

RESPONDENT: TEACHER / SUPPORT WORKER	DATE:

VISUAL ABILITY

1. What strategies have you used to teach the student a new task (circle all that apply)?	verbally	pictures or line-drawings	modelling	video	sign and/or gesture	Other: _____
2. What strategies do you feel are most effective at teaching the student a new task (circle all that apply)?	verbally	pictures or line-drawings	modelling	video	sign and/or gesture	Other: _____
3. What strategies do you feel are ineffective at teaching the student a new task (circle all that apply)?	verbally	pictures or line-drawings	modelling	video	sign and/or gesture	Other: _____

BEHAVIOR (questions from O'Neill et al., 1997)

1. For each of the behaviors of concern, define the topography (how it is performed), frequency (how often it occurs per day, week, or month), duration (how long it lasts when it occurs), and intensity (how damaging or destructive the behaviors are when they occur).

	BEHAVIOR	TOPOGRAPHY	FREQUENCY	DURATION	INTENSITY
A					
B					
C					
D					
E					
F					
G					
H					
I					
J					

2. Which of the behaviors described above are likely to occur together in some way? Do they occur about the same time? In some kind of predictable sequence or "chain"? In response to the same type of situation?

3. What do you know about the history of the undesirable behaviors, the programs that have been attempted to decrease or eliminate them, and the effects of those programs?

	BEHAVIOR	HOW LONG HAS THIS BEEN A PROBLEM?	PROGRAM	EFFECTS
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				

Appendix D:

Screening Form – Symbol Assessment Protocol

Symbol Assessment Procedures

Materials Before beginning the symbol assessment, the investigator will identify 20 functional items with which the participant is familiar. The investigator will select these items based on observations as well as advice provided by preschool/school staff. The investigator will collect the items and create 2" by 2" cards containing PCS or line-drawing symbols for each item. The investigator will randomly select 10 of these items for the initial symbol assessment. The remaining 10 items will be used for a second assessment session if the initial symbol assessment session fails to yield meaningful results.

Procedures The investigator will begin the symbol assessment at a table devoid of distractions. The investigator will employ a visual-matching task (Beukelman & Mirenda, 1998, Franklin, Mirenda, & Phillips, 1996) for the symbol assessment. The investigator will first place four PCS on the table. The investigator will then place an object corresponding to one of the PCSs on the table, approximately 2 inches in front of the participant and centred between the middle two PCSs. The investigator will ask the participant to match the item with the correct picture by saying "find the one that's the same" while gesturing with a pointed finger across all of the PCS cards.

Scoring A correct match will be scored if the participant points to, gestures toward, or grasps the correct PCS; places the object on top of the correct PCS; or uses any other definitive selection behavior to identify the correct PCS within 10 seconds. An incorrect match will be scored if the participant selects any other PCS. If the participant fails to indicate a selection within 10 seconds, the investigator will repeat the direct verbal and gestural prompt. A non-response will be scored if the participant fails to select a PCS twice in a row.

Matching Task Training If the participant makes a non-response on four or more consecutive trials, the investigator will train the participant to perform the matching task, using a most-to-least prompting procedure. This training will be conducted for 10 to 20 minutes, 2 to 3 times in one day. If the training is successful, the investigator will conduct the symbol assessment as described above on the following day with 10 new items and corresponding PCSs.

Appendix E:

Screening Form – Symbol Assessment Form

PARTICIPANT NUMBER:	DATE:

ITEMS FOR INITIAL ASSESSMENT (all items identified by team as "known' by participant and randomly ordered)

1.	11.
2.	12.
3.	13.
4.	14.
5.	15.
6.	16.
7.	17.
8.	18.
9.	19.
10.	20.

#1 MATCHING-TASK ASSESSMENT

TRIAL	TARGET ITEM #	PCS POSITION	SCORE
A.		L LM RM R	
B.		L LM RM R	
C.		L LM RM R	
D.		L LM RM R	
E.		L LM RM R	
F.		L LM RM R	
G.		L LM RM R	
H.		L LM RM R	
I.		L LM RM R	
J.		L LM RM R	

(PCS POSITION: L = left; LM = left middle; RM = right middle; R = right)
(SCORE: ✓ = correct; ✖ = incorrect; n/r = non-response)

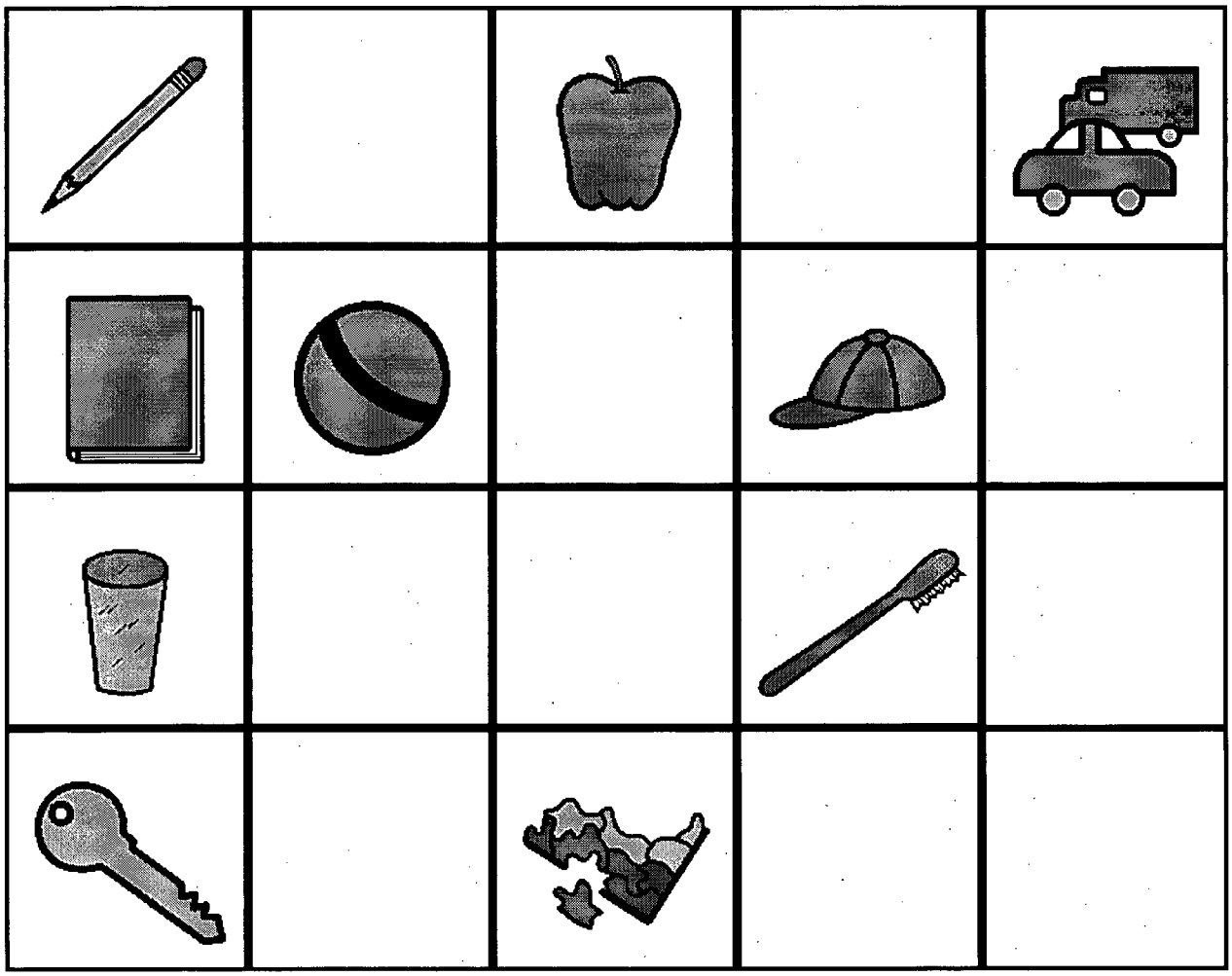
#2 MATCHING-TASK ASSESSMENT

TRIAL	TARGET ITEM #	PCS POSITION	SCORE
A.		L LM RM R	
B.		L LM RM R	
C.		L LM RM R	
D.		L LM RM R	
E.		L LM RM R	
F.		L LM RM R	
G.		L LM RM R	
H.		L LM RM R	
I.		L LM RM R	
J.		L LM RM R	

(PCS POSITION: L = left; LM = left middle; RM = right middle; R = right)
(SCORE: ✓ = correct; ✖ = incorrect; n/r = non-response)

Appendix F:

PCS used for Symbol Assessment



Appendix G:

Procedures for Verbal Contingency and Contingency Mapping Interventions

Procedural Notes for Intervention B: Verbal Contingency Only.

- **PROMPT TASK/SCHEDULE:** EA prompts Kirk or shows Kirk on schedule that it is time for [TASK],
- **MATERIALS TO WORK AREA:** EA helps Kirk acquire necessary materials and bring materials to designated work area (desk or back table for written assignments, computer for keyboarding),
- **TELL ABOUT CONTINGENCY:** EA verbally explains that if the Kirk just waits at his desk/computer, there will be no reinforcer. But, if the Kirk brings the finished work right away, he will get an edible reinforcer.

  EXAMPLE:
  - ***"Kirk"*** [gain attention, but do not force him to look at you]
  - ***"You are finished when you get here"*** [point to and hold your finger on the finished spot on page, and try to gain his attention on the spot]
  - ***"When you are finished, get up, bring your work to me and I will give you a treat."***
  - ***"When you are finished…*** [point to and hold your finger on the finished spot on page, and try to gain his attention on the spot] ***…if you wait and don't get up to give me your work, I will not give you a treat."***
  - ***"So Kirk, when you are finished…*** [point to and hold your finger on the finished spot on page, and try to gain his attention on the spot] ***… get up, bring your work to me and I will give you a treat."***
  - **Repeat positive message ending with getting treat.**
- **TASK EXPLANATION & ASSISTANCE:** EA provides explanation and initial assistance as needed. (This task should not be new. Do not deviate from current task and do not add new steps),
- **MONITOR AND SUPPORT INITIALLY:** EA monitors Kirk in activity as needed to ensure success in initial trials of task,
- **AVOID CUEING AT END:** EA avoids cueing Kirk after Kirk's completion of task (avoids eye contact, proximity cue, gestures, or vocalization),

a **IF HE BRINGS WORK -- PRAISE & REINFORCE:** If Kirk spontaneously brings completed work to EA, EA to accept work, praise Kirk for good work, and provides a treat for bringing work,

  EXAMPLE:
  - ***"Good work Kirk"***
  - ***"Here is treat for bringing me your work. Choose one*** [while showing him the PCS reinforcer option card] ***for bringing me your work"***

b **IF HE SITS AND WAITS -- PRAISE GOOD WORK, DO NOT REINFORCE:** If Kirk fails to bring work to EA for 3 minutes, Ken will cue EA to go to Kirk. EA will prompt

Kirk to initiate his completion routine. EA will praise Kirk for good work, but not provide reinforcer for independently bringing work to EA.

- **TIME TO EAT REINFORCER:** EA allows Kirk sufficient time to eat the treat,

➤ **PROMPT/SCHEDULE FOR NEXT TASK:** EA prompts Kirk to engage in next task or guides Kirk to schedule.

Procedural Notes for Intervention B: Contingency Mapping Intervention.

- **PROMPT TASK/SCHEDULE:** EA prompts Kirk or shows Kirk on schedule that it is time for [TASK],
- **MATERIALS TO WORK AREA:** EA helps Kirk acquire necessary materials and bring materials to designated work area (desk or back table for written assignments, computer for keyboarding),
- **SHOW CONTINGENCY MAP & TELL ABOUT CONTINGENCY:** **While pointing to each picture,** EA verbally explains that if the Kirk just waits at his desk/computer, there will be no reinforcer. But, if the Kirk brings the finished work right away, he will get an edible reinforcer.

  EXAMPLE:
  - ***"Kirk"*** [gain attention, but do not force him to look at you]
  - ***"You are finished when you get here"*** [point to and hold your finger on the finished spot on page, and try to gain his attention on the spot]
  - ***"When you are finished, get up, bring your work to me and I will give you a treat."***
  - ***"When you are finished…*** [point to and hold your finger on the finished spot on page, and try to gain his attention on the spot] ***…if you wait and don't get up to give me your work, I will not give you a treat."***
  - ***"So Kirk, when you are finished…*** [point to and hold your finger on the finished spot on page, and try to gain his attention on the spot] ***… get up, bring your work to me and I will give you a treat."***
  - **Repeat positive message ending with getting treat.**
- **TASK EXPLANATION & ASSISTANCE:** EA provides explanation and initial assistance as needed
  (This task should not be new. Do not deviate from current task and do not add new steps),
- **MONITOR AND SUPPORT INITIALLY:** EA monitors Kirk in activity as needed to ensure success in initial trials of task,
- **AVOID CUEING AT END:** EA avoids cueing Kirk after Kirk's completion of task (avoids eye contact, proximity cue, gestures, or vocalization),

IF HE BRINGS WORK -- PRAISE & REINFORCE: If Kirk spontaneously brings completed work to EA, EA to accept work, praise Kirk for good work, and provides a treat for bringing work,

EXAMPLE:
- ***"Good work Kirk"***
- ***"Here is treat for bringing me your work. Choose one*** [while showing him the PCS reinforcer option card] ***for bringing me your work***"

➤b **IF HE SITS AND WAITS -- PRAISE GOOD WORK, DO NOT REINFORCE:** If Kirk fails to bring work to EA for 3 minutes, Ken will cue EA to go to Kirk. EA will prompt Kirk to initiate his completion routine. EA will praise Kirk for good work, but not provide reinforcer for independently bringing work to EA.

- **TIME TO EAT REINFORCER:** EA allows Kirk sufficient time to eat the treat.

➤ **PROMPT/SCHEDULE FOR NEXT TASK:** EA prompts Kirk to engage in next task or guides Kirk to schedule.