Nonlinear Functional Analysis and Systemic Treatment of Selective Mutism

Dissertation

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By
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SYSTEMIC TREATMENT OF SELECTIVE MUTISM

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Abstract

The present research addressed two questions related to behavioral technologies for analyzing and treating Selective Mutism (SM). Experiment 1 examined to what extent contextual variables (e.g., setting, people, social interactions, task demand, negative reinforcement, positive reinforcement) affecting SM can be identified using nonlinear functional analysis. Experiment 2 examined the effects of systemic treatment on the remediation of SM and maintenance of behavioral change when treatment is derived from a nonlinear functional analysis. In Experiment 1, the nonlinear functional analysis identified the variables controlling SM for two participants. For a third participant, the nonlinear functional analysis revealed that mutism occurred slightly more often than verbalizations in one condition but not in others. Experiment 2 demonstrated that systemic treatment effectively increased verbalizations across three settings for one participant and appeared to be effective in at least one setting for the second participant. Procedures extended Goldiamond’s nonlinear functional analysis framework by experimentally manipulating environmental variables associated with SM, and the results showed promise identifying the variables maintaining SM. Research is needed with more participants to better develop generalizable methods. Future studies include refining the identification of conditions under which verbalization is expected (i.e., interaction opportunities) and an analysis of structural variations of antecedent stimuli to identify differential effects on SM.

Key terms: selective mutism, nonlinear functional analysis, systemic treatment
Selective Mutism (SM) is characterized by an individual’s failure to speak in certain situations where there is a common expectation to speak. The individual’s failure to speak usually occurs in particular contexts, despite the person possessing the appropriate structural and functional mechanisms to speak in other situations (American Psychiatric Association, *DSM-5*; 2013). A diagnosis of SM is considered when the individual’s behavior is not more appropriately described by the diagnostic criteria for a communication disorder and does not occur as a direct result of an autism spectrum disorder, schizophrenia, or other psychotic disorder (American Psychiatric Association, 2013).

The prevalence of SM is estimated at less than one percent of the population, although it may be higher as the severity of the behavioral symptoms is underreported (Kearney & Vecchio, 2006). Often, children who meet the diagnostic criteria for SM are simply perceived or labeled as shy, sensitive, anxious, and withdrawn. Bergman, Piacentini, and McCracken (2002) reported that the disorder may affect as many as one in every 143 youth. SM can have implications on the social, emotional, academic, and vocational aspects of an individual’s life. Moreover, children diagnosed with SM often experience comorbid psychiatric conditions including depression, panic disorders, and obsessive-compulsive disorder, as well as communication delays and developmental disorders (Wong, 2010).

A significant focus of SM treatment has been on managing the symptoms of the diagnosis, without experimentally analyzing the controlling variables or functions of the behavior. Many approaches to treating SM attempt to identify and resolve underlying psychological, family, and/or neurological characteristics that are theoretically suggested for the individual’s failure to speak under certain circumstances. For example, the psychodynamic model assumes an “intrapsychic conflict” (Anstendig, 1998, p. 383) as the cause of SM and uses
play therapy as a primary intervention. Alternatively, several reviews of the SM treatment literature have highlighted the empirically-validated efficacy of behavioral interventions (Cohan, Chavira, & Stein, 2006; Labbe & Williamson, 1984; Stone, Kratochwill, Sladezcek, & Serlin, 2002). There is ample research demonstrating positive outcomes with behavioral treatments for SM (Amari, Slifer, Gerson, Schenck, & Kane, 1999; Beare, Torgerson, & Crevison, 2008; Facon, Sahiri, & Riviere, 2008; Giddan, Ross, Sechler, & Beckler, 1997; Isaacs, Thomas, & Goldiamond, 1960; Kehle, Madaus, Baratta, & Bray, 1998; Kern, Starosta, Cook, Bambara, & Gresham, 2007; Lang, Regester, Mulloy, Rispoli, & Botout, 2011; Masten, Stacks, Caldwell-Colbert, & Jackson, 1996; Nolan & Pence, 1970; Norman & Broman, 1970; O’Reilley, et al, 2008; Reid et al., 1967; Vecchio & Kearney, 2009; Watson & Kramer, 1992; Wulbert, Nyman, Snow, & Owen, 1973). Although these studies demonstrated varying levels of positive changes in SM, few have used experimental methods to analyze the contextual variables that inform a customized treatment. Without an in-depth experimental analysis of these causal variables, treatment procedures may be “hit or miss,” leading to extended duration of treatment, prolonged existence of the behavior in the person’s repertoire, and poor maintenance of gains made in therapy. Nonlinear functional analysis and systemic treatment are technologies that may contribute to the effective management of SM.

Given the lack of experimental assessment in the diagnosis of SM, the variability in the process and duration of treatment, and the promise of existing assessment technologies in the field of behavior analysis, the purpose of this study was to examine assessment technologies from the field of applied behavior analysis to address how SM is analyzed prior to initiating treatment. In particular, nonlinear functional analysis was evaluated with regard to its efficacy in identifying variables that controlled SM for four participants. Further, a behavior analytic
framework for programming natural contingencies at the initiation of treatment was assessed. Establishing causal links between environmental variables and the behavioral presentation of SM allows practitioners to develop interventions that are tailored to the specific conditions maintaining this behavior for each individual. Moreover, customized interventions may contribute to a decrease in treatment duration and maintenance of behavior change for individuals with SM.

**Literature Review**

The present literature review was conducted per procedures recommended by Cone and Foster (2006). Specifically, ERIC, PubMed, and SAGE Journals databases were searched using “selective mutism” and “elective mutism” as the primary search terms. The search was limited to peer reviewed articles available in English. Article titles and abstracts were scanned to identify studies that included behaviorally-based methods for assessing and treating SM. Finally, six literature reviews spanning the last 15 years were cross-referenced for duplicate entries, in addition to examining three literature reviews that covered the previous 15 years.

Treatment models for SM fall into four primary categories: family systems therapy, behavior therapy, a psychodynamic model, and biological approaches (Stone et al., 2002). According to Cohan, Chavira, and Stein (2006), a literature review revealed individual psychotherapy to be the most commonly used treatment approach, although behavioral approaches were described as the “most widely respected” (p. 1087) as a result of strong supporting evidence for such interventions. A review of the SM treatment literature shows considerable variability in the duration of treatment across participants and interventions employed. For example, in an early study of behavioral treatment of SM (Reid et al., 1967), a six-year-old participant demonstrated vocal verbal behavior during a single “marathon
treatment” session of seven hours, while other studies have documented no vocal verbal behavior for the first 12 months of treatment (Hayden, 1980; Masten et al., 1996). Furthermore, in studies that employed non-behavioral (e.g., psychodynamic, socio-communicative) interventions, treatment lasted up to two years or more, making it difficult to determine whether the intervention procedures or simply participant maturation resulted in the remediation of SM (Cohan et al., 2006; Hungerford, Edwards, & Iantosca, 2003; Krysanski, 2003).

Stone et al. (2002) analyzed 114 studies involving treatment of SM within each of the four primary treatment models. Of the four categories, only studies within the behavioral model included sufficient data to determine effect sizes. The results of the analysis indicated that behavioral treatment of SM was significantly more effective than no treatment, with a median effect size of -1.635 for studies within this model. This indicates that strong positive treatment effects were evident across the studies with regard to participants’ frequency of speaking, as compared to baseline (no treatment). Furthermore, 78% of the studies examined within the behavioral model reported maintenance of treatment gains (Stone et al., 2002). Although the meta-analysis demonstrated that behavioral interventions for SM were effective, specific results were not reported with regard to treatment duration, degree, or maintenance of behavior change across studies. Similar results were reported by Sluckin, Foremann, and Herbert (1991) in their retrospective study of children who had previously received treatment for SM. The 25 children in the sample had received either a behaviorally-based treatment involving shaping and stimulus fading or a non-behavioral intervention, described as a “standard remedial program” (p. 134). The remedial program involved regular contact with special education teachers and other school-based specialists, with an emphasis on socialization; however no specific or systematic procedure was employed. Follow-up ranged from two to 10 years from the time that each child
was referred for intervention. Follow-up measures indicated that the children in the behavioral treatment group were more likely to have improved in their use of verbal speech as compared to those in the remedial treatment group (Sluckin et al., 1991).

**Behavioral Model**

**Treatment studies.** From a behavioral perspective, SM may develop as a result of severely restricted stimulus control, an extensive history of negative reinforcement or contingent attention for failing to speak, failure to generalize vocal verbal behavior across settings and people, and other unique combinations of behavioral contingencies (Amari et al., 1999; Cohan et al., 2006; Krysanski, 2003; Lang et al., 2011; Shriver, Segool, & Gortmaker, 2011). Based on these principles, behavioral interventions for SM commonly involve the use of shaping, stimulus fading, response initiation, and positive reinforcement (Amari et al., 1999; Facon et al., 2008; Giddan, et al., 1997; Masten et al., 1996; Nolan & Pence, 1970; Stone et al., 2002; Wulbert et al., 1973). Additionally, role play, video self-modeling, vocal volume feedback, timeout, and response cost have proven to be successful methods for establishing vocal verbal behavior in children with SM (Krysanski, 2003; Lang, et al., 2011; Norman & Broman, 1970; Vecchio & Kearney, 2009; Wulbert et al., 1973).

Table 1 depicts early and recent examples of behavioral treatments of SM spanning over 50 years, and provides a summary of the primary assessment and treatment studies that were reviewed. The specific behavioral methods employed in the studies are indicated in the table.
Table 1

*Early and Recent Examples of Behavioral Assessment and Treatment of Selective Mutism*

<table>
<thead>
<tr>
<th>Authors, publication date</th>
<th>Descriptive assessment/ Functional analysis</th>
<th>Stimulus fading</th>
<th>Shaping</th>
<th>Positive reinforcement (tangible)</th>
<th>Positive reinforcement (attention)</th>
<th>Extinction</th>
<th>Punishment</th>
<th>Antecedent manipulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amari, A., Slifer, K. J., Gerson, A. C., Schenck, E., &amp; Kane, A. (1999)</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Isaacs, W., Thomas, J., &amp; Goldiamond, I. (1960)</td>
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<td>Mace, F. C., &amp; West, B. J. (1986)</td>
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<td>X</td>
<td>X</td>
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<td>Authors, publication date</td>
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<tr>
<td>Shriver, M. D., Segool, N., &amp; Gortmaker, V. (2011)</td>
<td>X</td>
<td>X (Tx B)</td>
<td>X (Tx A)</td>
<td></td>
<td>X (Tx A &amp; B)</td>
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<td>X (Tx A)</td>
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<tr>
<td>Vecchio, J., &amp; Kearney, C. (2009)</td>
<td>X (Tx A)</td>
<td>X (Tx A)</td>
<td>X (Tx B)</td>
<td>X (Tx B)</td>
<td>X (Tx B)</td>
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</tbody>
</table>
As indicated in Table 1, behavior change procedures for SM are often provided as a “package” that includes management of multiple antecedents and consequences simultaneously (Beare et al., 2008; Kern et al., 2007; Krysanski, 2003; Mace & West, 1986). A number of the treatment studies reviewed for the present research involved the concurrent application of two or more behavioral methods. Positive tangible reinforcement was used most often, followed by shaping and stimulus fading, with punishment procedures used least frequently. For example, Reid et al. (1967) combined positive reinforcement, specifically, access to bites of breakfast food, with stimulus fading to increase verbal communication in a 6-year-old girl. As previously noted, the girl demonstrated vocal verbal behavior within seven hours of the initiation of treatment. Additionally, verbal communication was established with seven experimenters and three peers within the single session. In a more comprehensive treatment package, Watson and Kramer (1992) combined a 21-step shaping procedure, multiple positive reinforcers, mild aversive contingencies, and extinction of nonverbal communication in a behavioral treatment for an 8-year-old boy who had reportedly spoken to only his mother for most of his life. Although some aspects of the treatment procedures differed slightly between the participant’s home and school settings (e.g., different tangible reinforcers were used in each location), the variety of contexts and number of people with whom he spoke both in and out of school increased significantly over the six months during which the treatment took place. The results of this intervention were in stark contrast to the five years of individual psychological therapy that the boy had undergone with no gains in verbal communication.

Numerous studies demonstrated the effectiveness of various combinations of shaping, positive reinforcement, and stimulus fading in treating SM (Amari et al., 1999; Masten et al., 1996; Nolan & Pence, 1970; Norman & Broman, 1970). Masten et al. (1996) employed shaping
via the use of a vocal volume meter with positive (tangible) reinforcement provided for gradually increasing speech volumes until typical conversational volume was achieved. Stimulus fading was then used to transfer stimulus control from contexts that included only the psychologist, to the psychologist and teacher, then to the psychologist and a peer, then to a small social skills group with peers, and finally to a small group reading activity. Unfortunately in this case, an inconsistent schedule of treatment may have contributed to the gradual progress that the participant made over three years, and the lack of generalization of audible speech that was observed in non-treatment contexts. Masten et al. recommended focusing on increasing audible speech within natural settings (i.e., the classroom) as an initial rather than a terminal component of treatment.

An important consideration when multiple treatments are combined is the challenge they pose in allowing practitioners to determine which procedures are the most critical in affecting behavior change. An example of this challenge was demonstrated in Wulbert et al.’s (1973) use of positive tangible and social reinforcement, stimulus fading, and a timeout procedure in the treatment of SM in a 6-year-old kindergarten student. The researchers sought to determine whether stimulus fading was a critical component in evoking verbal communication in the presence of unfamiliar adults. In the experimental condition, the girl’s mother provided positive reinforcement (edible and social praise) contingent on the production of verbal and motor responses. Stimulus fading was used to introduce a novel adult into the room, and eventually transfer stimulus control for verbal responding to the new adult. In the control condition, an unfamiliar adult instructed the participant to respond, with no stimulus fading used for introducing the adult into the treatment setting. When a decreasing trend in verbal responding was observed over four consecutive sessions, a timeout procedure was introduced in both the
experimental and control conditions when the participant failed to respond. In the three subsequent sessions, the child responded verbally 100% of the time when directed to do so while the stimulus fading procedures were continued. In contrast, she produced no verbal responses in the control condition. In this case, conditions that exclusively applied positive reinforcement, timeout, or stimulus fading were insufficient to induce responding with strangers. The effect of the timeout procedure was not clearly distinguished, as it quickly produced verbal responding in the experimental condition, but had no effect in the control condition. Wulbert and colleagues concluded that stimulus fading plus timeout was the most effective combination for evoking verbal behavior for this child in the presence of strangers.

**Treatment derived from assessment.** One way in which the critical elements of behavioral treatments may be determined is to identify potential controlling variables of a target behavior prior to developing and initiating an intervention. Such descriptive functional assessment and experimental functional analysis procedures have repeatedly been shown to be effective in allowing practitioners to identify behavioral functions and subsequently apply function-matched treatment for a wide range of problem behaviors (Hanley, Iwata, & McCord, 2003). Although the literature is replete with examples of the application of functional assessment and analysis of problem behaviors such as self-injury and severe aggression, there are far fewer examples of the application of these technologies to the behavior of SM (Kearney & Vecchio, 2006; Kern et al., 2007; Mace & West, 1986; Schill, Kratochwill, & Gardner, 1996; Shriver et al., 2011).

Following their comprehensive review of the behavioral treatment literature, Labbe and Williamson (1984) offered a standardized set of recommendations for treating SM based on specific behavioral observations made during a pre-treatment assessment. For example, they
suggested that when an individual with SM is observed to speak at a typical rate with at least one person in several environments, the use of stimulus fading by systematically incorporating new communication partners into target environments should be considered as a primary model for treatment. For an individual who demonstrates limited verbal communication with most people, Labbe and Williamson suggested contingency management as the principal intervention (Labbe & Williamson, 1984). Although their recommendations for connecting assessment to treatment were logical and consistent with theoretical generalizations from the literature, they were not based on actual individualized analysis of the controlling variables. Such recommendations may be viewed as a practical starting point, but further individualized analysis is probably warranted.

Underscoring the need for an individualized functional analysis of SM prior to determining a treatment is an example from the literature in which participants’ behavior did not change in the manner expected when treatment was initiated. Shriver and colleagues (2011) used an antecedent-behavior descriptive functional assessment model to identify the settings, activities, and people associated with two participants’ vocal and non-vocal communication prior to developing an intervention plan. The results of direct observations were applied to Labbe and Williamson’s (1984) recommended courses of treatment. For one participant, Darren, the assessment indicated that he had few opportunities to respond to others, and therefore, treatment began with a response initiation approach to increase the number of opportunities to which he had to respond. Non-vocal behavior was allowed during this period. The frequency of Darren’s non-vocal behavior increased with the onset of intervention; however, a change in vocal communication did not occur until tangible positive reinforcement was made contingent on approximations of speech, approximately five months into treatment. The second participant, Alex, was observed to speak with peers but did not respond vocally to adults during the
assessment. Based on these findings, stimulus fading procedures were initiated to increase responding to his teacher at the outset of treatment. The initial effort at stimulus fading did not yield an increase in vocal communication with his teacher. After stimulus fading successfully increased vocal responding with a school psychologist, a second attempt at stimulus fading with the teacher was implemented, this time with a tangible positive reinforcement procedure added. A subsequent observation indicated that vocal communication increased with the teacher following this procedure. Shriver et al. noted that although the definition of SM suggests an analysis of antecedent relations as the primary subject of assessment, it is also necessary to identify and manipulate potentially reinforcing or punishing stimuli to inform a more specific treatment. Moreover, they stated that “It is possible that assessment of the ABC contingency will lead to more effective treatment than current AB assessments” (Shriver et al., 2011, p. 408).

Functional assessment and analysis technologies offer procedures for determining the environmental variables associated with mutism and verbalizations for individuals. The results of such analyses can then be used to develop a customized treatment, using the behavioral methods that most appropriately match the behavioral observations and functions of SM for each individual.

**Functional analysis.** Functional analysis involves the experimental manipulation of variables hypothesized to be maintaining a target behavior. In their influential article describing functional analysis procedures, Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) demonstrated that under analogue conditions, it is possible to objectively identify and isolate particular circumstances under which a target behavior is likely to occur. Further, Derby et al. (1994) used functional analysis to identify separate functions for stereotypy and aggression/self-injurious behavior in four individuals with moderate to profound mental retardation. The distinct
functions of each behavior were only able to be identified upon a separate analysis of each response topography. In contrast, when participants’ responses were analyzed aggregately, behavioral functions were undifferentiated. The primary benefit of confirming hypotheses is that precise, function-based treatments may be developed and implemented.

Table 2 presents an analysis of the nine studies identified from the present review of the literature that reported any kind of functional assessment prior to initiating treatment. One of the assessment studies relied on indirect descriptive assessment methods (Fisak, Oliveros, & Ehrenreich, 2006) and five included direct descriptive functional assessment procedures (Jackson, Allen, Boothe, Nava, & Coates, 2005; Jacob, Suveg, & Shaffer, 2013; Kern et al., 2007; Porjes, 1992; Shriver, et al., 2011). Only three included a controlled, experimental analysis as a means of isolating the specific controlling variables for each individual’s restricted speech (Mace & West, 1986; Schill et al., 1996; Sheridan, Kratochwill, & Ramirez, 1995).
Table 2

Studies Including a Functional Assessment of Selective Mutism

<table>
<thead>
<tr>
<th>Authors, publication date</th>
<th>Participants</th>
<th>Assessment Components</th>
<th>Hypothesized Functions</th>
<th>Treatment Procedures</th>
<th>Treatment Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisak, Jr., Oliveros, &amp; Ehrenreich (2006)</td>
<td>Male; 10 yrs. old</td>
<td>Interviews with parent, child</td>
<td>SM maintained by avoidance of anxiety and speech-related situations including academics; attention from mother; under-developed social skills repertoire also cited</td>
<td>Social Effectiveness Therapy for Children (SET-C) including repetition of sounds, words, and sentences</td>
<td>Number of verbalizations increased in initial treatment sessions, was variable throughout remainder of treatment</td>
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<td></td>
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<td>Checklists completed by teacher, parents, child</td>
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<td>Role play</td>
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<td>Exposure exercises</td>
<td>Limited generalization of verbalizations to school setting</td>
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<td>Tangible positive reinforcement of speech frequency and volume</td>
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<tr>
<td>Jackson, Allen, Boothe, Nava, &amp; Coates (2005)</td>
<td>Male; 6 yrs. old</td>
<td>Audio recording analysis to assess current speech-language abilities</td>
<td>SM maintained by others allowing nonverbal comm. and avoidance of “the outside world” (negative rfmt.)</td>
<td>Cognitive restructuring</td>
<td>Increase in verbal behavior, began speaking in public and school after 21 sessions</td>
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<tr>
<td></td>
<td></td>
<td>Direct obs. of interactions with teachers and peers</td>
<td></td>
<td>Relaxation training</td>
<td>Effects maintained at one-year follow-up</td>
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<td></td>
<td></td>
<td>“Feelings thermometer”</td>
<td></td>
<td>Family training to avoid reinforcing nonverbal interactions</td>
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<tr>
<td>Authors, publication date</td>
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<tr>
<td>Jacob, Suveg, &amp; Shaffer (2013)</td>
<td>Female; 4 yrs. Old</td>
<td>Questionnaires completed by parents, Interviews with parents and teachers, “Feelings thermometer”, Receptive language assessment, Direct observation of participant with sequence analysis</td>
<td>Negative rfmt. identified as consequence for SM</td>
<td>Psychoeducation, Positive reinforcement (tangible and social), Stimulus fading, Shaping, Modeling, Cognitive restructuring</td>
<td>Increased speaking with therapist and others targeted with stimulus fading; Returned to clinic after nine months for a “booster session”</td>
</tr>
<tr>
<td>Kern, Starosta, Cook, Bambara, &amp; Gresham (2007)</td>
<td>Female, 13 yrs. old (Beatriz), Male, 11 yrs. old (Sean)</td>
<td>Interviews with caregivers, Record review, Direct observation</td>
<td>Beatriz: Negative rfmt. maintained SM, Sean: Negative rfmt. maintained SM</td>
<td>Escape extinction, Shaping, Antecedent manipulations, Positive reinforcement (tangible and social)</td>
<td>Increased vocal responding for both participants; At 2-4 weeks post-intervention, both maintained level of responding required in final phase of intervention</td>
</tr>
<tr>
<td>Mace &amp; West (1986)</td>
<td>Male, 4 yrs. Old</td>
<td>Analogue functional analysis of academic demand conditions on speech rates, Reluctant speech maintained by negative rfmt.</td>
<td>Prompt-ignore-praise procedure: Escape extinction, Positive reinforcement (social)</td>
<td>Participant’s speech improved; Length of utterances remained lower than age-matched peer</td>
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</table>
## Analysis and Treatment of Selective Mutism

<table>
<thead>
<tr>
<th>Authors, publication date</th>
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<th>Treatment Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porjes (1992)</td>
<td>Female, 6 yrs. old</td>
<td>Direct observation of participant with sequence analysis</td>
<td>Nonverbal behavior maintained by positive rfmt. (social)</td>
<td>Positive reinforcement (social and tangible) for verbal behavior</td>
<td>Both participants demonstrated verbal communication by the end of the intervention procedures; contingency management procedures remained in place for one participant</td>
</tr>
<tr>
<td></td>
<td>Male, 6 yrs. old</td>
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<td>Shaping</td>
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<td>Extinction of nonverbal behavior</td>
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<td>Generalization training</td>
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<tr>
<td>Schill, Kratochwill, &amp; Gardner (1996)</td>
<td>Female, 8 yrs. old</td>
<td>Analogue functional analysis of multiple antecedent/consequence combinations</td>
<td>SM resulted from restricted stimulus control and maintained by negative rfmt.</td>
<td>Stimulus fading</td>
<td>Per parent report, participant demonstrated higher rates of speech with additional communication partners and in novel settings at 3-months follow-up</td>
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<td></td>
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<td>Escape extinction</td>
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<td>Contingent play</td>
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<tr>
<td>Sheridan, Kratochwill, &amp; Ramirez (1995)</td>
<td>Female, 6 yrs. old</td>
<td>Questionnaires completed by parents and teacher</td>
<td>Negative rfmt. in form of others responding for her</td>
<td>Response initiation (modeling and shaping)</td>
<td>No change in verbal behavior for first five months of treatment when interventions applied individually</td>
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<tr>
<td></td>
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<td>Fear Thermometer Assessment</td>
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<td>Positive reinforcement (tangible)</td>
<td>After combining interventions, participant spoke with eight different individuals within three settings at school within 31 days</td>
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<td>Analogue functional analysis of three demand conditions</td>
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<td>Antecedent manipulations</td>
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<td><em>Pictorial Test of Intelligence</em></td>
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<td>Stimulus fading</td>
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<td>Sequence analysis of speech in certain situations</td>
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<td>Analysis of home tape recordings of speech</td>
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### Analysis and Treatment of Selective Mutism

<table>
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<th>Authors, publication date</th>
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<th>Treatment Procedures</th>
<th>Treatment Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shriver, Segool, &amp; Gortmaker (2011)</td>
<td>Male, 10 yrs. old (Darren)</td>
<td>Interview questions Direct observation with A-B sequence analysis</td>
<td>Not specified; Labbe and Williamson’s (1984) criteria applied for development of appropriate interventions</td>
<td>Darren: Response initiation</td>
<td>Darren: Frequency of non-vocal comm. increased in first five months of treatment; vocal comm. increased only when positive reinforcement was made contingent on speech; vocal comm. included initiating at least one question per day verbally by end of treatment</td>
</tr>
<tr>
<td></td>
<td>Male, 7 yrs. old (Alex)</td>
<td></td>
<td></td>
<td>Shaping</td>
<td>Alex: Stimulus fading Positive reinforcement (tangible)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Positive reinforcement (tangible)</td>
<td>Alex: Vocal behavior did not increase with teacher in initial attempt at stimulus fading; school psychologist reported verbal communication in targeted small group sessions in hallway after stimulus fading; after second attempt with stimulus fading with teacher plus positive (tangible) reinforcement, vocal responding increased/ generalized vocal responding to next year’s teacher</td>
</tr>
</tbody>
</table>

The three studies that included analogue functional analyses are reviewed in detail below.

**Mace and West (1986).** In 1986, Mace and West analyzed the effects of five instructional demand conditions and negative reinforcement on the speech rates of a 4-year-old boy with “reluctant speech,” which they noted was distinct from SM although treated using the same behavioral principles and procedures. The participant reportedly spoke fluently with his family members and rarely spoke with his teacher or peers. Mace and West used the analogue functional analysis methodology operationalized by Iwata et al. (1982/1994) to identify the relationship between specific demands and the participant’s low rates of speech in certain circumstances. The number of words spoken per minute was measured in continuous 10-second intervals under each condition. Experimental conditions consisted of stimulus demands with varying degrees of difficulty, combined with prescribed responses from the examiner if the
The participant failed to respond within three seconds. The variables were experimentally manipulated to evaluate whether the participant responded differentially to “easy” and “hard” academic stimuli and to assess the effect of the differential consequences on the participant’s rate of responding. The five experimental conditions were: a) easy demands (participant was likely to know the answer) with the answer supplied by the experimenter after three seconds with no response; b) hard demands (participant was not likely to know the answer) with the answer supplied after three seconds without a response; c) hard demand with access to a preferred activity (puzzle) while demands to speak were suspended for one minute if the participant did not respond; d) easy demand with a prompt-ignore-praise procedure in an effort to prohibit escape from the demand by ignoring mutism, prompting the target vocal response, and enthusiastically praising any vocal response; and e) hard demand combined with the prompt-ignore-praise procedure.

The results of the analogue functional analysis revealed that the boy’s speech rates were lowest in conditions that allowed escape from demands, and highest in the two conditions that did not allow escape (i.e., the prompt-ignore-praise conditions). Furthermore, speech rates were lower during escape conditions that followed the presentation of “hard” demands as compared to those that followed the presentation of “easy” demands (Mace & West, 1986).

Following the analogue functional analysis, an intervention phase was implemented using the prompt-ignore-praise procedure that was associated with higher speech rates during the analysis. The results of the treatment indicated that replication of the prompt-ignore-praise procedure effectively increased speech rates across conditions. Mace and West noted, however, that the participant’s speech remained characteristically different from that of an age-matched peer at the end of the study. Specifically, the participant demonstrated a considerably diminished
mean length of utterance (MLU) as compared to an age-matched peer at an 8-month follow-up activity. The participant’s MLU during follow-up observations was 1.8 (morphemes) while the comparison peer’s was 3.45. Furthermore, the participant’s diminished MLU was observed to occur in the presence of individuals with whom he had demonstrated mutism prior to the intervention. In contrast, he was observed to speak to his mother and twin sister in 3- to 5-word utterances prior to the intervention.

Although this study successfully demonstrated an increase in verbalizations across conditions, it only analyzed the relationship between academic demands and negative reinforcement with regard to the participant’s reluctant speech. No analysis was done to determine the variables associated with his low speech rates during social interactions with peers.

**Sheridan, Kratochwill, and Ramirez (1995).** Several years after Mace and West’s initial effort at experimentally analyzing restricted speech, Sheridan, Kratochwill, and Ramirez (1995) offered a comprehensive assessment package that included analogue functional analysis procedures for a six-year-old girl with SM. Their multi-component assessment included indirect measures in the form of checklists and questionnaires, as well as direct measures including: administration of the *Pictorial Test of Intelligence* (French, 1964), a sequence analysis of antecedent-behavior-consequence patterns for speech within specific situations, an analogue functional analysis of mutism using speech rates as the dependent variable, and a descriptive assessment using tape recordings made at home in situations where speech occurred frequently. The three conditions that were manipulated within the analogue component of the assessment were modeled after Mace and West’s procedures. Specifically, Sheridan and colleagues replicated three of the demand conditions analyzed by Mace and West (i.e., easy demand/supply answer; hard demand/allow preferred activity; easy demand/prompt-ignore-praise), with
prescribed responses to mutism. The dependent measure was not specified beyond the description that the participant’s “speech behaviors were assessed under three demand conditions” (p. 64). An analysis of the participant’s rate of speech behaviors per session, however, did not yield data regarding what the participant did within each presentation of an opportunity to speak.

Results of the comprehensive assessment revealed that the participant spoke at home and failed to use speech in the school setting, with certain family members, with her dentist, and with “strangers.” No verbal responding occurred during any of the analogue functional analysis conditions. Based on the combined results of the assessment components, the researchers hypothesized that the participant’s failure to speak was maintained by negative reinforcement in the form of others responding for her in most situations where mutism occurred (Sheridan et al., 1995). Despite the inclusion of descriptive assessment procedures to analyze conditions in which the participant demonstrated verbalizations, no hypothesis was offered with regard to what maintained this behavior.

The assessment results were used to design an individualized treatment through a conjoint behavioral consultation model with her teacher, following Labbe and Williamson’s (1984) recommendations. Initially, response initiation via modeling and shaping in conjunction with positive reinforcement were attempted, in addition to manipulating the way in which others asked questions of the girl so that a gestural yes/no response would not be allowed. Another variation involved the use of a peer posing questions and prompting the participant to respond, while other peers were instructed to refrain from answering when the participant used nonverbal means of communication. There was no change in the participant’s verbal behavior in the first five months of therapy using these approaches separately. When the plan was again modified to
include the girl’s mother in response initiation procedures at school and subsequent use of stimulus fading with other school-related individuals, the participant demonstrated a rapid increase in verbal speech with eight different individuals and across three settings within the school environment within 31 days.

The authors noted that the lack of separation in the data paths in the analogue functional analysis component of the assessment was a significant limitation to developing a targeted treatment, and acknowledged that the assessment results did not allow a direct link to treatment procedures for the participant. They recommended that future assessments include procedures to evaluate both verbal and nonverbal communication (Sheridan et al., 1995).

Schill, Kratochwill, and Gardner (1996). In the third application of analogue functional analysis to SM, Schill, Kratochwill, and Gardner (1996) trained parents to present social demand situations that required an 8-year-old girl to speak with and without unfamiliar persons present. Eight experimental conditions were manipulated, with a combination of at least two variables manipulated within each condition. The following conditions were analyzed with respect to the number of words produced per minute: baseline/no demand; easy demand/allowed nonverbal response; hard demand/allowed nonverbal response; easy demand/prompt-ignore-praise; easy demand/reading; hard demand/reading; stimulus fading/contingent play; stimulus fading/noncontingent play. Easy demand conditions consisted of only the participant’s parents being present in the room, while hard demand conditions included the presence of an unfamiliar adult seated at the table but not posing questions to the girl. Although the experimenters hypothesized that attention from others in certain situations was a punisher for speech, this hypothesis was not evaluated. The majority of the experimental conditions evaluated the effects of communication partners’ responses to the participant’s mutism, with the exception of one, in
which contingent play was evaluated as a potential reinforcer for speech. The number of words spoken per minute in each of the 5-to-10-minute conditions comprised the data for this analysis.

Speech rates were found to be highest (more than 30 words-per-minute) during easy demand/allowed nonverbal response, easy demand/reading, and baseline (parents in room, no demand to speak) conditions. In contrast, situations that included unfamiliar individuals, including those that used stimulus fading to gradually introduce the unfamiliar person to the situation, and those in which a directive to speak was given, yielded the lowest rates of speaking. Based on these results, treatment recommendations included maintaining the expectation to speak by waiting for verbal responses versus withdrawing speaking demands (i.e., questions), using play activities that required speaking as a condition of participating, and using stimulus fading in the school and other settings that included unfamiliar adults.

Despite the many combinations of variables that were analyzed, only escape from the demand to speak and access to play activities were experimentally manipulated, thereby omitting an analysis of attention as a function of the participant’s mutism.

**General limitations.** Although the three studies that included functional analyses reported success, they all measured participants’ speech rates as the dependent variable under analogue conditions and the results were then extrapolated to hypothesize what maintained mutism in those cases. It is important to reiterate that the principle diagnostic element of SM is the *failure* to speak in situations where one is expected to speak, for example, when spoken to by another person. Analyzing low rates of verbalizations is different from studying what happens when a response is expected and does not occur. Although an analysis of speech rates yields valuable information about the variables associated with differential rates of verbalization, this may not reveal the same information as an analysis of the absence of verbalization when
presented with an opportunity to speak. With the exception of Schill et al. (1996), previous studies have typically only analyzed half of the equation, that is, they have hypothesized putative reinforcers for mutism while measuring only verbalizations. Shriver and colleagues (2011) noted that the research has yet to offer an analysis of what participants do in lieu of using vocalizations (Shriver et al., 2011). This subtle but important difference raises the question that if the behavior of interest was a low rate of verbal behavior under particular stimulus conditions, have previous studies really analyzed SM? Returning to the diagnostic features of SM, the DSM-5 (American Psychiatric Association, 2013) notes that “children with selective mutism do not initiate speech or reciprocally respond when spoken to by others” (p. 195). Given this key characteristic, an individual who is shown to demonstrate mutism within a specific proportion of opportunities to speak may be identified for intervention more readily than one who is identified as speaking, albeit at a low rate, within certain conditions.

It is clear from the literature that analogue functional analysis provides an assessment method that yields reliable, valid data regarding the function of behavior, and guides behavior analysts in applying the results to treatment of problem behaviors. If it is used to identify only some of the functions or the functions of only some of the behaviors of interest, however, the analysis may be incomplete. Standard functional analysis procedures (Iwata et al., 1982/1994) typically involve the manipulation of a single reinforcer within a single-antecedent condition to identify the reinforcing functions of a problem behavior. Recently, however, variations of functional analysis procedures have indicated that for some individuals, problem behaviors occurred at higher rates during combined-antecedent conditions as compared to rates observed during single-antecedent conditions (Call, Wacker, Ringdahl, & Boelter, 2005; Dolezal & Kurtz, 2010). In some cases, the only way to identify the function of a problem behavior was to
manipulate particular combinations of antecedent and consequence variables during the
functional analysis (Tiger, Fisher, Toussaint, & Kodak, 2009). Furthermore, Anderson and Long
(2002) found that at times both descriptive assessment and functional analysis procedures were
necessary for identifying the variables relevant to problem behavior (Anderson & Long, 2002).

In sum, although it is clear that analogue functional analysis is an effective technology
for identifying the variables controlling a behavior of interest, effectively treating SM may still
require developing a technology for identifying additional variables including the variables
controlling the absence of verbalizations, and combinations of antecedents and consequences that
occur in the context of specific interactions. One such technology may be derived from
nonlinear functional analysis and systemic treatment (Goldiamond, 1984).

**Nonlinear functional analysis and systemic treatment.** In the early 1960s, Israel
Goldiamond developed a systematic framework for assessing and treating disorders that had
historically been treated via psychiatric and pharmacological interventions. His nonlinear
approach to behavior analysis was related to the principles underlying Herrnstein’s (1961)
matching law; that is, given concurrent reinforcement schedules, organisms will respond at a rate
that is commensurate with the rate of reinforcement provided within each schedule. An example
of this relevant to SM would be the child who speaks to his peers and gains access to preferred
social activities (socially mediated positive reinforcement) and demonstrates mutism with
unfamiliar adults thereby escaping undesired social interactions (socially mediated negative
reinforcement). Although not yet formalized during this period of his work, Goldiamond’s
nonlinear approach to treatment led to significant advances in treating speech pathologies such as
stuttering (Flanagan, Goldiamond, & Azrin, 1958). Goldiamond postulated that all behavior was
caused or maintained by a variety of conditions, with both historical and current contingencies
contributing to the presenting symptoms. His nonlinear functional analysis involved examining not only the referent (problem) behavior and its contingencies, but also required an analysis of alternative behaviors and the contingencies maintaining them. Combined connections among behavioral repertoires and their contingencies constituted the nonlinear relationship (Twyman, Layng, Stikeleather, & Hobbins, 2005). From this nonlinear relationship, separate behaviors that exist within unrelated functional classes may combine to form complex new behaviors that are maintained by entirely different consequences (Andronis, Layng, & Goldiamond, 1997). In other words, the establishment of a functional relation does not always occur in a sequential (i.e., linear) manner. Goldiamond’s framework involved a descriptive comparison of the costs and benefits of response effort, establishment, transfer of stimulus control, consequences, and maintenance of both the referent behavior and available alternative behaviors at any given moment. Systematic control and variation of the manner and sequence in which stimuli were presented potentiated the prediction and control of future occurrences of a behavior (Goldiamond, 1984; Twyman et al., 2005).

Once the combined contingencies were identified, a systemic treatment was designed that effectively changed the set of conditions maintaining the behavior and allowed alternative behaviors to contact reinforcement directly (Goldiamond, Thompson, & Cohen, 1968, cited in Andronis, 2004). Systemic treatment of a problem behavior viewed the referent behavior as a symptom of a larger contextual problem, as opposed to viewing it as the single pathological problem (Goldiamond, 1984). Logically, the treatment focus was broader than a focus on the referent behavior alone, and was often directed at changing other functional relations, specifically those that maintained available alternative behaviors. Systemic treatment was tailored to a broad range of historical and current behavioral contingencies for each individual,
and conditions were arranged to allow new behaviors to contact the reinforcement that the referent behavior had previously contacted. Goldiamond argued that when only the immediate symptoms were targeted for improvement, the fundamental behavior-environment relationships were unchanged and therefore the behavior would likely return, perhaps with a new topography, in the future. Using a nonlinear approach, Goldiamond and his colleagues successfully treated scores of patients with psychological disorders including mutism, phobias, Tourette’s syndrome, and binge vomiting (Goldiamond, 1984; Isaacs et al., 1960). More recently, nonlinear functional relations have been implicated in the development of new, complex behaviors from unrelated existing behaviors, and in the phenomenon of relapse seen in human pathological behavior (Andronis et al., 1997; Layng, Andronis, & Goldiamond, 1999). Nonlinear functional analysis and intervention have also been used in the assessment and treatment of a range of organizational behavior challenges (Chase & Smith, 1994).

Goldiamond’s nonlinear functional analysis employed descriptive assessment procedures to identify the hypothesized controlling variables for referent and alternative behaviors. Systemic treatment was derived from the outcomes of interviews, data in the form of daily logs kept by his patients, and his application of the fundamental principles of behavior. Goldiamond analyzed a patient’s verbal responses and log entries to identify the terminal goal of treatment and existing behaviors in the individual’s repertoire that were related to the goal. Additionally, he used these data to identify and program natural reinforcers for the target behaviors, as well as to identify contingencies that were interfering with the target behaviors (Schwartz and Goldiamond, 1975). The field of applied behavior analysis has continued to refine the technological procedures for verifying the functional relation between a behavior and the variables associated with it; one such procedural refinement is the analogue functional analysis.
The current study combined descriptive functional assessment and experimental functional analysis procedures to identify and verify variables that were associated with mutism and available alternative behaviors for each participant.

**Statement of the Problem**

Although previous research has demonstrated success with applying behavior analytic approaches to the treatment of SM, existing data suggest that refinements may be needed to improve the functional assessment process prior to initiating treatment. Given that few studies have analyzed the critical features of antecedent and consequential stimuli for both the presenting behavior of SM and its alternatives prior to determining an individualized treatment (Kern et al., 2007; Shriver et al., 2011; Stone et al., 2002), one such refinement may be obtained with a nonlinear functional analysis. The purpose of the current study, therefore, was to evaluate the extent to which nonlinear functional analysis identified controlling variables and therefore informed a successful treatment for SM. Furthermore, the study evaluated the efficacy of systemic treatment for remediation of SM. Nonlinear functional analysis results were used as the basis for developing specific, function-based systemic interventions that matched the variables identified for each individual’s unique presentation of SM.

The present study built upon previous research in several ways. The first was the use of nonlinear functional analysis procedures as a means of analyzing variables that were correlated with both SM and verbalizations. Previous behavioral assessments have focused on verbal communication as the primary dependent variable (Kern et al., 2007; Mace & West, 1986; Schill et al., 1996; Sheridan et al., 1995). Because SM is characterized by a lack of verbal communication in opportunities when it is expected, it is equally important to identify the variables associated with mutism in order to develop an effective treatment. The treatment
solution may lie in the conditions that support behavior other than verbalizations. With nonlinear functional analysis, contrasting contingencies for both mutism and verbalizations were identified and then withheld and/or applied accordingly during treatment.

A more precise measure of the conditions under which participants were expected to speak and failed to do so was used in this study as compared to the dependent measure used in prior assessments of SM. Previous studies (Mace & West, 1986; Schill et al., 1996; Sheridan et al., 1995) measured the number of words spoken per minute, without considering the proportion of speech to opportunities presented. An analysis of what occurs when an individual is presented with an opportunity to speak and fails to do so improves the functional analysis and treatment process. Measurement of communication behavior within discrete opportunities provides a more fine-grained analysis and direct measure of the fundamental diagnostic characteristic of SM.

The present study also added an experimental functional analysis to Goldiamond’s descriptive nonlinear analysis procedures. Experimental functional analysis procedures allowed the behavioral functions of SM and verbalizations to be verified prior to initiating treatment. Hanley (2010) pointed out several advantages of this practice, including objectivity in identifying behavioral functions, parsimony in explaining functional relations, and the development of precise and socially acceptable interventions.

Another way in which the present study extended existing procedures was by including multiple-variable combinations in a functional analysis of SM. A primary limitation of previous studies that have included assessment prior to initiating treatment for SM (Kern et al., 2007; Mace & West, 1986; Schill et al., 1996; Sheridan et al., 1995) is that only a restricted set of conditions has been analyzed during functional assessment or analysis procedures. In the present nonlinear functional analysis procedures, several combinations of antecedent and consequential
variables were experimentally manipulated in a systematic manner to identify the precise combinations of variables that were contributing to both mutism and verbalizations.

The present study synthesized best practices from existing behavior analytic assessment-informed treatment of SM. Specifically, a descriptive assessment was used to identify variables correlated with mutism and verbalizations. Nonlinear functional analysis was conducted with experimental manipulation of specific antecedent and consequential variables derived directly from descriptive assessment results. Finally, a systemic treatment that targeted extinguishing mutism and directly reinforcing verbal communication was implemented.

**Research Questions**

The following questions were addressed within the present research:

RQ1: To what extent can contextual variables (e.g., setting, people, social interactions, type of demand, negative reinforcement, positive reinforcement) affecting Selective Mutism be identified using nonlinear functional analysis?

RQ2: What are the effects of systemic treatment on the remediation of Selective Mutism and maintenance of behavioral change when treatment is derived from a nonlinear functional analysis of the contextual variables?

To summarize, SM is a behavior that has yet to be thoroughly analyzed with respect to the particular matrix of stimuli that establish and maintain it for each individual. A foundational characteristic of applied behavior analysis is the identification and manipulation of environmental variables for the purpose of producing socially significant improvement in human behavior. Nonlinear behavioral analysis suggests that improvement of socially significant behavior requires an analysis of the environmental variables that are hypothesized to control both the referent behavior and alternative behaviors. When such an analysis is conducted, it is
anticipated that an efficacious treatment protocol may be developed and long-term remediation of SM will result.

**Experiment 1**

**General Method**

**Participants.** Four participants comprised the research sample for Experiment 1. This sample size was consistent with the vast majority of existing literature on SM treatment, which has been derived from single-subject research (Stone et al., 2002). Participants were recruited for participation based on a referral from a medical or educational professional. To be included in the study, all participants met the DSM-5 criteria for SM, as diagnosed by a practitioner not affiliated with the study. Participants were between the ages of 2 and 18 years old at the start of their enrollment in the study. Selective mutism is most commonly diagnosed in preschool or school-age youth (Bergman et al., 2002). All participants were enrolled in educational settings in New England. Although evidence suggests that there may be a correlation between SM and certain exogenous variables including ethnic background (specifically immigrant status) (Steinhausen, Wachter, Laimbock, & Metzke, 2006) and gender (Bergman et al., 2002), these variables were unrelated to the research questions in the current study and therefore were not controlled for in the sample. All of the individuals who were referred as potential participants for the current study were female, and all were natural citizens of the United States. Exclusion criteria were such that participants would not be enrolled if there was no difference in the frequency of SM in the contexts that were accessible to the researcher for this study. There were no participants for whom this was the case at the onset of their enrollment in the current study.

**Human subjects protection.** Informed consent and assent were obtained prior to participation in the study. Given that all but one of the participants (Holly) were minors, they
and their guardians were informed verbally and in writing of the exact nature of the research and all relevant procedures, including potential or anticipated benefits and risks of participation. Confidentiality of participant data was maintained at all times throughout the study. Participants’ names and identifying information were changed to conceal their identities and data were stored under the altered information. The Simmons College Institutional Review Board full review procedures were adhered to with respect to all required components of the study, including consent documentation from guardians and assent from participants. Participants were informed that their involvement in the research was voluntary and may be withdrawn at any time without penalty. Copies of informed consent and assent forms may be viewed in Appendix A.

**Setting and materials.** The study took place in participants’ natural environments, in contexts where both SM and verbal communication were typically observed. For all participants, home and school environments were the primary settings.

Video recording was conducted for most nonlinear functional analysis sessions using a Cisco brand Flip™ Ultra video camera placed within five to ten feet of the participant. Audio recording only, however, was used for sessions during which interactions with peers were analyzed, using an Apple iPhone4 with Voice Memo application placed within five to ten feet of the participant.

**Dependent measures.** The principle diagnostic characteristic of SM is an individual’s failure to speak in situations where speech is expected (American Psychiatric Association, 2013). To operationalize this definition, measurement in this dissertation provided a precise account of when verbalization occurred relative to when it was expected, and conversely, when mutism occurred in the presence of an interaction opportunity. The relative frequency or proportion of
mutism as compared to the number of interaction opportunities per session was the primary measure of interest for Experiment 1.

The definition of an interaction opportunity was modeled after Halle, Baer, and Spradlin (1981), in a study that measured children’s vocal initiations in response to teachers’ use of designated delay procedures. Following Halle and colleagues’ model, the following criteria defined an interaction opportunity for the present study: a) any verbal communication by another individual that was directed to the participant and required a verbal response by the participant (e.g., a question or request for information), or b) the presentation of a nonverbal stimulus by a communication partner that was directed to the participant and included the following conditions: the communication partner was within three feet of the participant, his or her head was oriented toward the participant and he or she was making eye contact with the participant (Halle et al., 1981). An example of an interaction opportunity that occurred frequently in sessions was the initiation of a social question by a communication partner, for example, “How is your day going today?” Other examples included academic questions or requests for information such as “Who is the governor of our state,” and “We learned four things that cells can do. Tell me one.” Social comments such as “I can’t wait to get out of school today” made by the communication partner, while making eye contact and in physical proximity with the participant were also observed as examples of interaction opportunities. An example of a situation that did not meet criteria as an interaction opportunity was when a communication partner was present in the room, but not in proximity to or directing his or her attention to the participant. Additionally, questions that were clearly rhetorical were not considered interaction opportunities. This type of question was easily distinguishable from an interaction opportunity as evidenced by a communication partner not allowing time for the participant to respond and/or
not directing his or her attention to the participant in anticipation of a response. A frequently observed example was a communication partner responding to a participant’s verbal communication by repeating what the participant had said in the form of a question, as in the following exchange:

    Communication partner: “How is your day going today?”
    Participant: “Good.”
    Communication partner: “Good? Oh, that’s great! I’m glad to hear it.”

In this example, the communication partner’s repetition of the response “Good” in the form of a question was not counted as an interaction opportunity as the communication partner did not allow time for the participant to respond, thereby indicating that she was not expecting a response from the participant.

**Verbalization.** Verbalization was defined as any production of a spoken word or phrase that occurred within five seconds of the presentation of an interaction opportunity by a communication partner and was audible from a distance of up to five feet. Verbalization that was initiated by the participant and was not in response to a question was also recorded according to this definition. Examples observed during the study included single-word responses to questions such as “yes” and “no,” contextually relevant responses such as, “Played” in response to the question “What did you do this weekend,” and participant mands for information such as “Where’s David?” Vocalizations that were made in response to interaction opportunities but were not words, such as “m-hm” and “m-mm” to indicate affirmation or negation were not counted as instances of verbalization.

**Mutism.** Mutism was defined as the failure to demonstrate an audible verbalization within five seconds of an interaction opportunity.
Participant behavior was measured by dividing the number of occurrences of mutism by the total number of interaction opportunities that occurred within a session to yield a percent occurrence score per session. In order to standardize measurement across sessions of variable duration, the first 10 interaction opportunities after two minutes had elapsed comprised the data for each session.

In addition to recording the number of times that the target behaviors occurred within each of the 10 interaction opportunities per session, a sequence analysis was conducted for each interaction opportunity within sessions. Each session was transcribed, and the particular antecedent-behavior-consequence sequence for each interaction was then analyzed individually and aggregated to determine whether any patterns could be identified with regard to communication partners’ responses to the target behaviors and any immediate temporal effects of each response on participants’ subsequent communication behaviors. An example of a session transcript may be viewed in Appendix B.

**Interobserver agreement.** Two additional observers were trained to identify interaction opportunities and occurrences of verbalization and mutism for the purpose of measuring interobserver agreement (IOA). The additional observers were both professionals with Master’s degrees in the fields of special education and speech-language pathology, respectively, who were in the process of completing coursework and fieldwork in applied behavior analysis. Interobserver agreement data were collected for the dependent variables in a total of 49% of randomly selected nonlinear functional analysis sessions across participants and conditions. To determine IOA, the number of agreements between observers was divided by the total number of opportunities (agreements plus disagreements) that were present per session and multiplied by 100.
**Holly.** Interobserver agreement for the dependent variables averaged 89.4% within nonlinear functional analysis conditions for Holly. When a disagreement was recorded between the two independent observers, it was by far more often related to disagreement regarding what constituted a specific interaction opportunity than to disagreement regarding the occurrence or absence of verbalization. For example, in one of Holly’s sessions, Holly responded with a verbalization on the initial trial of the session. The communication partner then stated that she could not hear Holly’s verbalization and asked Holly to repeat what she had said. In this case, both observers recorded a verbalization on the initial opportunity that Holly had to respond to the interaction. The primary observer did not score the request for repetition as a new trial, as it was a repetition of the response that Holly had just made; however, the second observer *did* count the repetition as a new trial. This difference in the two observers’ identification of the next interaction opportunity, therefore, misaligned the IOA data for the remainder of the interactions in the session. When the two observers’ transcripts were compared, both observers had transcribed the same interactions verbatim; however, when a single trial was misaligned in this way, the observers’ data were unmatched (i.e., off by one) for the remainder of the session. Sessions in which IOA for the dependent variables was less than 80% were analyzed to determine whether the observers had recorded the same interaction opportunity as a trial. Interobserver agreement was then recalculated using the “matched” interaction opportunities in which both observers recorded the same interaction and Holly’s response to it. When corrected for matched interaction opportunities, IOA for Holly’s nonlinear functional analysis conditions averaged 97.5%.

**Megan.** Interobserver agreement was 100% within the randomly selected sample of Megan’s nonlinear functional analysis sessions.
Amanda. Interobserver agreement for Amanda’s nonlinear functional analysis sessions averaged 52%; however, as noted for Holly, when disagreements were noted between the observers’ data, a side-by-side review of both observers’ session transcripts revealed that most often, the disagreement was with whether a particular interaction from the communication partner constituted a trial, and not whether Amanda had demonstrated a verbalization or mutism. When Amanda’s nonlinear functional analysis sessions were analyzed by reviewing both observers’ transcripts and aligning the transcribed interaction opportunities, IOA averaged 88.7% for the dependent variables.

Danielle. Interobserver agreement for the random sample of Danielle’s nonlinear functional analysis sessions averaged 84.3% for verbalization and mutism.

Research design. The current experiment included two phases: descriptive functional assessment and nonlinear functional analysis. The descriptive functional assessment procedures took place under naturalistic conditions. A sequential analysis of antecedent and consequence conditions was used to identify particular variables that were associated with verbalizations or mutism for each participant. Verbalizations and mutism were measured during this phase, but no environmental conditions were manipulated.

A multi-element (also referred to as an alternating treatments) design was used in the nonlinear functional analysis phase. This design allowed for rapid condition changes to experimentally manipulate multiple independent variables and evaluate their effects on behavior (Iwata et al., 1982/1994).

Procedures.

Descriptive functional assessment. To identify a broad range of possible environmental conditions that were associated with verbalization or mutism, an initial descriptive functional
assessment was conducted for each participant, using a combination of indirect and direct procedures. Indirect procedures included a comprehensive review of participants’ medical and educational records, and interviews with parents, family members and teachers within participants’ typical educational and community settings. Stakeholders were asked questions to determine participants’ general presentation of verbalizations and mutism within various home, school, and community situations. The *Functional Analysis Interview Form* (O’Neill et al., 1997) and *Selective Mutism Questionnaire* (Bergman, Keller, Piacentini, & Bergman, 2008) were included in the indirect assessment protocol. A sample questionnaire may be viewed in Appendix C.

Direct descriptive assessment procedures involved conducting structured observations of the participants in a variety of naturalistic situations in which verbalization and mutism typically occurred. Minimally, at least one observation was conducted in a setting where mutism occurred at a high frequency and at least one setting where verbalization occurred at a high frequency. In vivo narrative recording was the primary method for data collection during the observations. Although the precise variables differed for each participant, broad categories of antecedent conditions and consequences that have been correlated with SM in previous research such as people, social demands, academic demands, negative reinforcement, and positive reinforcement were directly observed and measured with respect to their correlation with mutism and verbalizations for participants in this study (Kern et al., 2007; Mace & West, 1986; Schill et al., 1996). Verbalization and mutism were recorded during each observation, in addition to such variables as the physical location, a description of the individuals present in the setting, the types of demands presented (i.e., social or academic), and individuals’ responses to participants’ communication behavior. Information obtained from the descriptive functional assessment
informed the conditions that were then manipulated in the nonlinear functional analysis phase of the study.

**Nonlinear functional analysis.** In the nonlinear functional analysis phase, verbalization and mutism were measured under experimental conditions within natural settings where mutism occurred most frequently for each participant, for example, in a participant’s classroom at school. Sessions were run one to two times per week during times when variables such as people, activities, types of demands, and responses to the target behaviors could be controlled to the greatest extent possible.

A matrix of conditions was created for each participant, based on the results of the descriptive functional assessment (e.g., setting x type of interaction opportunity x communication partner x consequence). The antecedent and consequence variables most frequently associated with mutism, as derived from each participant’s descriptive assessment, were systematically combined and manipulated for the purpose of verifying the hypothesized behavioral functions of SM for each participant. Verbalizations were measured, although there was no systematic manipulation of variables with respect to this behavior. Experimental conditions unique to each participant were numbered and selected in a quasi-random manner, without replacement, until all conditions had been presented or the allotted time expired for that day, whichever came first.

Each time a participant failed to demonstrate a verbalization in the presence of an interaction opportunity, escape was manipulated as follows:

1. If the participant did not demonstrate a verbalization within five seconds of the interaction opportunity, the communication partner stopped interacting with her by
pausing, breaking eye contact and turning his or her face away from the participant for 10 seconds.

2. After 10 seconds, the communication partner initiated a new and unrelated interaction opportunity.

When a participant failed to verbalize given an interaction opportunity, generalized social attention was manipulated as follows:

1. If the participant did not demonstrate a verbalization within five seconds of the interaction opportunity, the partner maintained physical orientation toward the participant by staying in proximity to her, maintaining eye contact with the participant, and acting as if the participant had responded.

2. A subsequent interaction opportunity within the same or similar topic was presented at least once every 30 seconds.

Control conditions consisted of a communication partner with whom the participant typically demonstrated frequent verbalizations providing unrestricted access to tangible items; generalized social attention such as smiling, making eye contact and commenting or asking questions; and removal of interaction opportunities non-contingently when the participant failed to verbalize.

Because the variables associated with mutism were unique for each participant, in addition to the above, a number of individualized conditions were included in each participant’s nonlinear functional analysis. Procedural individualizations and specific conditions that were manipulated for each participant are discussed in the text below.
The nonlinear functional analysis phase of the study continued until differential responding could be identified among the conditions or no difference was evident after at least three sessions of each condition.

**Methods Specific to Holly**

**Participant.** Holly was an 18-year-old female who was diagnosed with SM, anxiety disorder not otherwise specified, intellectual disability, and epilepsy. She turned 19 years old during the course of her enrollment in the study. At the start of her enrollment, she was prescribed clonazepam and felbamate for seizures and Paxil for symptoms of anxiety and SM. Due to her intellectual disability, Holly’s parents were appointed guardianship and conservatorship of Holly upon the age of majority. Holly was enrolled in special education classes in her high school and received specially designed instruction focusing on a functional life skills curriculum. She had met all of the academic requirements for graduation in the previous school year. Due to a combination of health issues related to her seizure disorder and having previously met academic requirements for graduation, she attended school on an abbreviated schedule (three hours per day, five days per week). Holly’s school day consisted of participation in elective classes including photography and folk art, in addition to receiving related special education services in speech-language and occupational therapies.

Holly’s mother provided the researcher with data regarding Holly’s seizure activity at regular intervals throughout the study. Data regarding the dates, frequency, and type of seizures that Holly experienced were regularly monitored by Holly’s neurologist. The data were considered with regard to Holly’s participation in the study in an effort to identify and prevent any detrimental effects from exposure to the research conditions. Although conditions were generally similar to those that Holly experienced within the natural environment, it was
important to ensure that the research procedures were not unduly placing additional stressors on Holly that would negatively affect her physical health. In addition to monitoring seizure data for these reasons, seizure data were compared to session data to identify whether any relationships could be observed between Holly’s communication behaviors and seizure activity. No detrimental effects to Holly’s physical health or correlations between seizure activity and communication behavior recorded during research sessions were observed throughout Holly’s participation in the study.

Holly spoke to her immediate family members to varying degrees within her home, and verbalizations with family members were limited in settings outside of the home. She seldom spoke to teachers and peers at school, family friends, and extended family members. In lieu of verbalizations, Holly frequently used conventional communicative gestures including nodding and shaking her head, pointing, and shrugging her shoulders with familiar communication partners including her teacher. With others, Holly would often cover her face with her arm, blocking her view of the person who was speaking to her.

**Procedures.**

**Descriptive functional assessment.** Holly’s descriptive functional assessment included a review of educational and medical records including her Individualized Education Program (IEP), occupational therapy evaluation, and speech-language and psychological evaluations. The *Selective Mutism Questionnaire* (SMQ; Bergman, et al., 2008) and *Functional Analysis Interview Form* (FAI; O’Neill et al., 1997) were completed during interviews with her mother and her teacher. Direct observations of Holly were also conducted on four separate occasions over a period of three weeks, under naturalistic conditions within her home and school settings. In vivo
narrative recording was used to collect data regarding the following environmental events within each of the first 10 interaction opportunities:

- Location
- Number of people present/in proximity to Holly
- Specific people present/in proximity to Holly
- Activity that was taking place
- Antecedent/type of interaction opportunity (e.g., question, comment, social demand, directive statement)
- Consequences for mutism and verbalization

**Nonlinear functional analysis.** Table 3 shows the conditions that were manipulated within Holly’s nonlinear functional analysis. Presentation of social demands, escape and generalized social attention procedures were consistent with those described previously. In addition to these conditions, Holly’s nonlinear functional analysis included access to a preferred tangible item, her Apple iPad computer. This condition was included as Holly was observed to have frequent access to her iPad during the descriptive functional assessment sessions. Mutism was observed as she engaged in solitary activities including watching videos and playing games and other “apps” on the iPad. Access to tangible items contingent upon failure to verbalize occurred in the following manner:

1. If Holly did not respond with a verbalization within five seconds of an interaction opportunity, the communication partner gave Holly her iPad and turned away from Holly, allowing her to engage with the iPad in any manner that she self-selected for approximately 30 seconds.
2. After 30 seconds, the partner would interrupt Holly’s activity and present a new interaction opportunity.

Table 3

*Nonlinear Functional Analysis Conditions for Holly*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Antecedents</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control 1</td>
<td>Chelsea (mother)</td>
<td>Noncontingent attention, access to tangibles, escape from social demands</td>
</tr>
<tr>
<td></td>
<td>Familiar location (school)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>Control 2</td>
<td>Chelsea</td>
<td>Noncontingent attention, access to tangibles, escape from social demands</td>
</tr>
<tr>
<td></td>
<td>Familiar location (home)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Nicole (researcher)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Nicole</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Nicole</td>
<td>Access to tangible</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Bill (educational paraprofessional)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Bill</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bill</td>
<td>Access to tangible</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
</tbody>
</table>
A total of 30 sessions were conducted across five days. Due to Holly’s availability, sessions did not occur on consecutive days. A maximum of seven days separated sessions. Sessions ranged from approximately two to five minutes in duration, although only the first 10 interaction opportunities comprised the data set in order to compare data consistently across sessions. In total, three sessions were conducted for each of the experimental conditions, and six sessions (three at home, three at school) were conducted for the control condition.

Sessions were conducted in Holly’s classroom and an adjacent classroom, whichever offered the greatest level of procedural control with regard to individuals present during times when the sessions were run. For example, on one of the days, several of Holly’s peers were present in her classroom; therefore, the sessions were held in a kitchen that was adjacent to the classroom. Although she generally spent little time in the kitchen during the school day, Holly was familiar with the adjacent room as the two rooms were connected by an adjoining door and her class periodically participated in cooking and other small group activities in there.

Information obtained during the descriptive functional assessment suggested that both mutism and verbalizations were related to interactions with specific individuals and escape from social demands. Mutism was observed and reported to occur frequently within the school setting while verbalizations were noted to occur most often with Holly’s mother within their home. Therefore, control conditions involved Holly’s mother presenting social interaction opportunities (antecedents), and providing noncontingent social attention, access to tangibles, and escape from social demands. To determine whether setting had a specific effect on Holly’s communication, control sessions were run in the school setting and within Holly’s home.

Communication partners were trained to identify mutism prior to beginning the nonlinear functional analysis. Color-coded printed instructions were reviewed and modeled for
communication partners before each session, and a hard copy was provided to differentiate their responses to mutism according to the condition that was in effect. Only Holly and the particular individual who was serving as a communication partner were present for each session. The researcher set up the video equipment in an inconspicuous location in advance of each session.

Methods Specific to Megan

Participant. Megan was a 10-year-old female with SM and anxiety disorder, not otherwise specified. She received specially designed educational instruction in the areas of literacy and math, and participated in general education programming for all other academic subjects. She received related special education services in speech-language therapy and social work.

Megan spoke with immediate family members within and outside of her home. She did not speak with teachers, and she reportedly had an intermittent history of speaking with her peers within the school setting. According to her mother, Megan did not use verbal communication with unfamiliar adults (e.g., cashiers, waitstaff, etc.) in community settings, even when immediate family members were present. She rarely used gestural communication (e.g., head nod, shrug, point, etc.) in situations where mutism was typically observed.

Procedures.

Descriptive functional assessment. As part of the descriptive functional assessment, interviews were conducted with Megan’s mother and Megan’s school social worker. Historical information regarding Megan’s SM as well as her educational history was gathered during the interview process, in addition to responses provided on the SMQ and FAI. A copy of Megan’s current IEP was also reviewed, along with an accompanying behavior support plan that
addressed her communication behavior and related accommodations for the educational environment.

Direct observations were conducted on three separate occasions within the school setting. Megan was seen during social and academic activities in both the general and special education settings. She was observed during a variety of naturally occurring academic and social activities including lunch, recess, specially designed instruction in literacy, her morning transition into school, and a general education music class. In vivo narrative recording was used to document the same variables as were described within Holly’s descriptive assessment procedures.

**Nonlinear functional analysis.** Megan’s nonlinear functional analysis consisted of social demands, escape, and generalized social attention as discussed previously. In addition, escape from academic demands and access to academic information were identified during the descriptive assessment as possible variables maintaining SM, and were thus manipulated accordingly during the nonlinear functional analysis.

Megan’s general education classroom teacher, Maria, presented academic interaction opportunities during the functional analysis. Although Megan worked with at least one other (special education) teacher regularly, Maria represented the adult instructors with whom Megan had contact throughout a typical school day. Academic demands consisted of stimuli that were within the average range of Megan’s educational performance level. For each session, Maria selected stimuli from Megan’s current curricular activities and instructional materials. Maria was instructed to “Present one academic question related to the lesson at a time, in a way that you would normally do when working with Megan.” For the escape procedure, Maria removed the academic demand when Megan failed to verbalize by pausing, breaking eye contact with Megan, and turning her face away from Megan for 10 seconds. After 10 seconds, she presented
a new and different academic demand. For the access to information procedure, Maria stated the correct response and waited another five seconds for Megan to respond. If Megan continued to demonstrate mutism, Maria instructed her to write the response. After 10 seconds, Maria presented a new and different academic demand. Table 4 depicts the conditions that comprised Megan’s functional analysis.

Table 4

*Nonlinear Functional Analysis Conditions for Megan*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Antecedents</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maria (teacher)</td>
<td>Remove academic demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Academic demands</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Maria</td>
<td>Access to academic information</td>
</tr>
<tr>
<td></td>
<td>Academic demands</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Barbara (social worker)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Nicole (researcher)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Emily (peer)</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
</tbody>
</table>

In addition to academic and social demands with adults, an experimental condition with a peer was included based on observations during the descriptive assessment that Megan engaged in social interactions regularly with peers using exclusively gestural interactions. A specific peer was identified from the descriptive functional assessment sessions and based on a recommendation from Maria as someone with whom Megan interacted frequently. Information was shared with the peer’s parents regarding the general nature of the study and procedures without revealing any identifying information about Megan or her role as a participant in the
study. Permission was given by Megan’s parents, the school principal, and the peer’s parents for her to participate as a communication partner during the functional analysis procedures.

Several attempts were made to establish a control condition, with Megan’s mother representing a condition in which Megan demonstrated a high frequency of verbal communication. The researcher did not receive responses to requests to conduct sessions under such conditions, and therefore, a control condition was not included as part of Megan’s nonlinear functional analysis.

A total of 15 sessions were conducted in Megan’s nonlinear functional analysis, with a range of two to four sessions per condition. The nonlinear functional analysis took place over a period of four days (not consecutive), with a maximum of eight days separating sessions. All sessions were conducted in Megan’s school setting. Primarily, sessions took place in Megan’s general education classroom, an adjacent classroom, and a vacant occupational therapy classroom, with selection based on availability of a room in which the presence of other individuals could be controlled. Sessions occurred during Megan’s designated recess time, once per week, and during her scheduled meeting times with Barbara, the school social worker. The order of conditions was assigned in an unsystematic, quasi-random manner, based on the availability of communication partners per session.

Communication partners were provided with instruction, modeling, and a color-coded textual copy of the procedures to indicate differential responding among conditions. A change of conditions was signaled by the researcher after approximately five minutes had elapsed, or 10 interaction opportunities were presented.

**Methods Specific to Amanda**
Participant. Amanda was a 7-year-old female diagnosed with SM, attention deficit hyperactivity disorder, mixed receptive and expressive language disorder, and specific learning disabilities in the areas of math and reading. She received special education services under the eligibility criteria of multiple disabilities, specifically, a speech-language disorder and learning disability. Services addressing SM were not included as part of her individual education program as school personnel did not observe this behavior to be interfering with her participation in the school setting. Her parents disagreed with this perspective, and requested that some of the research procedures be conducted within the school setting. Amanda’s SM was reportedly observed most often in situations with unknown or unfamiliar individuals.

Amanda’s parents were divorced and shared joint custody of Amanda. She spent equal amounts of time each week within each parent’s home. Her parents reported that she transitioned easily between the two environments and that there did not appear to be any significant difference in her communication across the two settings.

Procedures.

Descriptive functional assessment. Amanda’s mother completed the SMQ and FAI forms independently and returned them to the researcher. Both parents provided additional background information during interviews and correspondence prior to the direct observation sessions.

Amanda was referred for participation in the study just prior to the end of the school year. Two observations occurred within activities in her typical school setting, including lunch in the general education setting and academic instruction in a special education classroom within her school. Although the team of professionals who were observed working with Amanda during these observations was likely to change with the new school year, the information gathered was
considered representative of naturalistic conditions that she would experience in any educational setting. A third observation took place during Extended School Year services provided during the summer under her IEP. This session occurred at a central location for the school district, which was not in the school building that Amanda regularly attended; however, the instructors who were observed working with Amanda were known to her. The fourth observation was conducted during an outing with Amanda and her father, at a local supermarket. As noted previously, in vivo narrative recording was used to document situational variables including people present, type and content of academic and social demands, and others’ responses to verbalizations and mutism.

**Nonlinear functional analysis.** Amanda’s nonlinear functional analysis conditions are shown in Table 5.

Table 5

*Amanda Nonlinear Functional Analysis Conditions*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Antecedents</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Richard (father)</td>
<td>Noncontingent attention, access to tangibles, escape from social demands</td>
</tr>
<tr>
<td></td>
<td>Social demand</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Richard</td>
<td>Remove academic demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Academic demand</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Richard</td>
<td>Access to academic information</td>
</tr>
<tr>
<td></td>
<td>Academic demand</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Nicole (researcher)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Social demand</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Nicole</td>
<td>Generalized social attention/repeat social demand</td>
</tr>
<tr>
<td></td>
<td>Social demand</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Antecedents</td>
<td>Consequences</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Nicole Social demand</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td>6</td>
<td>Haley (peer) Social demand</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td>7</td>
<td>Haley Social demand</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td>8</td>
<td>Nicole Academic demand</td>
<td>Generalized social attention/repeat academic demand</td>
</tr>
</tbody>
</table>

Based on the latency of Amanda’s responding observed during the descriptive assessment, it was necessary to make a slight modification to the operational definition of verbalizations prior to beginning her nonlinear functional analysis. In naturally occurring opportunities, Amanda was observed to produce verbalizations in response to interaction opportunities at a latency of up to 10 seconds. Adhering to a latency of five seconds for the dependent variable would have falsely inflated the proportion of mutism for Amanda’s nonlinear functional analysis sessions. As such, this individualization was necessary to accurately measure the distinction between verbalizations and mutism for Amanda. All other parameters of the dependent variable remained unchanged.

Social demands, escape, and generalized social attention procedures were consistent with those described for Holly and Megan. In addition to social demands, academic demands were included, as mutism was observed to occur in the presence of such demands during the descriptive functional assessment. Academic demands were consistent with stimuli that Amanda was observed to respond to during descriptive assessment sessions within the school setting. Examples included: single-digit addition problems, presented verbally; consonant-vowel-
consonant words, presented textually; short sentences (three to four words in length) consisting of single-syllable words; and time-telling stimuli, depicting whole- and half-hour intervals, presented visually. Access to academic information and escape from academic demands were manipulated following the procedures that were described within this condition for Megan.

Due to the nature of Extended School Year services that Amanda participated in during the summer, it was not possible to conduct nonlinear functional analysis sessions in the school setting. Instead, all functional analysis sessions occurred within Amanda’s father’s home. In order to simulate conditions that Amanda was likely to encounter within the school setting, academic demands were included despite the lack of access to the school or school personnel during the summer months.

The researcher represented an unfamiliar adult, as a member of a class of communication partners with whom mutism was observed to occur during descriptive assessment procedures. The researcher’s interactions with Amanda were limited prior to the nonlinear functional analysis, although Amanda was aware that the researcher was present and conducting observations during the descriptive assessment phase. The researcher served as an unfamiliar adult to assess Amanda’s responses to both social and academic interaction opportunities presented by someone who was not well known to her. This level of exposure to an unfamiliar adult would be similar to what Amanda would experience when moving into a new classroom in the next school year as well as her experience in community locations such as stores and restaurants.

To test the likelihood that mutism was maintained by escape from academic demands or by access to academic information, academic demands were presented by two individuals, Amanda’s father and the researcher. Generalized social attention was manipulated as a
consequence for mutism in the presence of various individuals, specifically, an unfamiliar adult (the researcher), and a peer who was well known to Amanda. Permission was granted by Amanda’s parents and a peer’s parent for the peer’s involvement in the nonlinear functional analysis. The peer was Amanda’s age and lived next door to Amanda. General information regarding the nature of the study and the procedures was provided to the peer’s parent by the researcher, as well as by Amanda’s father. Finally, escape from social demands was tested as a consequence in the presence of the peer and the researcher.

In addition to the above, Amanda’s nonlinear functional analysis included a condition in which generalized social attention was maintained in the form of repeating an interaction opportunity contingent on a failure to verbalize. In this condition, if mutism occurred on the initial opportunity to respond to a communication partner’s interaction, the communication partner maintained eye contact with Amanda and repeated the social or academic demand one time. If mutism persisted, the interaction was discontinued, as in the escape procedure. This condition was added based on observations during the descriptive assessment that indicated that Amanda occasionally responded with verbalizations when an interaction opportunity was maintained or re-presented, suggesting that social attention in this form functioned as a punisher for SM.

A control condition in which mutism was least likely to occur served as a comparison for all other conditions. Control conditions involved Amanda’s father engaging socially with Amanda, providing noncontingent escape (i.e., periods of time with no social questions asked or academic demands presented), and noncontingent access to attention, tangible items, and information.
Each session included only Amanda and the designated communication partner. Partners were instructed in the differential condition procedures prior to the start of each session. Color-coded written instructions were available to communication partners throughout the sessions. Sessions were ended after 10 interaction opportunities were presented, and condition changes were signaled by the selection of a condition number from a container and a change in instructions (presented textually and verbally).

Methods Specific to Danielle

Participant. Danielle was an 8-year-old female and diagnosed with SM, attention deficit hyperactivity disorder, and anxiety disorder, not otherwise specified. At the time of her enrollment in the study, she was prescribed Adderall for control of symptoms related to ADHD and Prozac to address symptoms of anxiety. Danielle received special education services in the area of literacy. Selective mutism was not reportedly disrupting her participation in academic or social activities in school, and therefore she did not receive any special education services related to the diagnosis of SM. Danielle used verbal communication with peers, teachers, and some immediate family members. Selective mutism was reported with unfamiliar adults in community settings, immediate family members other than her mother in settings outside of the home, and specific family members within her home or their homes, even with her immediate family members present.

Procedures.

Descriptive functional assessment. Interviews were conducted with Danielle’s mother on two separate occasions. The SMQ and FAI were completed during the interviews. Danielle’s mother provided additional background information throughout the interview process. Based on responses to the SMQ and FAI, direct observations were conducted in settings where Danielle’s
mother indicated that Danielle “often” or “always” demonstrated mutism. Four observations were conducted: three occurred in Danielle’s home and another took place in a fast food restaurant and department store in the community. Due to the presence of individuals who were not part of the study, in vivo recording was conducted in lieu of videotaping.

**Nonlinear functional analysis.** Following the descriptive functional assessment, nonlinear functional analysis was conducted to verify hypotheses regarding the conditions that evoked and maintained mutism and verbalizations for Danielle. All functional analysis sessions took place in Danielle’s home. Specific family members who were reported or observed to be associated with verbalizations as well as those who were associated with mutism were instructed to ask questions and make statements to Danielle in a way that was typical of how they regularly interacted with her. Differential responses for attention and escape contingent on failure to verbalize when an interaction opportunity was presented were modeled and provided in writing to the designated communication partners. Partners were trained to identify mutism based on the following definition: “When Danielle does not speak to you by using at least a word or phrase that you can hear within 5 seconds of your question or comment.” The researcher signaled the end of each session and provided a brief (two-to-three minute) break before beginning the next session. Condition changes were signaled by a change in communication partner and/or a change in the color and font of the written instructions that were provided to the communication partner for each condition.

Table 6 shows the conditions that comprised Danielle’s nonlinear functional analysis. Social demands consisted of general conversational exchange including but not limited to: questions about Danielle’s interests, current events, discussion of past or future activities, comments about the present environment, and responses to Danielle’s questions or comments.
The researcher served as the unfamiliar adult, as Danielle had the least history of interacting with the examiner as compared to her history of interaction with the other individuals who were present. Escape and generalized social attention occurred as previously described.

Table 6

*Danielle Nonlinear Functional Analysis Conditions*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Antecedents</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Julie (mother)</td>
<td>Noncontingent attention, access to preferred items and activities, and escape from social demands</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Samantha (adult sister-in-law)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Samantha</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Joseph (father)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Joseph</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Small group (Samantha, Joseph, Nicole – researcher)</td>
<td>Remove social demand (escape)</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Small group (Samantha, Joseph, Nicole)</td>
<td>Generalized social attention</td>
</tr>
<tr>
<td></td>
<td>Social demands</td>
<td></td>
</tr>
</tbody>
</table>

**Procedural Integrity**

Procedural integrity data were collected by the researcher for a randomly selected sample of 80% of nonlinear functional analysis sessions. Procedural integrity was measured by recording whether a communication partner correctly or incorrectly executed each prescribed
step for the differential responses of attention, escape, and access to an item or information each time the participant failed to verbalize in response to an interaction opportunity. For example, the procedures for the attention condition required communication partners to initiate a comment or question to begin a trial; if the participant failed to respond with a verbalization, the procedures prescribed that the communication partner would continue to look at the participant and “act as though she responded verbally,” for example by responding to the participant’s gestural behavior (if applicable), asking a related question, or making a comment. Figure 1 depicts an example of procedural integrity measurement for Holly’s attention condition, with Bill as her communication partner.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Initiate question or comment</th>
<th>Holly’s response (+ if verbal)</th>
<th>If no verbalization, maintain eye contact with Holly</th>
<th>If no verbalization, respond as if Holly verbalized</th>
<th>PI trial:</th>
</tr>
</thead>
<tbody>
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*Figure 1.* Example of procedural integrity for Holly’s nonlinear functional analysis depicting accurate execution of each step within trials during an attention condition with Bill.
Holly. Procedural integrity for Holly’s nonlinear functional analysis conditions averaged 87%, with a range of 53% to 98%. Table 7 shows the procedural integrity data for Holly’s nonlinear functional analysis conditions.

Table 7

**Holly Nonlinear Functional Analysis Procedural Integrity per Condition**

<table>
<thead>
<tr>
<th>Nonlinear Functional Analysis Condition</th>
<th>Procedural Integrity</th>
</tr>
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<tbody>
<tr>
<td>Bill – Escape</td>
<td>85%</td>
</tr>
<tr>
<td>Bill – Attention</td>
<td>98%</td>
</tr>
<tr>
<td>Bill – Access</td>
<td>53%</td>
</tr>
<tr>
<td>Nicole – Escape</td>
<td>98%</td>
</tr>
<tr>
<td>Nicole – Attention</td>
<td>94%</td>
</tr>
<tr>
<td>Nicole – Access</td>
<td>92%</td>
</tr>
</tbody>
</table>

Procedural errors in the access condition with Bill occurred primarily in the form of failing to turn away from Holly when she had access to the iPad, in order to differentiate this consequence from that of generalized social attention. Bill refrained from speaking to or otherwise interacting with Holly, however, which sufficiently differentiated this condition from the generalized social attention procedure.

Megan. Procedural integrity for Megan’s nonlinear functional analysis averaged 77%, with a range of 57% to 98%. Megan’s nonlinear functional analysis procedural integrity data are depicted in Table 8.
Analysis and Treatment of Selective Mutism 62

Table 8

*Megan Nonlinear Functional Analysis Procedural Integrity per Condition*

<table>
<thead>
<tr>
<th>Nonlinear Functional Analysis Condition</th>
<th>Procedural Integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maria – Academic – Escape</td>
<td>57%</td>
</tr>
<tr>
<td>Barbara – Social – Escape</td>
<td>82%</td>
</tr>
<tr>
<td>Nicole – Social – Escape</td>
<td>98%</td>
</tr>
<tr>
<td>Maria – Academic – Access</td>
<td>62%</td>
</tr>
<tr>
<td>Emily – Social – Attention</td>
<td>84%</td>
</tr>
</tbody>
</table>

Procedural integrity in the sessions with Maria was poor for the first two days of the functional analysis procedures. The researcher provided a review of the procedures and a new set of written instructions to Maria prior to the third session. Procedural integrity improved significantly; however, there was no change in Megan’s nonlinear functional analysis data as compared to previous sessions.

**Amanda.** Procedural integrity for Amanda’s nonlinear functional analysis may be viewed in Table 9. Procedural integrity averaged 89%, with a range of 66% to 100%.

Table 9

*Amanda Nonlinear Functional Analysis Procedural Integrity per Condition*

<table>
<thead>
<tr>
<th>Nonlinear Functional Analysis Condition</th>
<th>Procedural Integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard – Academic – Escape</td>
<td>81%</td>
</tr>
<tr>
<td>Nicole – Social – Escape</td>
<td>100%</td>
</tr>
<tr>
<td>Haley – Social – Escape</td>
<td>79%</td>
</tr>
<tr>
<td>Richard – Academic – Access</td>
<td>66%</td>
</tr>
<tr>
<td>Nicole – Social – Attention</td>
<td>96%</td>
</tr>
<tr>
<td>Nicole – Academic – Repeat</td>
<td>89%</td>
</tr>
<tr>
<td>Nicole – Social – Repeat</td>
<td>100%</td>
</tr>
<tr>
<td>Haley – Social – Attention</td>
<td>100%</td>
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</tbody>
</table>

The majority of procedural errors were observed in the condition in which Amanda’s father, Richard, presented academic questions and provided access to the correct answer upon an
occurrence of mutism. The procedures for this condition required Richard to provide the correct academic information after repeating the question one time. Errors were observed most often in this step, as Richard tended to repeat the question more than one time before providing the correct response.

**Danielle.** Procedural integrity data were poor for all of the escape conditions within Danielle’s nonlinear functional analysis. Within escape conditions, procedural components were implemented with an average of 26% accuracy, as compared to an average of 96% of components implemented accurately in attention conditions. For example, communication partners frequently responded to vocalizations that were not words, such as “m-hm” as if Danielle had verbalized, instead of discontinuing the interaction and turning away from Danielle as prescribed by the escape condition procedures. The researcher retrained communication partners including modeling and providing additional written copies of procedural components; however, procedural integrity did not improve.

**Results and Discussion**

**Holly.** Descriptive functional assessment results suggested that interaction opportunities with strangers or less familiar people were associated with mutism, and that a failure to use verbal communication was most often followed by generalized social attention and discontinuing the interaction, respectively. Verbalizations were observed in the presence of certain people and when Holly wanted information (e.g., asking questions). Social attention in the form of eye contact, continuing to talk to Holly, and providing requested information were frequent consequences for verbalizations.

Figure 2 shows the results of the nonlinear functional analysis for Holly.
Figure 2. The percentage of interaction opportunities with mutism during nonlinear functional analysis for Holly.

Mutism occurred consistently in 100% of interaction opportunities across conditions with the researcher, the communication partner with whom Holly had the least history of interacting prior to this study. An increasing trend was evident across sessions in all three conditions with Bill, Holly’s one-to-one educational paraprofessional. This may have been a result of mutism generalizing across communication partners. Alternatively, the researcher’s presence may have signaled atypical conditions during Holly’s interactions with others, thereby decreasing the likelihood of responding under the altered conditions. Mutism was consistently lowest with Holly’s mother providing non-contingent reinforcement (i.e., control condition), and occurred more frequently in control condition sessions that took place within the school setting as
compared to those that occurred within Holly’s home environment. There were no occurrences of verbalization with Bill after session eight, with the exception of one occurrence (session 27) in a condition in which Holly received access to the iPad contingent on remaining mute.

Aggregate data of antecedent and consequence variables across all functional analysis sessions for Holly are shown in Figure 3.

Figure 3. Aggregate data from Holly’s nonlinear functional analysis showing greater differences in mutism across antecedent variables as compared to consequence variables.

Figure 3 shows clearly that the greatest difference in Holly’s communication behavior was observed among antecedent variables as compared to consequence variables. Specifically, she demonstrated mutism in 100% of interactions across sessions with the researcher, in an average of 87% of sessions with Bill, in an average of 67% of sessions with her mother in the
school setting, and 55% of sessions with her mother in their home. Minimal difference was observed among consequence conditions.

It was not possible to control for the presence of other people consistently in the natural environment of a school during the functional analysis sessions. In six of the 30 sessions, a range of one to three peers and one to three adults from Holly’s classroom were present in the room during 70% or more of the interaction opportunities, although not in close proximity to or interacting with Holly and her respective communication partners (Nicole, Bill, Chelsea). There were no substantial differences in Holly’s communication behavior across sessions in which other individuals who were not part of the nonlinear functional analysis procedures were present in the environment. This suggests that although there did not appear to be a correlation between the presence of others in the environment and Holly’s communication behavior, a functional relation between specific individuals as Holly’s communication partner and her communication behavior is likely.

A sequence analysis of interaction opportunities during functional analysis sessions revealed that during the control conditions, there were a number of instances when Holly demonstrated no communicative topography (e.g., gestural, vocal, eye gaze, facial expression) in response to a question or interaction posed by her mother. When this occurred, Holly’s mother was frequently observed to repeat the interaction or otherwise maintain the expectation for Holly to respond. When her mother maintained the expectation for her to respond, Holly responded with an observable communicative topography in four of the five times that this was observed. Although she did not always demonstrate verbalizations in these instances, she responded in a socially conventional communicative manner. Specifically, she responded twice with verbalizations, once with a communicative gesture, and once with a non-word vocalization, “m-
hm.” Based on these observations and the results of the nonlinear functional analysis, an escape extinction procedure was developed for Experiment 2 with generalized social attention provided contingent on verbalizations.

**Megan.** Figure 4 illustrates the results of Megan’s nonlinear functional analysis.

![Figure 4](image)

**Figure 4.** Megan’s nonlinear functional analysis data indicating no difference in the percentage of mutism across conditions.

Megan’s descriptive functional assessment and nonlinear functional analysis revealed minimal difference in mutism across conditions. Of the three observations conducted as part of the descriptive assessment process, Megan demonstrated only one occurrence of verbalization. Mutism occurred in 100% of interaction opportunities across conditions with all communication partners within the nonlinear functional analysis.
During the functional analysis conditions in which access to academic information was provided contingent on a failure to verbalize, Megan wrote responses as directed in 100% of opportunities. She did not initiate textual behavior until directed by Maria on any interaction opportunities.

A sequence analysis of interactions within each functional analysis session revealed that Megan demonstrated audible vocal behavior during the attention condition with a preferred peer. This behavior did not occur in the presence of any other communication partners. Specifically, Megan demonstrated audible laughter, both with her mouth open and closed, in 80%, 40%, and 50% of trials, respectively, over the three functional analysis sessions with her peer. During Session 12, she demonstrated two occurrences of using open vowel sounds, “uh” and “eh” while engaged in a play activity with the peer. Additionally during sessions with her peer, Megan was observed to initiate interactions using nonverbal means including physically contacting her peer, gesturing (e.g., holding up an item and showing it to her peer), and engaging in pretend play such as using two fingers to “walk” across the table toward her peer. Megan did not initiate physical or gestural interactions with any other communication partners. Likewise, she was not observed to open her mouth, vocalize, or whisper any speech sounds during sessions with communication partners other than her peer.

The results of Megan’s nonlinear functional analysis indicated that mutism was evoked and maintained by multiple variables. Although she never produced verbalizations during this phase, nonlinear functional analysis revealed that she demonstrated a broader range of non-vocal communicative topographies in sessions with her peer as compared to sessions with other communication partners. As a result, a treatment procedure involving social interactions with
her peer and contingent social attention as a consequence for approximations of verbalization was developed for Megan.

**Amanda.** Amanda’s nonlinear functional analysis results are depicted in Figure 5.

*Figure 5.* Session data for Amanda’s nonlinear functional analysis conditions indicating variability across conditions.

Nonlinear functional analysis revealed that Amanda demonstrated verbalizations more frequently than mutism in response to interaction opportunities in all conditions with the exception of one, the condition in which unfamiliar adults terminated social interactions contingent upon failure to verbalize. Overall, Amanda demonstrated verbalizations on an average of 61% of opportunities, while mutism occurred on an average of 39% of opportunities across conditions in the nonlinear functional analysis; however, there was substantial variability in the data. There was considerable overlap of data across sessions, including several conditions...
in which mutism occurred less frequently than in the control condition. Mutism occurred in an average of 40% of interaction opportunities within the control condition. As can be seen in Figure 5, mutism occurred at a higher rate than verbalizations in only five of the 29 total sessions in the nonlinear functional analysis.

Due to the variability in the data, Amanda’s functional analysis data were aggregated within a histogram to show a summary of mutism across conditions. Figure 6 provides this view of the data.

Figure 6. Aggregate data for Amanda’s nonlinear functional analysis. Mutism occurred in less than 50% of interactions in all but one condition.
Mutism occurred in less than 50% of the overall interactions in all but one condition during the functional analysis, specifically, the condition in which the researcher presented social interactions and then discontinued an interaction upon a failure to verbalize (i.e., Nicole-Social-Escape). In this condition, mutism was observed in an average of 57% of the interactions.

A sequence analysis of interaction opportunities within functional analysis sessions indicated that although verbalizations occurred more frequently than mutism in most conditions, there were several instances when Amanda demonstrated extraneous verbal utterances in response to interaction opportunities. For example, during a condition in which Amanda’s father presented academic demands in the form of single-digit addition problems, Amanda was observed to count aloud sequentially, making no attempt to respond to the specific stimulus that was presented. Another example of an unrelated verbalization was observed when Amanda changed the topic of conversation, effectively avoiding an interaction that the communication partner initiated, while still exhibiting verbalizations.

In situations when social interactions were repeated following a failure to verbalize on the initial occurrence of an interaction opportunity, verbalizations were equally proportionate to mutism during descriptive assessment observations and occurred at a greater proportion than mutism during nonlinear functional analysis sessions. There were minimal differences in the frequency of mutism in the conditions that were accessible to the researcher for the present study. Per exclusion criteria for the current study, Amanda discontinued as a participant at this phase in the research.

Danielle. The results of Danielle’s descriptive functional assessment suggested that antecedent variables most frequently associated with mutism were specific people and the number of people present in an environment. Additionally, Danielle’s mother reported during
interviews that interaction opportunities involving any telephone or computer-based medium (e.g., Skype, FaceTime) were associated with mutism. Consequence variables most often associated with mutism for Danielle were generalized social attention and termination of interaction opportunities. Verbalizations were observed to occur in the presence of particular individuals, and were most often followed by generalized social attention from the communication partner with whom Danielle was engaged at the time.

Conditions that were identified for systematic manipulation within Danielle’s nonlinear functional analysis were based on the following hypotheses: a specific communication partner discontinuing an attempt to interact with Danielle was an immediate, frequent, contingent reinforcer for mutism; generalized social attention in the form of smiling, eye contact, and continued conversational exchange was an immediate, frequent, noncontingent reinforcer for verbalizations.

The results of Danielle’s nonlinear functional analysis indicated that mutism occurred most frequently in the presence of a small group of others as compared to conditions in which she interacted one-on-one with a communication partner. Additionally, mutism was observed more frequently when followed by attention than when followed by escape. Verbalizations occurred most frequently in the control condition, with her mother as the communication partner and non-contingent attention, access to a preferred item (laptop computer), and escape from social demands. As noted previously, procedural integrity data were poor for all of the escape conditions in Danielle’s nonlinear functional analysis. Despite retraining the communication partners, procedural integrity did not improve, and as a result, data from Danielle’s functional analysis were not considered reliable. Danielle discontinued as a participant at this phase in the study.
General Discussion

Two participants from Experiment 1 met the criteria to continue to the treatment phase of the study (Experiment 2), Holly and Megan. Data from the descriptive assessment and nonlinear functional analysis for Holly indicated that the greatest difference in the proportion of mutism was observed with particular communication partners. Verbalizations were most often observed when Holly wanted or needed information (e.g., asking questions) and were maintained by social attention in the form of eye contact, continuing to talk to Holly, and providing requested information. At times, communication partners provided escape by discontinuing the interaction when Holly did not demonstrate a verbalization.

Megan’s descriptive functional assessment and nonlinear functional analysis results were undifferentiated with regard to communication partner, type of interaction, and consequence. No verbalizations occurred during Megan’s nonlinear functional analysis; however, she was observed to exhibit audible vocal behavior during the condition in which a preferred peer provided continuous social attention if Megan failed to verbalize in response to an interaction. This behavior did not occur in the presence of any other communication partners.

The other two participants, Danielle and Amanda, stopped participation at the end of Experiment 1. Consistent with the exclusion criteria of the study, the researcher did not have controlled access to conditions that reliably evoked or maintained verbalizations for Danielle. Procedural integrity was poor during Danielle’s nonlinear functional analysis, and as a result, data from Danielle’s functional analysis were not considered reliable. Furthermore, conducting a controlled experimental analysis and prescribed intervention with novel communication partners (i.e., “strangers”), another possible antecedent variable associated with a low frequency of verbalizations for Danielle, was not feasible for Danielle’s family, as it would have required
exposure to novel individuals for each session. Danielle discontinued as a participant at this phase in the study.

Amanda’s nonlinear functional analysis showed that she demonstrated a low proportion of mutism in all but one condition. The highest frequency of mutism was identified in a condition in which an unfamiliar individual (the researcher) provided escape from social demands when Amanda did not respond to interaction opportunities. To replicate this condition, treatment procedures would have necessitated that Amanda interact with unfamiliar people across treatment sessions. The researcher represented unfamiliar individuals during nonlinear functional analysis; however, repeated exposure to a single unfamiliar individual across treatment sessions would have confounded the variable of “familiarity,” making it impossible to determine whether any therapeutic effects were the result of repeated exposure to that individual or the manipulation of a consequence in response to occurrences of mutism. On the other hand, arranging for Amanda to interact with a novel, unfamiliar individual for each treatment session would have been difficult for Amanda’s parents to accommodate. Furthermore, in a naturalistic setting, it would have been unrealistic to prescribe the manner in which unknown individuals should respond to Amanda within the context of social interactions in public locations such as restaurants and retail stores. Because of the practical challenges of exposing Amanda to unfamiliar individuals for each session and inability to control the way that unknown individuals would respond to Amanda, she did not participate in this phase of the study.

**Experiment 2**

**General Method**

**Participants, setting, and materials.** Two participants from Experiment 1, Holly and Megan, participated in this phase of the study. Video and/or audio recording was conducted for
all intervention sessions using the same equipment described in Experiment 1. Sessions were then transcribed to identify specific antecedent-behavior-consequence sequences for each interaction opportunity (total of 10 interaction opportunities per session).

**Dependent measures.** Experiment 2 used the same response definitions for verbalization and mutism as were used in Experiment 1. Because this phase of the study employed procedures to increase participants’ verbalization, measurement in Experiment 2 focused on the proportion of interaction opportunities in which verbalization occurred relative to when it was expected. As such, graphs for Experiment 2 depict the percentage of interaction opportunities with verbalization per session. This change reflects the social validity of showing an improvement in the alternative behavior (i.e., verbalization).

The occurrence or nonoccurrence of a verbalization was recorded for each interaction opportunity presented. To control for variations in session duration, the first 10 interaction opportunities after two minutes had elapsed comprised the data set for each session. Sessions were run one to two times per week in the same settings in which each participant’s nonlinear functional analysis had been conducted.

**Interobserver agreement.** The researcher and one observer who had been trained previously to identify interaction opportunities and record occurrences of verbalizations for the nonlinear functional analysis evaluated interobserver agreement (IOA) during the systemic treatment phase of the study. Interobserver agreement was calculated for a randomly selected sample of 64% of both participants’ treatment sessions. As in Experiment 1, IOA was measured by counting the number of agreements between observers, dividing by the total number of opportunities (agreements plus disagreements) that were present per session for verbalizations and interaction opportunities and multiplied by 100.
Interobserver agreement for verbalizations averaged 96% (range 78% to 100%) overall within treatment conditions. For Holly, IOA averaged 94.4%, and for Megan, IOA averaged 96.7%.

**Methods specific to Holly.**

**Research design.** A multiple probe across settings design (Horner & Baer, 1978) was employed to evaluate the effectiveness of Holly’s individualized intervention. The “settings” were three different communication partners with whom Holly demonstrated a low proportion of verbalizations during the descriptive assessment and/or nonlinear functional analysis. Specifically, the individuals were Bill, Holly’s one-to-one educational paraprofessional; Susan, Holly’s special education teacher; and this researcher. Experimental control was demonstrated through two within-subject replications, with Holly serving as her own control (Horner & Baer, 1978).

**Procedures.** For Holly, Experiment 2 took place in her school and home environments. During baseline, when Holly demonstrated a verbalization, the communication partner moved on to the next interaction opportunity without responding to Holly’s verbalization. When Holly demonstrated mutism during the baseline condition, the communication partner moved on to the next interaction opportunity without acknowledging the mutism. Due to time constraints and to avoid further extending the time without treatment, baseline procedures were not conducted in the initial intervention setting, that is, within interaction opportunities with Bill. Baseline probes were conducted periodically in the two remaining treatment conditions with Susan and Nicole while intervention was in progress with Bill.

Intervention procedures consisted of the communication partner initiating a social interaction with Holly and then providing the verbal prompt “Use words to tell me” at a 0-second
delay following the social interaction. If Holly demonstrated a verbalization, the communication partner provided generalized social attention by looking at Holly, smiling at her, and/or making a statement in response to Holly’s verbalization. The interaction was then ended and a novel interaction opportunity was presented. The delay to the verbal prompt was systematically increased by one second for each consecutive interaction opportunity in which Holly demonstrated a verbalization. This was done in an effort to transfer stimulus control from the verbal prompt to the interaction opportunity (Touchette, 1971).

In the event that Holly failed to demonstrate a verbalization in response to the partner’s interaction opportunity, the communication partner repeated the same interaction and verbal prompt, waiting another five seconds for Holly to respond to the interaction opportunity. This process was repeated until Holly responded to the interaction or up to five times, whichever occurred first. Following a failure to respond, the delay between the interaction opportunity and the verbal prompt was reset to a 0-second delay on the subsequent trial.

The intervention procedures were applied systematically across conditions, beginning with Holly’s interactions with Bill. Once verbalizations reached a stable, increased level with Bill, the independent variables were introduced in interactions with Susan, and baseline remained in effect for interactions with Nicole. Finally, when verbalizations reached a stable level within interactions with Susan, the independent variables were applied to interactions with Nicole.

Once criterion was met in all three treatment settings, the study moved into maintenance phase. Direct manipulation of contextual variables was no longer applied. In order to assess the maintenance of any change in Holly’s verbalizations, a maintenance check was conducted at one month post-treatment, following the same procedures as were implemented during the intervention phase.
Procedural integrity. Procedural integrity was calculated by scoring communication partners’ correct and incorrect implementation of the contingent attention and escape extinction procedures that comprised Holly’s systemic treatment. The number of trials with procedures implemented correctly was divided by the total number of trials (ten) per session to yield a percent accuracy for procedural integrity per treatment session. Procedural integrity was measured for a randomly selected sample of 43% of Holly’s intervention sessions, and averaged 99%, with a range of 93% to 100% across communication partners.

Methods specific to Megan.

Research design. As described for Holly, a multiple probe across settings design (Horner & Baer, 1978) was planned to evaluate the effects of systemic treatment with Megan, with three communication partners serving as the “settings” across which the independent variable was to be applied. Specifically, the communication partners were Emily, Megan’s peer who had participated in the nonlinear functional analysis; Maria, Megan’s general education teacher; and this researcher. Unfortunately, Megan’s family moved out of state soon after the intervention phase began, and the research procedures were only able to be conducted within one condition, interactions with her peer. In addition, because the end of the school year was nearing as the study moved into intervention phase with Megan, data from Megan’s nonlinear functional analysis were compared with intervention data to observe any change in verbalizations with the introduction of the intervention procedure. This comparison was assumed to be valid because Megan’s mutism occurred in 100% of conditions during the nonlinear functional analysis and consistent results were expected to continue prior to implementing the intervention. Therefore, an A-B design was used to compare the proportion of Megan’s verbalizations during functional
analysis procedures with Emily (A) to the proportion of verbalizations during intervention procedures with Emily (B).

**Procedures.** Procedures for Experiment 2 involved Megan and her peer participating in a cooperative social game that required Megan to respond to questions from the peer and take turns within the context of the particular games. Activities included: creating identical structures using Legos, clay, or Playdoh; drawing identical pictures; and playing the games “Guess Who” and “Hangman.” At the beginning of each session, Megan and her peer were informed of the session ‘goal,’ which was specific to the activity that was presented; for example, the goal of playing “Guess Who” was for Megan and her peer to work together so that the peer was able to guess which person Megan had selected on her game board.

During several of the structured activities planned for the intervention sessions, a tri-fold board was placed between Megan and her peer as a physical barrier, or they were seated back to back in an effort to prevent the peer from being able to see, and therefore respond to, subtle nonverbal behaviors such as smiling in response to a question. A barrier was also used when the activity required the peer to create an identical drawing or structure, based on Megan’s responses to questions. Session activities were structured such that Megan had opportunities to initiate verbalizations as well as to respond to interactions presented by her peer and/or within naturally occurring opportunities in the context of a turn-taking activity.

All sessions occurred within Megan’s classroom at school. Trials consisted of the peer asking questions to Megan in the context of the social activity. Shaping procedures were implemented to successively increase Megan’s approximations of verbalizations. In an effort to establish behavioral momentum, nonvocal response topographies were allowed in the initial session, specifically, using speech generating software, writing, and nodding or shaking her head.
to indicate ‘yes’ or ‘no’; however, these topographies did not constitute approximations of verbalizations as outlined in the shaping procedure and were therefore not recorded as such. In subsequent successive sessions, shaping procedures required Megan to produce approximations of verbalizations in response to interaction opportunities. Successive approximations of verbalizations that were reinforced within shaping procedures were: audible laughter, voiceless and voiced phonemes, and non-word vocalizations that were recognized as having the same meaning as a word (e.g., “m-hm” for ‘yes’ and “m-mm” for ‘no’). A phoneme is an individual speech sound that is produced distinctly from other speech sounds. Voiced phonemes, including consonant sounds (e.g., / b, d, v, z/) and vowels (e.g., “ih,” “a,” “oo,” “ow,” etc.), are produced with accompanying vibration of the vocal folds, while voiceless phonemes (e.g., / h, k, t, s, f, p, t/) are produced without accompanying vocalization.

The peer was trained via modeling and role play with the researcher until an accurate demonstration of the differential responses to verbalizations (or verbal approximations as outlined in shaping procedures) and mutism were observed. Procedures were reviewed verbally before each session and were provided in writing to the peer for reference during sessions. The researcher provided verbal reminders as needed during sessions if the peer demonstrated an error in implementing the designated response to Megan’s verbalization or mutism.

If Megan demonstrated a verbal approximation at the target level (as defined by each step in the shaping procedure), the peer provided generalized social attention by complimenting Megan for communicating, responding to the content of Megan’s approximation, and moving on to a new interaction in the context of the activity. If she demonstrated mutism, the peer withheld attention by turning her face away from Megan and remaining silent for approximately 30 seconds. If the session goal was met, Megan and her peer were allowed to select from a “prize
box” with a choice of small tangible and activity reinforcers at the end of the session. Because
the shaping procedures involved topographies that were approximations of the operational
definition of verbalizations, data were recorded for the proportion of verbal approximations as
well as the proportion of actual verbalizations that occurred.

**Procedural integrity.** Procedural integrity was calculated by scoring the peer’s correct
and incorrect implementation of the contingent attention procedure for Megan’s systemic
treatment. Procedural integrity data were collected for 46% of Megan’s intervention sessions,
and averaged 78% (range of 50% to 95%).

**Results and Discussion**

**Holly.** Figure 7 shows the results of Holly’s intervention sessions.
Figure 7. The percentage of interaction opportunities with verbalizations during systemic treatment conditions for Holly.
After the first intervention session, Holly’s physician began to decrease her dosage of Paxil and introduce Lexapro to her medication regime. This change was unrelated to Holly’s participation in the study. The dosage of Paxil was reduced by one quarter between the first and second intervention sessions and decreased to half of her typical dosage between the second and third intervention sessions. Between the fifth and sixth intervention sessions, the dosage of Paxil was decreased by another quarter and then discontinued. At this point, there was an approximately three week interruption in the schedule of intervention sessions, as Holly was ill and then on vacation out of state with her family. Sessions resumed upon her return.

Holly demonstrated verbalizations in an average of 2% of interaction opportunities during the nonlinear functional analysis conditions with Bill. In the initial intervention session with Bill, she demonstrated verbalizations in 100% of interaction opportunities. In 50% of those interactions, she responded the first time Bill asked a question (initial opportunities); in the remaining 50% of the interactions within the session, she responded when Bill repeated the original question (repeated opportunities). Sessions continued with Bill until verbalizations occurred consistently at a socially significant increased level, as compared to responding during the nonlinear functional analysis. In total, Holly demonstrated verbalizations in an average of 93% of interactions across all sessions with Bill, as compared to an average of 2% of interactions prior to the intervention.

Once Holly was demonstrating verbalizations consistently with Bill, intervention procedures were initiated with Susan to determine whether the results could be replicated with another communication partner. Verbalizations increased from an average of 0% of interactions during baseline, to an average of 93% of interactions across sessions with Susan. A decrease in verbalizations was observed in the third session with Susan. On that date, Holly arrived at
school just prior to the scheduled session, and transitioned into her classroom with the researcher. This was considerably out of her routine, as she typically transitioned into her classroom with her mother. Additionally, Holly’s mother had been out of town for five days, and had just returned that morning. Upon dropping Holly off at school, she reported to the researcher that Holly was ill with a cold. On the next session, verbalizations were again observed to occur at a frequency that was consistent with the first two treatment sessions. A total of four treatment sessions were completed with Susan; sessions with Susan were discontinued at the end of the regular school year, as Holly did not participate in Extended School Year services.

Following the intervention phase with Susan, treatment procedures were implemented with this researcher to again assess for replication of the results obtained with Bill and Susan. Because the procedures with Bill and Susan were conducted within Holly’s school setting and that setting was not accessible during the summer, a baseline session was conducted in Holly’s home prior to beginning intervention in that location. Holly demonstrated verbalizations in 0% of opportunities within the baseline session in her home, which was consistent with data from baseline sessions conducted in the school setting. After an initial intervention session with 0% verbalizations, verbalizations increased to an average of 84% of interaction opportunities during sessions with this researcher as Holly’s communication partner.

Overall, Holly’s verbalizations increased from an average of 1% of pre-treatment interactions to an average of 41% of initial interaction opportunities and an average of 90% of repeated interaction opportunities across all communication partners during intervention. She maintained verbalizations in 60% of initial and 100% of repeated opportunities during a planned maintenance check with this researcher at four weeks post-intervention.
A number of observations were made of Holly’s communication behavior during the intervention. One observation was the latency between the interaction opportunity and when she initiated any communicative response topography. In numerous instances, Holly responded with a conventional communicative gesture and/or a non-speech vocalization immediately following the communication partner’s interaction. Gestural responses included shaking and nodding her head and shrugging her shoulders, and she often used a vocalization that was consistent with the intonation of the phrase “I don’t know” (with her mouth closed) simultaneously while shrugging her shoulders. In many of these occurrences, verbalization occurred only after the delivery of the verbal prompt. Similarly, in instances when Holly failed to verbalize on the initial opportunity, she verbalized prior to the delivery of the verbal prompt upon repetition of the interaction.

Another observation of Holly’s general communicative behavior during intervention sessions was that both verbal and nonverbal initiations occurred significantly less frequently than communicative responses. Throughout all of the intervention sessions, Holly was observed to initiate a total of nine times, four of which were verbalizations, and five nonverbal interactions. She initiated verbalizations once with Bill, once with Susan and twice with this researcher. On one occasion during a session conducted in the school setting with Susan, Holly spontaneously initiated a verbal interaction with a peer who was seated approximately ten feet away laughing audibly, asking, “Alexis, what’s so funny?” The peer responded to Holly’s question and Holly discontinued the interaction. Of the two occurrences of initiating interactions with the researcher, both were gestural (pointing), to direct the researcher’s attention to an object in the environment.

A number of times, Holly’s verbalizations were uttered at a whispered volume. Although these responses were audible from a distance of five feet, as required by the operational
definition, there were times when communication partners spontaneously directed Holly to repeat her response at a louder volume. When this occurred, Holly repeated her response each time, with at least a slight increase in her vocal volume.

Another observation of Holly’s communicative behavior was that after a period of sessions with a communication partner, she began to respond with verbalizations prior to the delivery of the verbal prompt. Within the seventh treatment session with Bill, Holly demonstrated the first occurrence of responding with a verbalization prior to the delivery of the verbal prompt. This was observed to occur inconsistently on trials throughout the next two consecutive sessions. A similar pattern was observed during sessions with this researcher. Holly responded with a verbalization prior to the verbal prompt in the fifth intervention session, and did so with increasing frequency during the two subsequent sessions. She did not demonstrate the response to the stimulus in the absence of the verbal prompt with Susan; however, this may have been due to the limited number of sessions that were conducted with Susan prior to the school year ending.

A concurrent avoidance behavior that Holly was observed to demonstrate frequently during descriptive assessment and nonlinear functional analysis conditions was holding her arm next to her face to block her visual access to her communication partner. This behavior spontaneously decreased across intervention sessions. During the first treatment session with this researcher, Holly held a stuffed animal to her face, blocking her ability to see the researcher throughout the entire session. The behavior occurred intermittently throughout the next two sessions. No occurrences of the behavior were observed within the fourth and fifth treatment sessions. It was again seen at a low, intermittent frequency in the last two sessions. When the
researcher returned for the maintenance session, Holly blocked her ability to see the researcher consistently for the first several trials, and intermittently throughout the remainder of the session.

Motivation or interest in the subject matter of the interactions may have also influenced the frequency and content of Holly’s verbal responses. For example, in the initial intervention session with this researcher, Holly demonstrated verbalizations in 0% of interaction opportunities. At the end of the session, the video camera continued recording the interactions for the next several minutes, and the researcher continued to ask questions of Holly. Holly was observed to respond verbally, albeit with a whispered volume, to questions including “Do you want to hear about something silly that happened at my house this morning?” and “Do you want to know what happened?” as compared to a number of questions about her daily activities and items in the environment during the session. The content of Holly’s verbalizations also changed over the course of the intervention sessions, from primarily yes/no responses to more content-specific responses. For example, in an early session with this researcher, Holly responded “I don’t know” when asked which of two types of videos she preferred. Several sessions later, she responded to a similar question by stating one of the choices.

Finally, within the last several intervention sessions, Holly began to respond to verbal stimuli other than questions. Specifically, she responded to directive statements such as, “Tell me one thing that you did this morning,” cloze sentences such as, “Look at this, do you see these gray hairs right here? That means I’m getting kind of…,” and to verbal prompts such as, “If you wanted to know how old I was, how could you ask me?” Anecdotally, Holly’s mother reported that in the interim between the last intervention session and the maintenance session, Holly had responded with verbalizations upon the initial meeting with a new physician. She noted that
Holly had never verbalized with her pediatrician, who followed Holly from the ages of two through eighteen.

**Megan.** The results of Megan’s intervention sessions are shown in Figure 8. The data reported below reflect Megan’s performance in the first of the three planned intervention phases, prior to her attrition from the study.

*Figure 8.* The percentage of Megan’s interaction opportunities with verbalizations and verbal approximations during treatment.

In the first intervention session (Session 4 on graph), no verbal approximations or verbalizations occurred. During Session 5, Megan demonstrated audible vocalizations in the form of laughter in 100% of trials; however, there were no occurrences of verbal approximations or verbalizations. In Sessions 6 through 9, voiceless or voiced phonemes that were not
embedded in laughter occurred in 10%, 0%, 0%, and 0% of trials respectively. Megan continued to produce audible vocal laughter intermittently in response to interaction opportunities within these sessions.

An increasing trend was observed in Megan’s production of voiceless and voiced phonemes in the final two treatment sessions. At this point, she began to produce distinct speech sounds differentially from laughter. Specifically, Megan produced the consonants /k/ and /m/ in 50% of trials during Session 10. In the final session, she again produced /k/ and /m/ when it was her turn to respond during the game, as well as the voiceless consonant /f/ and a vowel, “eh.” Moreover, immediately following that session, Megan was observed to produce additional variations of vocal sounds and phonemes as she assumed the role of a dog within a spontaneous continuation of the game with the peer. During this period, she demonstrated the following approximations of verbalizations: barking like a dog, producing /h/ repeatedly as in imitating a dog panting; producing a prolonged and varied /m/ sound as in imitation of a dog whining, using the phone /er/ to indicate a question intonation, and producing the vowel sound “ih.”

Unfortunately, Megan discontinued as a participant in the study at this point, due to the school year ending and her family preparing to move out of state. Megan’s family did not respond to the researcher’s attempts to arrange for sessions to continue during the summer prior to the family’s move.

Despite the promising increasing trend observed in Megan’s vocal verbal behavior within the final two treatment sessions, the phenomenon of “bootleg” reinforcement (Cooper, Heron, & Heward, 2007, p. 233) likely had a significant impact on the effectiveness of the intervention procedures in this case. Megan and her peer had an extensive history of interacting nonverbally. This occurred frequently throughout the week, with Megan’s nonverbal communicative behavior
continuously reinforced as she engaged in play and social interactions with her peers. A casual response from Megan’s peer illustrates the extent to which Megan engaged in social interactions with her peer without the social expectation to verbalize. The researcher told Megan’s peer that Megan had selected an item prize from the prize box in the previous week. Megan’s peer responded to this information with, “Yeah, she told me she got crayons and colored pencils.” Presumably, the peer used the word “told” to indicate that Megan had shared this information via nonverbal means. With Megan’s schedule only allowing for treatment sessions once per week, her nonverbal communication was reinforced at a significantly greater frequency throughout the week than her verbal approximations were during treatment sessions.

**General Discussion**

For many individuals with SM, the behavior has a multifaceted history of development and reinforcement. Because of the complex nature of the behavior, it requires an empirical and objective identification of the variables associated with it in order to provide the most specific treatment possible for each individual. The present research addressed two questions, namely: 1) to what extent can contextual variables (e.g., people, social context, type of demand, negative reinforcement, positive reinforcement) affecting SM be identified using nonlinear functional analysis?; and 2) what are the effects of systemic treatment on the remediation of SM and maintenance of behavioral change when treatment is derived from a nonlinear functional analysis of the contextual variables?

The first question was answered through the use of both descriptive and experimental analyses. Selective mutism and verbalizations occurred differentially in the presence of specific antecedent and consequential variables for all participants in this study. Even Megan, who demonstrated mutism across all functional analysis conditions, exhibited differences in her
mutism across the specific conditions that were analyzed. Nonlinear functional analysis identified the unique variables that maintained this behavior for two participants, Holly and Megan. Despite the fact that Megan’s nonlinear functional analysis did not yield differential data across experimental conditions allowing for the identification of a functional relation to SM, the procedure did illuminate what happened when she failed to verbalize under particular conditions. For Amanda, mutism occurred slightly more often than verbalizations in only a single condition.

The question of the effects of systemic treatment on the remediation of SM and maintenance of behavior change was partially answered. Individualized, function-based treatment derived from the results of the nonlinear functional analysis minimized or eliminated the existing reinforcers for SM and allowed for the programmed reinforcement of verbalizations for Holly. Using reinforcement contingencies, the increase in verbalizations was established across three people with whom she demonstrated mutism as well as across two settings in which mutism occurred. Additionally, the behavior change maintained at four weeks following the final treatment session. For Megan, systemic treatment was developed from the results of her nonlinear functional analysis; however, a change in her verbal behavior was limited to approximations of verbalizations that were not observed prior to initiating treatment. Data for the final two sessions of Megan’s participation in the study showed an increasing trend in verbal approximations before she discontinued as a participant due to her family’s move out of state. The change in Megan’s verbal communication occurred in only one setting, as prior to the intervention being implemented in two additional settings, she discontinued as a participant in the study.
Nonlinear functional analysis and systemic treatment extended the body of work in the areas of assessment and treatment of SM in several ways. First, nonlinear functional analysis procedures allowed for the identification of variables that maintained the absence of verbalizations as well as the conditions under which verbalizations occurred. Subsequently, the data from Holly’s treatment suggested that analyzing the contingencies associated with the absence of speech was an important factor in determining an effective treatment program for her. The few studies that have included an analysis of an individual’s mutism prior to initiating treatment (Mace & West, 1986; Schill et al., 1996; Sheridan et al., 1995) measured participants’ verbalizations, allowing for differentiation in verbalization across the conditions. Although an analysis of speech rates yields valuable information about the variables associated with differential rates of verbalizations, analyzing the absence of verbalizations when presented with an interaction opportunity provides information regarding the variables specifically associated with mutism. Schill et al. (1996) identified this as a limitation to their study, stating that attention was not experimentally manipulated as a potential reinforcer for mutism although they hypothesized this function based on the results of a descriptive assessment. By analogy, Sir Arthur Conan Doyle’s famous detective Sherlock Holmes provided an example of the importance of analyzing what is not present in The Adventure of Silver Blaze (Doyle, 1894). It was in this story that Holmes drew attention to “the curious incident of the dog in the night-time” (Doyle, 1894, p. 347). In that case, Holmes pointed out that the dog’s failure to bark was the critical clue that allowed for the identification of the criminal. The fact that the dog did not bark suggested that the criminal was someone who was familiar to the dog. With this astute observation, Holmes highlighted the concept that without an analysis of what is not present in the process of evaluating what is present in a given situation, one may be overlooking the very clues
that are necessary to solve a problem. Likewise, an analysis of mutism in this study allowed for the identification of the stimulus conditions as well as the potential reinforcers maintaining the participants’ failure to speak. For Megan, this allowed for manipulation of attention as a reinforcer. When attention was withheld following occurrences of mutism and only given when she demonstrated verbal approximations, an increasing trend in verbal approximations was observed. Similarly, Holly’s verbalizations increased when escape from interactions was discontinued as a reinforcer for mutism.

Another way in which the present study extended the SM treatment literature was by measuring participants’ verbalizations in proportion to the opportunities for verbalization that were presented. Measuring the percent of interaction opportunities in which verbalization or mutism occurred was contrasted with previous studies that measured participants’ verbal behavior as a rate (i.e., number of words spoken per minute; Mace & West, 1986; Schill et al., 1996; Sheridan et al., 1995). Because the primary characteristic of SM is an individual’s failure to speak when speech is expected, a measurement was employed in the current study that allowed for an analysis of participants’ verbal behavior under the precise conditions when speech was expected. A measure of behavior per opportunity yields a percentage or relative proportion of times that a behavior occurs within a particular condition, thus providing a more direct measure of behavior under the conditions of interest.

For restricted operant behavior such as responding when presented with an interaction opportunity, the rate of stimulus presentation is also a factor that directly affects the rate of responding. Moreover, the particular content of the antecedent stimuli used in Mace and West’s (1986) functional analysis of SM may have evoked differential rates of verbalization. For example, in the first experimental analysis condition, the stimulus picture was presented and the
participant was instructed to tell the examiner about the picture. In the second condition, the participant was instructed to name all of the items in the picture that began with a specific letter (Mace & West, 1986). Here, the number of words produced by the participant per minute may have differed as a result of the stimulus demand versus “reluctant” or selective speech under the specific conditions. It is feasible, for example, that the participant could have used a single-word utterance to describe a picture presented in the first condition, although in the next condition he may have seen five objects that began with a particular sound, which he was expected to name. As a result, the measurement was not standardized across conditions. With SM, whether or not an individual verbalizes may be a more appropriate question than the amount of verbalization that occurs.

Including an experimental manipulation of variables within Goldiamond’s (1984) descriptive nonlinear functional analysis procedures expanded his previous work in this area. Goldiamond used descriptive assessment methods to develop hypotheses upon which treatment was based. The current study verified hypothesized behavioral functions by combining nonlinear functional analysis with experimental analysis procedures. Adding experimental procedures to Goldiamond’s nonlinear functional analysis framework allowed for the verification of the functions of SM and verbalizations prior to treatment.

Another contribution of the current study was that nonlinear functional analysis allowed for a broader analysis of several possible combinations of variables than a linear analysis of behavior. The use of nonlinear functional analysis considered and systematically manipulated a number of specific combinations of antecedent and consequence variables to measure the effect of the combined variables on participants’ verbalizations and mutism. This methodological variation was contrasted with the traditional approach to functional analysis and treatment, which
typically pairs a single antecedent stimulus with a prescribed consequence to identify a condition under which a behavior of interest is most likely to occur. For example, in a standard functional analysis, the escape condition commonly involves the presentation of a task demand, with the demand removed contingent on an occurrence of the target behavior (Iwata, et al., 1982/1994). Such a linear model may fail to account for the effects of specific combinations of variables on the behavior. The utility of experimentally analyzing combinations of variables has been demonstrated in previous studies that included functional analyses of mutism (Mace & West, 1986; Schill et al., 1996; Sheridan, et al., 1995), but was not accounted for in other studies that assessed SM prior to treatment (e.g., Fisak, et al., 2006; Jackson, et al., 2005; Jacob, et al., 2013; Kern et al., 2007; Labbe & Williamson, 1984; Porjes, 1992; Shriver, et al., 2011). The results of Holly’s nonlinear functional analysis corroborated previous findings (Mace & West, 1986; Schill et al., 1996; Sheridan, et al., 1995) that particular combinations of variables may differentially effect an individual’s communication. For Holly, the proportion of interaction opportunities in which mutism was observed was greater with her mother in the school setting as compared to with her mother in their home, when all other variables were held constant. This difference may not have been discovered without analyzing the effects of combined variables on Holly’s communication behavior.

Finally, the present study extended the current body of literature by including a sequence analysis of each interaction within the functional analysis procedures. This level of analysis allowed for the differentiation of a specific consequence to mutism that increased the future likelihood of verbalizations. Focusing only on the session data without analyzing communication partners’ responses to occurrences of mutism and the effect on subsequent interactions would have prevented the identification of escape extinction as an effective
procedure to increase Holly’s verbalizations. As demonstrated by her mother within their naturally occurring interactions, maintaining the expectation to speak by repeating an interaction frequently resulted in Holly verbalizing within the subsequent interaction. When replicated in a treatment protocol, this critical observation led to an increase in verbalizations across three communication partners.

**Unexpected Results**

Besides the positive outcomes of the current study, some unexpected results emerged that warrant discussion. First, the numerous topographical variations of mutism that were observed both within and across participants were not expected. For Megan, mutism ranged from the complete absence of any observable communicative response under certain conditions to elaborate and animated gestural communication under others. Amanda demonstrated little behavior that qualified as mutism although she exhibited lengthy but irrelevant verbal utterances in several conditions. Holly frequently used non-word vocalizations (e.g., “m-hm,” “m-mm”) in lieu of words. Despite these differences, all of the participants were diagnosed with SM prior to their enrollment in the study. The way in which communication partners responded to these nonverbal communicative behaviors was the critical factor in determining function-based treatments for Holly and Megan. A diagnosis of SM is based on structural versus functional criteria and indicates the presence of a problem, but offers little to no guidance toward understanding how to treat it. A behavioral analysis of SM offered a beneficial approach for assessing and treating the disorder.

Another unexpected result was that as an increase was observed in Holly’s verbalizations, qualitative aspects of her verbalizations changed without apparent direct reinforcement. For example, the behavior of visually blocking her face when others spoke to her decreased over
treatment sessions with this researcher. This behavior was not addressed as a qualitative component of her verbalizations, and generalized social attention was provided whether verbalizations occurred with or without this accompanying behavior. Other qualitative improvements were also observed in Holly’s verbalizations over time, specifically the content of her verbalizations and her vocal volume. These socially significant aspects of verbalization were not addressed through differential contingencies; however, her verbalizations changed from primarily whispered ‘yes/no’ responses within the initial treatment sessions to content-specific voiced responses in later sessions. Such topographical variations and concomitant behaviors are likely members of the same response classes as their related behaviors (e.g., visual blocking may be functionally equivalent to mutism); therefore, it is probable that the same variables functioned as reinforcers for these behaviors as for mutism and verbalizations.

**Limitations**

It is important to acknowledge several limitations of the present study. One limitation was that despite an initial descriptive functional assessment and several individualized experimental conditions, it was not feasible to predict all of the possible variables that may have contributed to each participant’s mutism. Because of this, some variables were excluded from the nonlinear functional analysis, and therefore were not able to be identified or manipulated as part of systemic treatment. This was exemplified in Megan’s nonlinear functional analysis and treatment results. Despite having identified several possible antecedents and consequences that were likely associated with mutism, Megan’s functional analysis results were undifferentiated. One example of a possible variable that was not tested was generalized social attention in the form of others talking about her failure to speak, either by talking directly to Megan or to another person about it. This variation may have offered Megan a unique form of attention within
multiple social contexts, as she was quite aware that others were concerned about this behavior and were actively working with her to change it.

Additionally, it is possible that the procedure to analyze the effect of escape from academic and social demands used in the present study was neither long enough nor functional as a negative reinforcer for mutism. The procedures provided 10 seconds of escape from interacting and a discontinuation of the specific interaction that evoked mutism. After ten seconds, the communication partner was instructed to present a new interaction opportunity that was unrelated to the previous interaction. In natural settings, mutism may result in a communication partner ceasing all further interactions with the individual, as compared to the temporary escape from interaction provided in this study. Observations of this study’s participants within naturally occurring conditions suggested that the temporary escape procedure was consistent with the way in which others responded to their mutism; however, this procedure did not assess complete termination of interactions as a negative reinforcer for mutism.

Another limitation of the study was the challenge imposed by conducting experimental analysis and prescribed intervention procedures within natural settings. For example, it was not possible to control for the presence of other people within the classroom environment of the school setting, where mutism occurs most often for many individuals. For Holly, although the occasional presence of others in the classroom did not appear to have an effect on her communication, the results of her nonlinear functional analysis indicated that interactions with specific people were associated with differential communicative behavior. In a naturalistic setting such as the classroom, it can be difficult to prevent others from spontaneously interacting with an individual for whom a prescribed set of procedures is in progress. Relatedly, while it may be possible to control for the delivery or withholding of reinforcement during prescribed
procedures, it is not possible to control for the extraneous reinforcement conditions that may be in effect for SM in situations outside of the controlled assessment and treatment procedures. As a result, the problem of bootleg reinforcement (Cooper et al., 2007) may have unpredictably influenced the rate and magnitude of behavior change for Holly and Megan.

The lack of a control condition in Megan’s nonlinear functional analysis was another procedural constraint. Including at least one condition in which verbalizations were likely to occur may have provided additional clues to understanding the conditions that maintained her failure to speak. It is possible that not enough conditions were run to allow for a clear differentiation of the behavior across conditions. The difference between Holly’s and Megan’s functional analysis results and subsequent treatment outcomes suggested that a more precise verification of the variables associated with SM may have contributed to more rapid progress during treatment for Holly. Differences were also noted in the number of sessions in which behavior change was observed for these two participants. For Holly, an increase in verbalizations was observed within the first session of the intervention, while a change in Megan’s verbal approximations was not observed until the seventh treatment session. The controlling variables were more clearly identified for Holly, suggesting that verification of the controlling variables led to more robust treatment outcomes.

Finally, there were limitations to the study’s external validity due to the limited number of participants who completed the treatment phase. All four participants engaged in the nonlinear functional analysis procedures; however, due to procedural constraints, treatment was only able to be implemented with Holly and Megan, and only Holly completed a full course of intervention including establishing a change in verbalizations across three situations. Because Holly was the only participant to complete all of the components including assessment, analysis,
Analysis and Treatment of Selective Mutism 100

and treatment across conditions, it is not known if the results that were seen with her are
generalizable to other individuals with SM. It will be important to evaluate the study’s external
validity through future replications of the full procedures.

**Future Research**

Beyond the need to assess external validity through more applications of the study’s
procedures, the current study brought to light several additional opportunities for future research
in the area of assessing and treating SM. One of the most important considerations for future
analyses of SM is to include criteria based on naturalistic observations within the definition of
interaction opportunities. The challenge of determining when an interaction opportunity occurs
in the context of measuring verbal behavior is not a new one (Drash & Tudor, 1991; Shriver, et
al., 2011). Therefore, the difficulty of measuring verbal behavior in a standardized manner has
been cited as a possible reason for the limited number of studies targeting the functional analysis
of verbal behavior in behavior analytic literature (Drash & Tudor, 1991). The definition of an
interaction opportunity in the current study was based on a definition used in previous research
(Halle et al., 1981) that targeted increasing individuals’ verbal communication. Other
researchers have attempted to provide consistent procedures for counting verbal behavior by
defining frequency of response as the basic unit of measurement and recording data in terms of
probability and rate of responding (Drash & Tudor, 1991). Several instances were observed in
the present study, however, in which such a standardized definition did not account for
idiosyncratic variations of individuals’ interactions with the participants. For example, while it
was generally clear that a response was expected when someone asked a question to a
participant, it was not clear whether a response was expected when a communication partner
initiated an interaction by making a comment. Moreover, the current study relied on a definition
from previous research to outline the conditions under which participants could be expected to initiate an interaction; however, other stimuli were observed during the sessions that could have aided observers in reliably measuring participants’ initiations in the cases presented in this study. For example, a person entering the room presented an opportunity for participants to initiate a greeting, regardless of whether or not the person was making eye contact or was within three feet of the participant upon entering the room. Future definitions of interaction opportunities should be based on establishing operations as well as stimuli observed within natural social interactions for the individuals involved. Establishing operations such as deprivation of attention or information in addition to antecedent stimuli such as proximity and nonverbal behavior of potential communication partners should be included in prospective definitions of interaction opportunities. Furthermore, including a specified amount of “wait” time in future definitions could eliminate ambiguity in identifying whether (or when) a response is expected from a participant.

Another opportunity for future research in assessment and treatment of SM is to evaluate the quality of participants’ verbalizations in addition to analyzing the relative frequency of the behavior. This could be accomplished by including individual qualitative criteria in the definition of verbalizations in future studies. Examples of such qualitative criteria include the length of an individual’s utterances, the latency of responding, and vocal volume. Other individualizations may be defined based on factors such as age, gender, and cultural norms. Improving such socially significant characteristics as vocal volume, length or complexity of utterances, and accompanying social behaviors such as eye contact and physical orientation toward communication partner may contribute to further communicative competence in the remediation of SM.
Finally, specific procedures should be included in nonlinear functional analysis to identify structural variations of antecedent stimuli that may be contributing to instances of mutism for an individual. For example, when analyzing an individual’s response to academic stimuli, materials could be restricted to those that the individual has already demonstrated mastery of in other contexts (e.g., class, assessment, etc.). This would assist with distinguishing whether the individual is not responding because he or she does not “know” the answer, or because of a more global pattern of non-responding associated with SM. Another example of a structural antecedent analysis would be to determine whether there is a difference in an individual’s responses to specific types of social interactions such as open-ended versus closed-ended questions, factual versus personal questions, etc. Just as Mace & West (1986) evaluated participants’ responses to easy versus hard instructional demands, such variations exist in the context of social interactions that may yield additional clues as to the variables controlling an individual’s verbalizations and mutism.

**Conclusion**

The fundamental principles of behavior and empirically-validated technologies of applied behavior analysis have contributed to considerable improvements in a number of socially significant behaviors from severe self-injury and aggression (Iwata et al., 1982/1994) to phobias and depression (Goldiamond, 1984). Behavior analytic interventions have also successfully extinguished SM and contributed to improved verbal communication for a number of individuals since practitioners began applying the principles of stimulus control, reinforcement, extinction, and punishment to this behavior. The present study extended the body of literature and supported nonlinear functional analysis and systemic treatment as efficacious behavior analytic procedures for analyzing and treating selective mutism.
References


Appendix A

Consent for Participation in Research

June 5, 2011

Your child has been referred for possible involvement in the research study “Nonlinear Analysis and Systemic Treatment of Selective Mutism,” conducted by Nicole E. Boivin, M.S., CCC-SLP, BCBA. The researcher is conducting this study as a part of the requirements for the doctoral degree at Simmons College in Boston, Massachusetts. The purpose of the study is to examine how a procedure (“nonlinear functional analysis”) may be used to identify situations that are connected to your child’s diagnosis of Selective Mutism (SM). Additionally, this information will be used to develop a treatment plan for your child, based on his or her symptoms and characteristics.

Procedures

The research will involve three phases, to be conducted over a period of approximately three to four months. The first is an assessment that involves interviews with you, your child, and others such as teachers and family members who interact with your child. Observations of your child will also be conducted during this part of the process. The second phase involves setting up specific situations to find out how they may be affecting your child’s SM. This includes arranging particular people, activities, and ways that people respond when your child is mute and when he or she talks. This is done to find out when SM is most likely to occur and when speaking is most likely to occur. The last phase will be to put into action a treatment plan for your child that is designed to reduce SM, increase speaking, and keep up these changes in behavior. The research will be done in everyday activities and places for your child, including school, church, home, or other common places.

Data will be collected about your child’s SM and speaking behaviors in all phases of the study. Specifically, information about how often your child talks or does not talk, how others interact with your child and how often, and how others respond when your child talks/does not talk will be recorded. Other information such as who your child does/does not speak with and what types of activities are taking place during those times will also be recorded. This information will be used to find out if there are any situations when it is more or less likely that your child will talk, and to measure whether your child is making progress with the treatment. The data will be made up of observation notes as well as measurements showing the number of times that your child talks/does not talk compared to the number of times that others interact with him/her. Your permission is also requested to share the data, if it represents outcomes that would be important to people who work with children with SM.

Data will also be collected about the reliability of the information that is gathered about your child’s mutism and verbal communication. This form of data, called Interobserver Agreement (IOA), will involve video taping some or all of the assessment and treatment sessions with your child. At least 30% of the video taped sessions will be viewed by an additional trained observer who will work with the researcher for this purpose. The trained observer’s main role will be to review video, therefore he or she will have little to no contact with your child. Video data will be stored on a password-protected, secure laptop computer and will be kept confidential at all
times. The video will only be used for the purpose of data collection; it will not be used for such activities as instruction or presentations. No one besides the investigator and the video reviewer will view the video.

*Risks*
No physical danger is anticipated with this study. It is possible that during this study, your child may be put in some situations that are currently causing him/her to feel nervous or anxious. For example, if your child feels nervous or shy around people who he or she does not know, he/she may be asked to be in a situation where an unknown person will speak to him/her. Another possibility is that no change will occur with your child’s SM as a result of the treatment. Finally, time that your child spends participating in this study will not be able to be made up, even if no changes happen with his or her SM.

*Protection Against Risks*
All phases of the study will take place in everyday activities and places where your child’s SM is likely to occur. Your child will not be in situations that are different than common daily activities that are currently causing him or her to feel nervous or anxious. The researcher will work with you and/or your child at least one time each week. Also, the researcher will ask for your/your child’s permission (separate from permission to participate in the research) to share information with other people such as teachers or doctors who are working with your child so that your child’s emotional and physical well-being can be monitored during the study. If you or your child wants to stop participating in the study at any time, the researcher will give you/your child information about how to contact other appropriate professionals (i.e., psychologist, speech-language pathologist, etc.) for continued treatment at your request.

*Benefits*
The main expected benefit of participating in the research is a possible improvement in your child’s SM symptoms. The goals of the study are: 1) to identify why your child is demonstrating SM, 2) to reduce the possibility of mutism continuing, and 3) to increase the possibility of your child speaking in many different situations.

*Privacy and Confidentiality*
Several safety measures shall be taken to protect your/your child’s privacy and the confidentiality of the records and data pertaining to your child and his/her participation in the research. All data will be kept confidential at all times. Your child’s name and any identifying information will be changed to hide his/her identity, and data will be kept under the changed information.

*Duration of Consent*
Your permission is entirely voluntary, and may be withdrawn at any time. This permission form is valid for up to one year after its approval. A copy of this form will be given to you. If you do not give permission or later choose to withdraw it, it is with the promise that there will be no consequence to you or your child.

If you have any questions, please contact Nicole E. Boivin at (207) 608-9518 or Simmons College Institutional Review Board at (617) 521-2415. The IRB office oversees the process for
protecting individuals who are the subjects of any research conducted by people who are associated with Simmons College.

Consent for Participation in Research

By signing below, I certify that the research study “Nonlinear Analysis and Systemic Treatment of Selective Mutism” has been fully explained to me that I understand its contents. I understand the possible benefits and risks, and I acknowledge that no guarantee has been made regarding the results of this research. I appreciate that within the scope of this research there is no intent to cause harmful side effects to my child. I recognize that I may withdraw my consent at any time without penalty. I hereby provide my consent for my child to participate in this research.

Printed Name of Parent/Guardian: ___________________________________________

Signature of Parent/Guardian: _______________________________________________

Date: ___________________________________________________________________

Printed Name of Researcher: _______________________________________________

Signature of Researcher: ___________________________________________________

Date: ___________________________________________________________________

Assent for Participation in Research

I am doing a study to find out why some children do not talk and how I can help them with this problem. I would like to work with you to learn more about some reasons that may be making it hard or easy for you to talk in places like school, church, restaurants, and home. Some reasons might be who is around, what you are doing, or what people do when you do not talk.

If you agree to be in the study, you will not be asked to do anything that could hurt you. Sometimes, you may be asked to talk, which might make you feel uncomfortable. You can ask questions about the study at any time.

Your parent knows that I have asked you to be in this study. You can decide if you would like to be in the study or not. If you decide you would not like to be in the study, no one will be upset. If you decide that you would like to be in the study but then later you change your mind, you can decide to stop at any time.

If you sign this paper, it means that you want to be in the study and that you know what the study is about. If you do not want to be in this study, do not sign this paper.

Your printed name: _______________________________________________________

Your signature: __________________________________________________________
Date: __________________________________________________________________________

*If you want to be in this study but do not want to write your name, you can put an “X” in box below. Putting an “X” in the box means that you want to be in this study but do not want to write your name. The researcher, Nicole Boivin, will sign under the box to show that you checked the box yourself, but did not want to sign your name.

I [ ] want to be in this study.

Witnessed by Researcher on (date): ________________________________________________

Signature of Parent/Guardian: ____________________________________________________

Printed Name of Researcher: _____________________________________________________

Signature of Researcher: _________________________________________________________

Date: _________________________________________________________________________
### Appendix B

Sample Session Transcript

Participants: Holly  
Date: 7/18/13  
Session: Treatment, phase 3 (Nicole)

<table>
<thead>
<tr>
<th>Interaction Opportunity (trial #)</th>
<th>Antecedent</th>
<th>Behavior (Holly)</th>
<th>Consequence</th>
</tr>
</thead>
</table>
| 1 | Nicole: “Hey, I see something written on here” (points to MagnaDoodle on desk). “What is it?”  
Verbal prompt: “Use words to tell me.” | Verbalization: “Pool.” | Nicole responds with generalized social attention: “It says ‘pool’! That is awesome.” |
| 2 | Nicole: “Did you go in the pool today?” | Verbalization: “Yes”  
[Holly responded before delivery of verbal prompt] | Nicole responds with generalized social attention: “You did? Wow, nice! It’s a gorgeous day out there.” |
| 3 | [Holly stands up and looks at Nicole’s data sheet.] Nicole: “Would you like to see what I’m writing?”  
Verbal prompt: “Use words to tell me.” | Verbalization: “Yeah.” | Nicole responds with generalized social attention: “Yes! Holly, this is awesome. I’m glad that you want to know. I am writing down some of the questions that I’ve been asking you so that I can remember what things that I have asked you so I don’t bore you too much and ask you the same things all the time. And also so I know what things you like to talk about.” |
| 4 | Nicole: “So how’s your day going today?” | Verbalization: “Good.”  
[Holly responded before delivery of verbal] | Nicole responds with generalized social attention: “Good? Oh man, that’s awesome, I’m so glad to hear it!” |
<table>
<thead>
<tr>
<th>5</th>
<th>Nicole: “Tell me one thing that you’ve done today.”</th>
<th>Verbalization: “Pool.” [Holly responded before delivery of verbal prompt]</th>
<th>Nicole responds with generalized social attention: “You’ve gone in the pool. In fact, you just told me that, right, because I asked you did you go in the pool. That is awesome.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Nicole: “You know, Holly, something I was thinking about on my way here—I know that you like numbers and I know that you like to know how old people are sometimes. Do you know how old I am?”</td>
<td>Verbalization: “No” [Holly responded before delivery of verbal prompt]</td>
<td>Nicole responds with generalized social attention: “No, you don’t?” [rhetorical question; Nicole does not wait for a response]</td>
</tr>
<tr>
<td>7</td>
<td>Nicole: “Well, Holly, do you want to know?”</td>
<td>Verbalization: “Yeah” [Holly responded before delivery of verbal prompt]</td>
<td>Nicole responds with generalized social attention: “Yes!”</td>
</tr>
<tr>
<td>8</td>
<td>Nicole: “So, if you wanted to know how old I was, how could you ask me?”</td>
<td>Mutism</td>
<td>Nicole repeats interaction opportunity</td>
</tr>
<tr>
<td></td>
<td>Verbal prompt: “Use words to ask me.” “If you wanted to know how old I was—“</td>
<td>Verbalization: “How old are you?”</td>
<td>Nicole response with generalized social attention: “Great job!! Holly, get ready! I’m 38!”</td>
</tr>
<tr>
<td>9</td>
<td>Nicole: “Do you think that’s old or young?”</td>
<td>Verbalization: “I don’t know.”</td>
<td>Nicole response with generalized social attention: “You don’t know if 38 is old or young? Well Holly, ah, it’s kinda old.”</td>
</tr>
<tr>
<td>10</td>
<td>Nicole: “Look at this, do you see these gray hairs right here? (pause) That</td>
<td>Mutism</td>
<td>Nicole repeats interaction opportunity</td>
</tr>
</tbody>
</table>
means I’m getting kind of…(pause)…what?"
Verbal prompt: “Use words to tell me.”

<table>
<thead>
<tr>
<th>“I’m getting kind of…”</th>
<th>Mutism</th>
<th>Nicole repeats interaction opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal prompt: “Use words to tell me.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“You can say it, I won’t be mad. I won’t be offended. I’m getting kind of…(pause) You can say ‘old’.”

<table>
<thead>
<tr>
<th>“I’m getting kind of…”</th>
<th>Mutism</th>
<th>Nicole repeats interaction opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal prompt: “Use words to tell me.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Verbalization: “Young.”
Nicole response with generalized social attention: “Young!? Oh Holly!! Can I give you a big hug?”
[end of session]
Appendix C

Selective Mutism Questionnaire

<table>
<thead>
<tr>
<th>Name of Child:</th>
<th>Completed by:</th>
<th>Date:</th>
</tr>
</thead>
</table>

**Selective Mutism Questionnaire** *(SMQ)*
(to be filled out by parents)

Please consider your child’s behavior and activities of the past month and rate how frequently each statement is true for your child.

### AT SCHOOL

<table>
<thead>
<tr>
<th>Statement</th>
<th>Always</th>
<th>Often</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When appropriate, my child talks to most peers at school.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. When appropriate, my child talks to selected peers (his/her friends) at school.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. When called on by his or her teacher, my child answers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. When appropriate, my child asks his or her teacher questions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. When appropriate, my child speaks to most teachers or staff at school.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. When appropriate, my child speaks in groups or in front of the class.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How much does not talking interfere with school for your child? (please circle)

- Not at all
- Slightly
- Moderately
- Extremely

### WITH FAMILY

<table>
<thead>
<tr>
<th>Statement</th>
<th>Always</th>
<th>Often</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. While at home, my child speaks comfortably with the other family members who live there.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. When appropriate, my child talks to family members while in unfamiliar places.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. When appropriate, my child talks to family members that don’t live with him/her (e.g. grandparent, cousin).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. When appropriate, my child talks on the phone to his/her parents and siblings.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. When appropriate, my child speaks with family friends.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. My child speaks to at least one babysitter.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How much does not talking interfere with family relationships? (please circle)

- Not at all
- Slightly
- Moderately
- Extremely

### IN SOCIAL SITUATIONS (OUTSIDE OF SCHOOL)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Always</th>
<th>Often</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. When appropriate, my child speaks with other children who s/he doesn’t know.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. When appropriate, my child speaks with family friends who s/he doesn’t know.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. When appropriate, my child speaks with his or her doctor and/or dentist.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. When appropriate, my child speaks to store clerks and/or waiters.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. When appropriate, my child talks when in clubs, teams or organized activities outside of school.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How much does not talking interfere in social situations for your child? (please circle)

- Not at all
- Slightly
- Moderately
- Extremely

*SMQ under development; use with permission of author, Lindsay Bergman, Ph.D.; bergman@ucla.edu*