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Is Selective Mutism An Emotion Regulation Strategy For Children With Social Phobia? A Single Case Design Investigation

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IS SELECTIVE MUTISM AN EMOTION REGULATION STRATEGY FOR CHILDREN WITH SOCIAL PHOBIA?
A SINGLE CASE DESIGN INVESTIGATION

by

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ABSTRACT

To determine whether children with selective mutism (SM) withhold speech to regulate their emotional arousal and decrease automatic distress, the current study examines the behavioral and physiological responses of children with SM in comparison to children with social phobia (SP) and children with no psychiatric disorder (TD) as they participate in two social situations. A single case design strategy is used to compare behavioral and physiological responses both within and across groups. Examining the temporal sequencing of behaviors and physiology provides a direct test of the utility of emotion regulation theory as it pertains to children with social phobia/selective mutism. The results indicate that children with SM show elevated arousal and emotional reactivity across all interaction segments relative to other children. Unique affective, behavioral and physiological responses occur between and within groups in relation to situational demands. The temporal sequencing of behavioral and physiological responses suggests that behavioral deficits may be related to underutilized and/or deficient physiological response systems and that not speaking represents a primitive avoidance strategy by children with SM to regulate extreme physiological arousal.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Selective Mutism (SM) is characterized by the refusal or withholding of speech in situations in which speech is expected (e.g., school), despite speaking in other situations (DSM-IV-TR: American Psychiatric Association [APA], 2000). Currently included in the "Other Disorders of Childhood and Adolescence" category, there is continued speculation regarding its correct classification and the marked overlap in symptoms between SM and other anxiety disorders, particularly Social Phobia (SP). Despite increased research examining its etiology and clinical presentation, our understanding of this vexing disorder remains unclear. For example, assumptions about the factors (e.g., heightened emotional arousal, inhibited temperament style, oppositionality) that underlie this behavior (inability/ refusal to speak) remain speculative and in many instances, etiological explanations are based upon parental assumptions and rater biases (e.g., subjective parent and teacher ratings, clinician and observer biases, fallacies related to self-report measures) about the underlying core fear (i.e., anxiety). To date, there are few objective data that actually examine emotional arousal or attempt to conceptualize this behavior in terms of modern psychological theory such as emotion regulation strategies. Thus, an accurate conceptualization of SM requires more objective research grounded in contemporary theory.

Selective Mutism: A Brief Overview

Historically, SM was first described by Kussmal in 1877 and termed A*phasia Voluntaria*. In 1934, this disorder was renamed *Elective Mutism*, suggesting the presence of defiance (i.e., children were described as *electing* not to speak). A greater emphasis on social context led to the current conceptualization and clinical term Selective Mutism, which has been used since the publication of the DSM-IV (1994). Currently, SM is defined as “the persistent failure to speak in specific social situations (e.g., school, with playmates) when speaking is expected, despite speaking in other situations” (APA 1994, 2000). Children with SM may speak only at home in front of immediate family members or may speak in front of family and peers and remain mute in front of more specific individuals, most often teachers. It is important to note that, although children with SM may vary with respect to whom they speak, all of these children are capable of speaking in an age-appropriate manner (Black & Uhde, 1995; Steinhauzen & Juzi, 1996). In addition, to be diagnosed with SM, the failure to speak must have been present for at least one month and not better accounted for by a communication disorder, pervasive developmental disorder, or psychotic disorder. Because some apprehension is typical for young children, particularly in new situations and when meeting new people, SM cannot be diagnosed during the first month of school. Lastly, failure to speak must result in social and academic impairment (APA, 2000).

SM is a rare but serious childhood disorder with prevalence ranging between .47 to .76% in the general population (Viana, Beidel, & Rabian, 2009). SM is often characterized by a variable course with some children continuing to experience symptoms and associated deficits in functioning for many years. This may be particularly true for those children who go unidentified and/or misdiagnosed (Schwartz, Freedy, & Sheridan, 2006). In fact, although the onset of SM usually occurs before age 5, children with this disorder often are not identified until they enter formal schooling (Viana et al., 2009). Even then, they may continue to be overlooked. There are at least two possible reasons for this oversight: (a) these children speak at home and (b) do not get in trouble at school. Thus, parents may be unaware that a problem exists, and teachers may overlook these children as they do not exhibit overt behavior problems (Standart & Couteur, 2003; Viana et al., 2009). In fact, these children may not even appear distressed, particularly if they successfully avoid situations that may cause distress (e.g., speaking in class).

Despite under-recognition, features associated with SM may interfere with functioning across many domains, particularly social and academic settings (APA, 2000). For example, children with SM may avoid social situations and interactions, which may interfere with their ability to form and maintain peer relationships. It is not uncommon for children with SM to be teased by peers and eventually ignored. In turn, as a result of fewer social interactions, these children may miss out on positive experiences necessary for typical social development (Cline & Baldwin, 1994). In addition, as the majority of these children do not speak at school or ask teachers questions, this behavior could interfere with learning and academic functioning. Over time, these difficulties may be compounded, resulting in lower self-esteem, substance abuse, and additional psychopathology, often depression (Woodward & Fergusson, 2001). Thus, the repercussions of SM may be extensive, and more severe than currently considered.

Social Phobia: A Brief Overview

Social phobia (SP), also known as social anxiety disorder, refers to the marked and persistent fear of social or performance situations in which embarrassment might occur (APA, 2000). For children, this fear must occur with peers, not just adults, and the child must be capable of having age-appropriate social relationships. Upon exposure to perceived anxiety-provoking social and performance situations, anxiety almost always occurs and may present in a variety of behavioral, cognitive, and physical responses (Cisler, Olatunji, Feldner, & Forsyth, 2010). For example, for children and adolescents, fear and anxiety may be expressed by somatic symptoms (e.g., sweating, stomachaches, muscle tension), freezing or shrinking from contact, and/or crying, tantrums, and behavior problems. Children may also be unaware that their fears are unreasonable. Because social worries and even some avoidance of new social situations are not uncommon for children and adolescents, anxiety symptoms must have been present for at least 6 months before a formal diagnosis can be made. Lastly, SP can be generalized (i.e., the child's fears are related to most social and performance situations) or more specific (i.e., the child's fears related to specific social and or performance situations). Those with generalized SP experience greater social deficits and impairment in functioning (APA, 2000; Southam-Gerow & Chorpita, 2007).

SP typically emerges in early adolescence (i.e., 11-12 years; Beidel, Morris, & Turner, 2004; Beidel & Turner, 2005; Southam-Gerow & Chorpita, 2007; Velting & Albano, 2001). Earlier onset (as young as 8; Beidel, Turner & Morris, 1999), however, does occur and often suggests a more chronic and impairing course. Prevalence in youth ranges from .5 to 2.8% (Beidel & Turner, 2005), with lifetime prevalence ranging from 3% to 13% (APA, 2000). Prevalence increases with age and is slightly higher for females. The majority of children (92%) meet criteria for the generalized subtype (Beidel et al., 2004). Although SP typically persists into and throughout adulthood, symptoms and severity of impairment may wax and wane in relation to new experiences and stressful life events (APA, 2000).

As previously suggested, social anxiety and related symptoms often result in avoidance of fear-provoking social and performance situations. It is important to note, however, that for children, avoidance may not always be possible. For example, while adults may avoid feared social situations such as going to work, children are not always able to avoid similar situations such as going to school and being called on in class. Thus, children with SP often endure social and performance situations with marked distress and/or attempt to avoid feared situations in other ways (e.g., going to the nurse to get out of class, isolating oneself during a social event).

For many years, children with SM have been described as experiencing anxiety symptoms (e.g., shyness, fearfulness) that are similar to those exhibited by children with SP (e.g., Brown & Lloyd, 1975). In fact, research and clinical practice suggest that almost all children with SM also meet diagnostic criteria for SP (Beidel & Turner, 2005). In contrast, however, only a very small percentage of children with SP are selectively mute. In considering the overlap in symptoms demonstrated by children with SP and SM, two questions arise: does lack of speech demonstrated by children with SM reflect an avoidance behavior utilized by some children with social phobia, and if so, does this avoidance pattern serve the same arousal reducing function as other "classic" behavioral avoidance strategies?

Toward a new understanding of SM

Although currently classified under "Other Disorders of Childhood and Adolescence" in the DSM-IV-TR, SM has long been regarded as a disorder characterized primarily by anxiety. Evidence supporting this notion reflects the extensive overlap among symptoms of SM and other anxiety disorders, most notably SP (e.g., shyness, social isolation, withdrawal, and fear of social embarrassment (Dow, Sonies, Scheib, Moss, & Leonard, 1995). In addition, children with SM often have high rates of comorbid anxiety disorders such as specific phobias (Manassis, Fung, Tannock, Sloman, Fiksenbaum, & McInnes, 2003), separation anxiety disorder (Kristensen, 2000), and/or SP (Anstendig, 1999; Kristensen, 2000). In fact, in many studies, children meeting criteria for SM almost always meet criteria for SP as well (Beidel & Turner, 2005; Black & Uhde, 1992/1995; Dummit, Klein, Tancer, Asche, Martin, & Fairbanks, 1997). Further, children with SM often respond positively to treatments utilized with children with SP (i.e., CBT and BT; Viana et al., 2009; pharmacological treatment; Carlson, Kratochwill, & Johnson, 1999). Thus, it has been suggested that SM may better reflect a behavioral variant of SP rather than a distinct disorder. If this is the case, then why do only some children with SP refuse to speak in social settings? One proposed hypothesis is that SM may occur as a result of extreme anxiety, suggesting that children with social fears experience a continuum of anxiety and that SM reflects an extreme behavioral variant of SP (Black & Uhde, 1992/1995).

This hypothesis has been the subject of recent research, but the results often yield conflicting data that may reflect methodological biases in subjective ratings of anxiety. When directly compared to children with SP, children with SM are perceived as experiencing greater anxiety by parents, teachers, clinicians, and blinded raters. From this, it has been suggested that SM may better reflect a behavioral variant of SP rather than a distinct disorder; non-speaking behavior represents an extreme reaction to greater levels of anxiety (Black & Uhde, 1992/1995). However, when these children provide self-report ratings, group differences in level of anxiety are not detected (Yeganeh, Beidel, & Turner, 2006; Yeganeh, Beidel, Turner, Pina, & Silverman, 2003). Thus, it is unclear whether children with SM experience severe social anxiety, particularly in comparison to children with SP.

The assessment strategy for most of these investigations includes diagnostic interviews with the child's caregiver (and the child when appropriate), parent and teacher rating forms, and at times, self-report measures. When possible, but rarely, direct observation of the child in various settings also may be included. Although utilizing a variety of assessment methods is considered best practice, data obtained from these various methods often yield inconsistent reports (e.g., divergent ratings provided by clinicians, parents, teachers, blind observers and self-report ratings by the child). It may be that observation of non-speaking behavior by adults leads to the conclusion that a child is experiencing great distress. This, however, may be a false assumption (e.g., Yeganeh et al., 2006; Yeganeh et al., 2003) and reflective of the non-blinded nature of the raters (if the child does not speak, the clinician knows the diagnosis). Thus, a great need exists for more objective and well-controlled measures of behavioral and physiological responses in relation anxiety-provoking situations. To aid in this effort, it is important to ground this research on contemporary theories of anxiety.

Emotion Regulation Theory

Anxiety is an emotion, characterized by physiological arousal, subjective distress and negative cognitions, and behavioral escape or avoidance. The experience of anxiety, including the intensity of distress and subsequent emotional reactivity, varies greatly across individuals (Davidson, 1998). Variations occur for many reasons and at different points in the experience of an anxiety-provoking stimulus. For example, the specific response is highly dependent upon perceptions of the situation and resulting level of distress. Once an emotional reaction occurs, additional variations in cognitive, behavioral, and physiological responses will follow. Emotion regulation theory suggests that these responses should be considered lower order indicators and that they are the direct result of an individual’s ability to regulate emotional arousal in the wake of distress (Cisler et al., 2010). In other words, emotion regulation directly influences the intensity, duration, and expression of anxiety (Gross & Thompson, 2007). Based upon this theory, dysfunctional emotion regulation may be a key determinant in the development of an anxiety disorder (Cisler et al., 2010).

It has been suggested that individuals with anxiety disorders are hyper-sensitive to perceived threat (Wilson, MacLeod, Mathews, & Rutherford, 2006) which often results in more frequent and intense emotional experiences and reactions (Carthy, Horesh, Apter, Edge, & Gross, 2010). This is true for children and adolescents as well (Bogels & Zigterman, 2000) and may be particularly concerning for youth who are still developing emotion regulation skills. In fact, it has been suggested that infants and young children who experience frequent and intense feelings of anxiety may be particularly vulnerable to underdeveloped emotion regulation skills (Calkins, 1994). Unfortunately, engaging in poor emotion regulation strategies, while resulting in an immediate reduction of negative emotions, often serves to strengthen the frequency and intensity of negative emotions in the long term, resulting in a pattern of maladaptive behavior and outcomes (Amstadter, 2008). Thus, to treat or prevent a maladaptive pattern of responding (i.e., an anxiety disorder), one initial step must be to target specific emotion regulation strategies that serve to reinforce situation specific reactions to anxiety.

One difficulty in measuring emotion regulation is the broad use of this term to capture a wide range of emotional responses (both cognitive and behavioral). For example, emotion regulation strategies may be overt and quite noticeable (e.g., avoidance, escape, substance use) or more subtle and covert (e.g., re-appraisal, distraction, suppression). In addition, some emotion regulation strategies may occur prior to a fear-provoking situation (e.g., a child avoiding attending a party) or following the situation (e.g., a child suppressing feelings of sadness related to not attending a party). Lastly, emotion regulation strategies may be deliberate or more habitual and outside of conscious awareness (Gross 1998a/1998b). Thus, simply using the term "Emotion Regulation" may lead to false conclusions about specific behaviors.

Additionally, the use of emotion regulation strategies develops over time and is context dependent. More deliberate emotion regulation strategies occur as children's cognitive abilities mature (Southam-Gerow & Kendell, 2002). Thus, young children may be particularly vulnerable to utilizing poor emotion regulation strategies that become reinforced and become more patterned over time.

Recent attempts have been made to rectify some of the difficulties associated with the study of emotion regulation by applying this theory to specific lower order indicators of anxiety (Cisler et al., 2010). For example, below is a basic schematic representing emotion regulation theory as it pertains to anxiety.

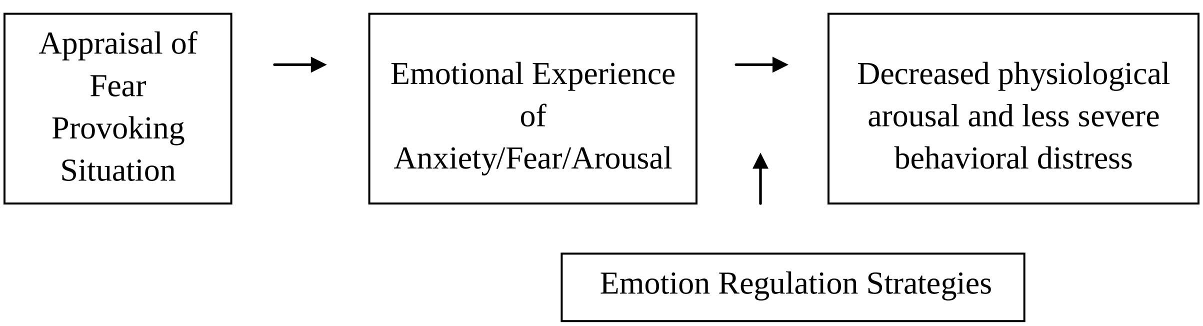

Figure 1: Emotion Regulation and Anxiety

In the above figure, emotion regulation strategies may serve to decrease emotional stress, resulting in more adaptive functioning and perhaps preventing the development of anxiety disorders. Although the role of emotion regulation in the expression of anxiety is widely accepted, very few empirical studies exist that actually use operationalized behaviors, objective criteria and temporal sequencing, particularly with children. SM provides a unique opportunity to test this increasingly influential construct, using more objective methods than heretofore proposed or utilized in existing studies.

From an emotion regulation theory perspective, SM might be conceptualized as either a deliberate or automatic behavior that moderates arousal to an anxiety-producing situation. As an active behavior, SM may serves as an emotion regulation strategy – that is, the perception of overarousal leads to the use of a behavior designed to regulate (and in this case, decrease) emotional arousal. Conceptualized in this manner, lack of speech reflects an avoidance behavior, which results in escape from aversive situations and decreased arousal. Thus, in comparison with children who are anxious and do speak, SM may be characteristic of children with the most extreme social distress but who have found a way to avoid social interactions, thereby moderating subjective distress and perhaps physiological arousal. Considered in this fashion, SM may represent a maladaptive emotion regulation strategy that reduces extreme emotional arousal (see figure below).

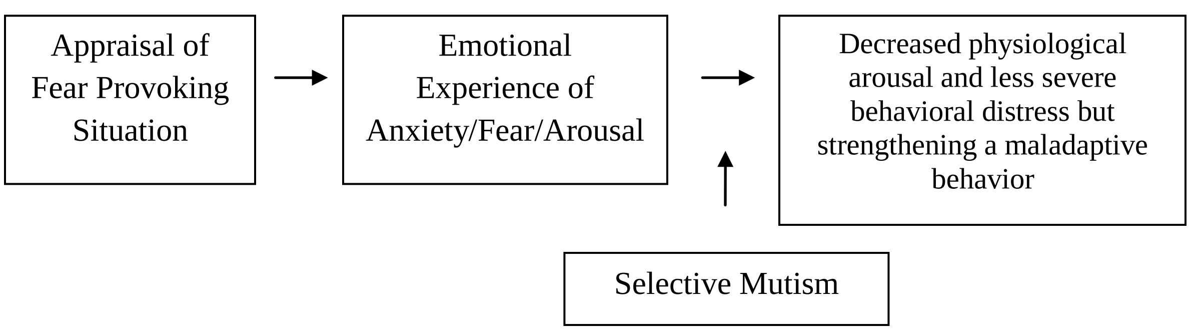

Figure 2: Emotion Regulation and Selective Mutism

Collectively, marked individual differences exist in the appraisal of threatening situations, intensity of distress experienced, and the subsequent cognitive, behavioral, and physiological symptoms of anxiety. Emotion regulation may directly influence this process, moderating emotional arousal and behavioral functioning. For children, particularly those experiencing greater emotional arousal and underdeveloped adaptive emotion regulation skills, the use of ineffective and negatively reinforcing strategies may result in maladaptive behavior (i.e., an anxiety disorder). Utilizing this perspective, SM may indeed represent a behavioral variant of SP, where non-speaking behavior reflects a specific emotion regulation strategy, avoidance, secondary to extreme anxiety. However, if children with SM do not experience extreme emotional arousal in social settings, emotion regulation (avoidance) would not explain their lack of speech, and suggests the need to direct research efforts and treatment considerations elsewhere. Thus, in addition to potentially providing important information on the conceptualization of SM, this study may provide initial validation of emotion regulation theory as it relates to anxiety disorders.

Psychophysiology and Emotional Responding

Psychophysiology examines how individuals experience and respond psychologically to environmental demands and context (Cacioppo, Tassinary, & Berntson, 2007). Although fewer studies have been conducted with children, current research suggests its validity using carefully controlled, age-appropriate paradigms (Fox, Louis, Schmidt, Henderson, & Marshall, 2007). The current paper will now turn to an overview of the Autonomic Nervous System (ANS) as it pertains to emotional and behavioral responding, followed by an explanation of two important physiological theories that support the proposed emotion regulation model.

There is currently no *gold standard* for measuring physiological responses to emotional arousal. Cardiovascular measures such as Heart Rate (HR) and Heart Rate Variability (HRV) offer relatively easy, non-invasive measures of sympathetic and parasympathetic responses to external stimuli. Heart rate variability (HRV), or the measure of the variation of beat-to-beat intervals, has become increasingly used in psychophysiological research. Specifically, respiratory sinus arrhythmia (RSA) is a generally accepted frequency, or spectral measure of vagal cardiac control related to respiration (Berntson, Quigley, & Lozano, 2007) that offers a direct examination of parasympathetic activity within the ANS. RSA measures fluctuations in heart rate associated with breathing and activity of the vagas nerve. The vagas is the 10th cranial nerve that serves to transmit information, bidirectionally from the brainstem to various organs. Thus, the vagas nerve can be considered a feedback system between motor and sensory pathways, and brain structures that monitor, change, and regulate sensory input and motor responses (Porges, 2003).

Similarly, electrodermal activity (EDA), typically measured by skin conductance (SCL) or resistance (SCR) offers a direct measure of sympathetic activity on the ANS. Tasks that require effort and attention will increase EDA as well as situations that elicit strong emotions. For example, it is common for SCL to gradually decrease when at rest, rapidly increase when novel stimuli are presented and then gradually decrease again after the stimulus is repeated. In contrast, skin conductance response (SCR) reflects phasic increases in conductance following the onset of a stimulus. When an SCR occurs without an identifiable stimulus, it is known as a nonspecific SCR which may also characterize deep breaths and movement. In contrast, event-related SCRs denote quick sympathetic physiological reactions to specific events. Thus, SCRs may provide useful information regarding emotional reactivity but should be viewed within in the context of the situation (Dawson, Schell, & Filion, 2007). Changes in EDA do not occur in isolation, but instead are a part of a pattern of responses mediated by the ANS. EDA is often used in research because it provides a direct representation of sympathetic activity; the eccrine sweat glands are under sympathetic control. Thus, increases in SCL are due entirely to increased tonic or phasic sympathetic activation. This is in contrast to HR which reflects both sympathetic and parasympathetic activity. It has also been suggested that HR is influenced by a behavioral activation system (e.g., reward seeking, active avoidance), whereas EDA is influenced by behavioral inhibition (e.g., passive avoidance). Thus, it is recommended to examine EDA in situations where anxiety is elicited but active avoidance is not possible. EDA is also recommended because individual differences in EDA appear to be the most reliably associated with psychopathological states. However, experimental control is important as many things can influence EDA such as attention, activation and stimulus intensity (Dawson et al., 2007).

However, examining only one system of the ANS may not capture patterns of responding such as reciprocal or coactivational changes of autonomic functioning (Berntson et al., 2007). Thus, it is suggested that a more accurate portrayal of physiological responding to emotion should include multiple measures simultaneously to examine response patterns (Kreibig, 2010). Recently there has been a turn to including Respiratory Sinus Arrhythmia (RSA) as a direct measure of parasympathetic cardiac control, specifically vagal control (Berntson, et al., 2007).

The vagus has been described as a “brake” (Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996) inhibiting the sympathetic system and enabling the ability to regulate affective and behavioral tendencies. In safe contexts, the vagal brake maintains heart rate and aids in physiological homeostasis. When threat is perceived, the vagal brake is released (i.e., vagal withdrawal), increasing sympathetic activity (e.g., HR, SCL) to enable mobilization (i.e., fight or flight behavior). Thus, if the vagal brake is not disengaged, sympathetic activity may be less, preventing appropriate responding. In other words, vagal withdrawal supports action tendencies and motor preparation in response to threat (Porges, 2003). With regard to social functioning, if the vagus brake is not disengaged, the ability to self-soothe and regulate heightened emotional arousal is lessened, impairing social interaction. It has been suggested that there is an optimal level of vagal withdrawal required for appropriate social engagement (Porges, 2001, 2003). Excessive vagal withdrawal, therefore, may be a key factor in why some children respond in anxious ways (Beauchaine, 2001).

Resting RSA and RSA regulation may offer unique explanations for affective and behavioral functioning (Porges, Heilman, Bazhenova, Bal, Doussard-Roosevelt, & Koledin, 2007). For example, resting RSA, typically measured during baseline tasks, is associated with appropriate emotional reactivity (Calkins, Graziano, & Keane, 2007; Porges et al., 2007); and perhaps a more innate temperamental style of emotional responding. When threat occurs and sympathetic activity increases, resting RSA prepares an individual to handle changes in physiological reactions, resulting in greater overall regulation of emotional responding. In contrast, RSA regulation, or event-related fluctuations in RSA, reflects the ability to engage or disengage during challenging or distressing events (Beauchaine, 2001; Doussard-Roosevelt &

Porges, 1999, Porges et al., 2007). Vagal withdrawal is considered a physiological strategy that increases attention and active coping strategies affording the ability to shift from focusing on internal emotional states to generate coping strategies that control arousal (Calkins, et al., 2007; Porges, 2001; Porges, 2003). Thus, it may be best to consider resting RSA and RSA reactivity as indications of temperamental reactivity style and situation-specific reactivity, respectively (Doussard-Roosevelt, Montgomery, & Porges, 2003).

In young children, higher resting RSA is associated with behavioral and physiological reactivity to both positive and negative stimuli (Calkins & Fox, 1992; Fox 1989; Stifter & Fox, 1990; Stifter & Jain, 1996). In older children and adolescents, higher resting RSA is associated with coping and social competence (Eisenberg et al., 1996; Fabes, Eisenberg, & Eisenbud, 1993; Mezzacappa et al., 1996) and, in adults, greater RSA predicts more self-reported regulatory control and decreased negative emotional arousal in response to stressors (Fabes & Eisenberg, 1997). Thus, greater resting RSA appears to be a stable measure of emotion regulation and general reactivity to emotionally-related stimuli (Frazier, Strauss, & Steinhauer, 2004), whereas lower resting RSA may indicate a predisposition to anxious responding, increasing the risk for social difficulties.

Whereas resting RSA reflects temperamental reactivity and emotionality, shifts in RSA in response to environmental demands reflect attentional focus, emotion regulation, and mood state (Doussard-Roosevelt et al., 2003). In general, RSA regulation is related to better social engagement (Bazhenova, Plonskaia, & Porges, 2001) and more adaptive behavior (Porges, et al., 1996) whereas poor RSA regulation is associated with social anxiety (Movius & Allen, 2005). For example, preschoolers with inhibited temperament styles have been found to exhibit higher and less variable resting heart rates than typically developing children during a cognitive task. Shifts in HRV implicated sympathetic influences on the heart (Kagan, Reznick, & Snidman, 1987). Similar sympathetic influences (shifts in HRV) were found in a study of adolescent boys who reported anxiety (Mezzacappa et al., 1997). Monk and colleagues (2001) examined children with a variety of anxiety disorders and found that anxious children had significantly higher and more stable HR (fewer HR fluctuations) than controls during baseline. It was suggested that higher HR and less variable HRV were related to a deficiency in vagal modulation (Monk et al., 2001).

Patterns of Physiological Responding

Although the extent to which emotions are related to autonomic responding is debated, it is generally agreed that some specific emotion-related patterns of physiological responses exist (Cacioppo, Berntson, Klein, & Poehlmann, 1997; Cacioppo, Berntson, Larson, Poehlmann, & Ito, 2000; Kreibig, 2010). For example, anxiety is considered to be characterized by a pattern of reciprocal inhibition including sympathetic activation and parasympathetic deactivation. In an extensive review of psychophysiological research, Kreibig and colleagues (2010) found patterns of increased HR and EDA (increased SCR and SCL) and decreased HRV (RSA) in studies examining anxiety. Exceptions to this trend were found, however, implicating the importance of considering additional states related to anxiety. For example, studies of imminent-threat fear were characterized by a pattern of reciprocal parasympathetic activation and decreased respiratory activity (i.e., HR deceleration and increased HRV (peak-valley RSA). In addition, whereas most studies of fear typically resulted in broad sympathetic activation (increased HR and/or EDA), decreased HR was noted in studies using paradigms of threatening material and a strong degree of self-involvement. It was suggested that a higher imminence of threat and self-involvement may result in immobilization (or avoidance) rather than an active coping response leading to sympathetic inhibition (Kreibig, 2010).

Taken together, under certain conditions, HR acceleration may indicate anxiety, whereas HR deceleration may indicate a fear response, related to perceptions of threat and self-involvement. Because increased EDA characterizes cognitively and/or emotionally mediated motor preparation (Fredrickson & Levenson, 1998; Kreibig, 2010), sympathetic inhibition (SCL deceleration) may reflect relief or perceptions of lessened threat. Thus, appraisal of the situation (e.g., imminence of threat and self-involvement) may result in a different but associated emotion (i.e., fear) that has unique implications for physiological responding (Barlow 1991; Craske 1999; Kreibig, 2010). Patterns of responding may therefore provide important information regarding the state of emotional arousal (fear and/or anxiety) in relation to emotion regulation strategies chosen when under distress. To better understand patterned responding in relation to emotion regulation, two important physiological theories are import to consider. The first, the Defense Cascade Model, offers a generally agreed upon and well studied model of how animals respond to perceived threat. The second, the Polyvagal Theory, is a more recent model of physiological response to threat as it pertains to humans presented with challenge or threat.

The Defense Cascade Model

The Defense Cascade Model suggests that animals undergo a “freezing” period or Orienting Response (OR) when processing potentially threatening events. During this period, attention to the threatening stimulus increases and motor activity temporarily decreases as level of threat is processed. This is accompanied by decreases in heart rate and an inhibition of the startle response; i.e., “fear bradycardia.” If threat is perceived, an acute stress response occurs and the animal enters the *fight or flight phase*, characterized by sympathetic activation (i.e., increased HR, blood pressure and vascoconstriction). Increases in respiration and sweating also may occur. During this phase, the animal may attempt to flee and, if unable, resort to fighting. If these options are not possible, parasympathetic activation may occur. This coactivation of sympathetic and parasympathetic systems characterizes the *fright* phase and resembles a panic-like reaction. Tonic immobility occurs such that the animal experiences muscle rigidity and appears frozen or dead. Two additional phases (for humans) may then occur that are considered “shut down” or dissociative responses to extreme arousal. The *flag* phase is characterized by bradycardia (decreased arousal), cognitive failure, surrender and emotional numbing. Even more extreme is flaccid immobility, or *fainting* which reflects stage six (Schauer & Elbert, 2010).

With regard to humans, specifically children with social anxiety, interacting with new peers and adults may trigger the perception of threat. During this orienting phase, the child is appraising the situation and considering behavioral options. As arousal increases and they enter the fight or flight stage, active avoidance strategies are typically sought, for example actually leaving the situation. When fleeing (and fighting) are not viable or acceptable responses, more passive avoidance strategies may occur such as a reduction in speech, eye-contact and movement. Lack of speech, an extreme avoidance strategy, may reflect panic (tonic immobility) as described by the fright phase.

While animal models of arousal provide useful information, it is important to consider additional cognitive mechanisms characteristic of humans that play an important role in acute stress reactions (Lang, Davis, & Ohman, 2000). In fact, individual differences in stress reactions (and the engagement in specific stress-related phases) depend greatly upon perception of threat, perceptions of the ability to respond to that threat, and previous experiences with similar threats (i.e., conditioning). In addition, reactivity is thought to reflect optimal responding depending upon the proximity of the threat (Bradley, Codispoti, Cuthbart, & Lang, 2001; Schauer & Elbert, 2010). For example, tonic immobility may be elicited by extreme fear and perceptions of helplessness, where the proximity of the threat (or inability to avoid the threat) plays a large role. Thus, it may be that children with SP differ from children with SM in the extent to which they perceive social situations as threatening, how capable they are of handling the situation, and the strategies employed to lessen their arousal in such situations.

Polyvagal Theory

The Polyvagal Theory, originally proposed by Steven Porges in 1995, offers an evolutionary model in which the nervous system has developed over time to maintain balance and react to challenge and/or threat. The theory ascertains that three phylogenic systems exist that range in complexity and form a hierarchy of behavioral responses including social engagement (facial expression, communication, listening), mobilization (fight or flight) and immobilization (feigning death). Based upon this theory, physiological arousal influences psychological experience and subsequent affective and behavioral responses, both verbal and non-verbal. Physiologically, the Social Engagement System is the most sophisticated system and is dependent upon the myelinated vagas to foster calm affective and behavioral states via decreased sympathetic activation. The Mobilization System is similar to the concept of fight or flight and is dependent upon the sympathetic system, and Immobilization is considered the most primitive system, dependent upon the unmyelinated vagas (Porges, 1995, 2003).

The use of the most advanced system, the social engagement system, is ideal and should result in physiological stability and calmness affording optimal emotional and behavioral responding. The social engagement system is made up of sociomotor and viceromotor components that regulate face and head muscles and regulate the heart through the myelenated vagas, respectively. When the social engagement system is compromised, more primitive forms of behavior are exhibited. For example, a deficient or underutilized social engagement system may result in less developed social skills such as poor eye-contact, limited facial expression and head gestures, decreased social awareness and less spontaneous social behavior. Physiologically, because there is a reduction in the influence of the myelinated vagas (i.e., vagal withdrawal) an increase in sympathetic activity occurs (increased HR and EDA), resulting in a more primitive response pattern, mobilization, characterized by fight or flight behavior. When both the social engagement and mobilization systems are unavailable or ineffective, the individual may then enter the most primitive stage, immobilization, often characterized by passive avoidance strategies. Physiologically, this stage resembles the fright phase with coactivated parasympathetic and sympathetic activity.

It is important to consider the environmental context on physiological responding. In safe contexts, physiological homeostasis is maintained through vagal pathways that slow the heart, inhibit mobilization responses and decrease the stress response system. When threat is perceived, however, the individual may enter one of the three stages described above. Thus, the emotion regulation strategy chosen may be highly reliant upon individual perceptions of threat imminence and persistence, or how long the threat will last. When a threatening situation cannot be avoided, and fear responses (fight/flight) are not possible, habituation should eventually occur with continued exposure to the feared stimulus. Physiologically, overall arousal should decrease and withdrawal of the vagal brake should stop as the perception of the situation as threatening lessens. However, when habituation does not occur, and physiological arousal persists or worsens, the individual may enter an immobilization phase, resorting to even less effective (and more passive) avoidance strategies (Porges, 1995, 2003).

With regard to children with social anxiety, the polyvagal theory may have important implications for why some children do not speak in social situations. For example, in unavoidable social situations, children with SP and SM often exhibit active, albeit ineffective, coping strategies (e.g., decreased eye-contact and motor activity) and less controlled physiological responses (e.g., blushing, sweating, and shaking). Children with SM, however, do not talk and may exhibit even greater signs of distress (appearing frozen with fear). Therefore, a potential physiological difference between children with SP and SM may be that children with SM have deficient social engagement AND mobilization systems resulting in the engagement of the most primitive stage of responding, immobilization. Children with SP may experience similar arousal levels but are able to access a more developed system; i.e., mobilization. If so, it would follow that children with SP maintain a heightened state of arousal while in the mobilization stage until habituation occurs or the threat is removed. In contrast, children with SM may experience heightened arousal and enter a state of panic or immobility. Not speaking may then occur as an emotion regulation strategy to alleviate this panic-like sensation.

Another reason for lack of speech may be related to cognitive processes involved in threat appraisal. The term neuroception (Porges, 2004) has been used to describe the process of evaluating threat as safe, dangerous, or life threatening. This may be within conscious awareness but can also occur subconsciously. Either way, valid appraisals of the situation may be adaptive. For example, inhibiting defense systems in a safe environment should facilitate appropriate social engagement and utilizing defense strategies in threatening situations may provide protection from danger. Alternatively, enabling defense strategies in a safe environment may result in ineffective behavioral and affective responses that may provide temporary relief but result in psychiatric dysfunction (i.e., selective mutism). Thus, the use of not speaking as an emotion regulation strategy may be related to neuroception, particularly the appraisal of the demands of the situation (i.e., the degree of self-involvement related to speaking).

The Current Study

Based upon the above literature review, parents, teachers, clinicians, and blinded observers may perceive children with SM, relative to those with SP, as experiencing significantly greater levels of anxiety than actually reported by the child (Yeganeh, 2006; Yeganeh et al., 2003). Often, this judgment of greater anxiety is based primarily on the child's inability/refusal to speak; thus this argument is circuitous. In addition, the majority of previous emotion regulation research relies on self-report measures and observations of facial expressions as indicators of emotion regulation abilities (Amstadter, 2008). Thus, a great need exists for comparison of these groups using objective, physiological measures of arousal not subject to rater bias. Furthermore, descriptive studies of children with SM rarely include both control groups of children with SP but who do speak in social situations and children without any psychiatric disorder, necessary to accurately establish baseline levels of physiological arousal and the extent of the reactivity in specific social situations. Lastly, although the role of emotion regulation in the expression of anxiety is widely accepted, very few empirical studies have been conducted to test this theory, particularly with children. Thus, the current study compares children with SM to children with SP and no psychological disorder using overt behavioral observations, physiological arousal and the sequencing of these two systems to determine whether avoidance of speech functioned as a strategy consistent with a model of emotion regulation.

Because the temporal comparison of behavior and physiological arousal has not been examined, specific hypotheses were not proposed. Instead, the following aims were assessed using a single case design strategy:

1. To determine if children with SM have overall elevated physiological arousal relative to children with SP or no psychological disorder when engaged in social interactions with unfamiliar adults and peers.
2. To assess whether the demands of the specific social encounters (speaking vs. not speaking) affect the physiological arousal of children with SM.
3. To determine if lack of speech functions as an emotion regulation strategy by examining the temporal sequencing of behavior and physiological response when children with SM are engaged in a series of social encounters with unfamiliar adults and peers.

METHODS

Participants

The sample consisted of 15 children representing three groups: 5 children with Selective Mutism (SM; 2 males, 3 females), 5 children with Social Phobia without SM (SP; 3 males, 2 females) and 5 children without any psychiatric disorder (TD; 2 males, 3 females).Children ranged in age from 6 to 12 years (*Ms* = 7.6, 8.8, and 7.6 years old respectively). Ethnicity varied within groups and included 6 Caucasians, 6 Hispanics, 1 Indian American, 1 Asian American and 1 African American child. Eleven of the 15 children attended public school, 3 were in private school and 1 child was home schooled. A detailed breakdown by group is included in Table 1.

Table 1: Participant Demographics

GROUP	AGE	GENDER	ETHNICITY	Grade	School	Sequence
SM 012	6	Male	Hispanic	1	Private	1
SM 015	6	Male	Hispanic	K	Public	4
SM 016	8	Female	Hispanic	3	Public	2
SM 018	12	Female	Caucasian	4	Public	2
SM 019	6	Female	Asian	K	Public	3
SP 001	12	Female	Indian	7	Public	1
SP 006	11	Male	Caucasian	6	Private	1
SP 010	7	Male	Hispanic	2	Public	2
SP 011	7	Male	Hispanic	1	Private	4
SP 017	7	Female	Caucasian	2	Public	3
TD 007	7	Female	Caucasian	2	Public	2
TD 008	7	Female	Hispanic	1	Public	2
TD 009	7	Male	Caucasian	1	Public	1
TD 013	7	Male	Caucasian	1	Home	4
TD 014	10	Female	African American	4	Public	3

Diagnostic Measures

To determine participation eligibility and diagnostic status, children and their parents were interviewed together using the Anxiety Disorders Interview Schedule for Children and Parents (ADIS-C/P, Silverman & Albano, 1996). The ADIS – C/P is a semi-structured interview designed to assess DSM-IV anxiety disorders and other DSM-IV psychiatric disorders. The diagnostic interview was conducted by a doctoral candidate in clinical psychology. To be included in the study, children met diagnostic criteria for (a) social phobia, (b) social phobia and selective mutism, or (c) no diagnosis. As part of the ADIS-C/P diagnostic interview, a Clinician Severity Rating (CSR) was assigned to each diagnosis, using a 9-point scale (0-8). A severity rating of 4 or higher was required for inclusion in the study. The ADIS-C/P has high inter-rater reliability, particularly with regard to anxiety disorder categories (i.e., ranging from .85 to 1.0; Kendall, 1994; Kendall & Southam-Gerow, 1996) and is a widely used and accepted diagnostic interview.

To assess range and severity of social fears, children completed the Social Phobia and Anxiety Interview for Children (SPAI-C; Beidel, Turner, & Morris, 1995). This 26-item self report measure assesses symptom severity on a 3-point Likert scale. The SPAI-C has demonstrated excellent internal consistency (alpha = .95) and high test-retest reliability over a two week ($r = .86$) and ten month ($r = .63$) time period. In addition, it differentiates children with social phobia from normal controls and children with externalizing disorders (Beidel et al., 1995) and children with other anxiety disorders. The SPAI-C has been formally validated for children as young as 8-years old. All children completed the SPAI-C with a trained graduate student available to answer questions. All children 8 and younger were read the items to ensure understanding and accurate reporting.

Children also completed the Children's Depression Inventory (CDI; Kovacs, 1992), a 27-item self-report questionnaire used to assess the presence and severity of depression-related symptoms in children and adolescents. The CDI has high internal consistency (ranging from .71 to .84) and good test-retest reliability over two to three weeks (ranging from .74 to .83; Smucker, Craighead, Wicoxen-Craighead, & Green, 1986).

Procedure

The behavioral assessment consisted of two tasks: playing the Wii with two unfamiliar adults, one male and one female. Children interacted with each adult separately with a baseline phase between interactions that included time spent with his/her parent in the same play room. The second task consisted of playing the Wii with two unfamiliar peers.

Prior to task initiation, the child and his/her mother (fathers accompanied 2 of the participants) were escorted to the playroom where the assessment procedure and physiological equipment was explained. Disposable electrodes and a small device that resembles a common PDA were used to collect and record physiological data. Two electrodes were placed on the palms of the child's non-dominant hand and three electrodes were placed directly on the child's skin (one on the child's collar bone and the other two directly below the child's rib cage). Electrodes were connected to an ambulatory recording device and placed in a fanny pack or back pack to ensure that leads did not interfere with play activities. After signal acquisition and syncing with the digital recording system, children participated in the two social interaction sequences. Interaction 1 consisted of: A=baseline, B= interaction with an unfamiliar adult, A=baseline, B=interaction with an unfamiliar adult. Interaction 2 consisted of A= baseline, B= interaction with two unfamiliar peers, A=baseline, B=interaction with two unfamiliar peers. Order of interaction 1 and 2 were randomized, leading to one of 4 different possible sequences:

1. Adult male, adult female, peers 1, peers 2
2. Adult female, adult male, peers 1, peers 2
3. Peers1, peers 2, adult male, adult female
4. Peers 1, peers 2, adult female, adult male

The sequence of interactions was alternated within groups so that each sequence was used in all 3 groups. At the beginning of each interaction, the child rated his/her level of distress using a modified Self Assessment Manikin (SAM), which used pictures to illustrate various levels of distress. Given the developmental level of the children, five pictures were chosen to correspond to a 5-point Likert scale (1 = little to no anxiety to 5 = extreme anxiety; SAM; Bradley & Lang, 1994).

Overview of Interaction Sequence

Initial Baseline.

The child stood for five minutes and then sat for five minutes while his/her mother was in the room.

Interaction with an Unfamiliar Adult.

The mother left the room and an unfamiliar adult entered the room. The investigator obtained a SAM rating from the child and exited the room. The adult attempted to engage the child in play by stating, “Hi, my name is ____. Do you want to play the Wii with me?” Children who did not join in playing the Wii were asked to play again approximately ½ way through the 10 minute segment. Whether or not the child played the Wii, the adult asked 5 standard questions (3 closed and 2 open ended) throughout the interaction sequence. Five different questions were asked by the second unfamiliar adult in the second interaction. Unfamiliar adults did not engage in any casual conversation with the children unless initiated by the child or deemed necessary to set up the game.

Peer Interaction.

The mother left the room and two unfamiliar peers (one male and one female within 2 years of age of the target child) entered. As they did, the investigator obtained a SAM rating from the child and left the room. The children were not provided any specific instructions other than to play the Wii and to have fun. The children were given 10 minutes to play freely.

Additional Baselines.

Following each interaction, mothers re-entered the play room with the investigator. Upon entering, the child rated their distress using the SAM. Children and mothers were not provided any specific instructions other than to wait in the room together for a few minutes. Each baseline segment lasted at least 5 minutes.

Post Assessment.

Following the final interaction sequence, the investigator returned to the room to interview the child regarding his/her experience. The child's mother was asked to return to the room prior to the removal of electrodes and recording equipment.

Recording Procedures

Behavioral Coding.

Using the Noldus Behavioral Observation System, the child's verbal and nonverbal behaviors during the social interaction sequence were recorded. Non-verbal play behaviors included play initiation (hesitant versus spontaneous), latency to play (coded in seconds), time spent playing (coded in seconds), and proximity to peers/adult during play (beside versus separated). Communication behaviors included latency to speech (coded in seconds) and responses to a set of 12 questions asked by the unfamiliar adult. Additional objective codes were coded in 1 minute intervals during all four interactions. These included affect (flat versus appropriately reactive), anxiety (no anxiety versus anxious), movement (restricted versus appropriate) and engagement (restricted versus fully engaged). Operational definitions of play, verbal and objective codes are included in Table 2.

Table 2: Behavioral Assessment Definitions

	Behavior	Operational Definition
Play Behavior	Play Initiation	**Hesitant**: the child hesitates to join the peers or adult and/or waits to be handed the controller. **Spontaneous:** the child shows no hesitancy when invited to play; joins peers and adult immediately with or without an invitation
	Latency to Play	Duration of time from the start of an interaction segment (after obtaining SAM and experimenter exit) until the child joins or initiates play.

	Behavior	Operational Definition
	Time Spent Playing	Duration of time spent playing with peers and adults.
	Proximity	**Beside:** child stands beside adult or peers while playing **Separated:** child plays behind, in front of isolated from peers and adults (also may include when child is separated and not playing)
Communication Behaviors	Verbal Response	**No Response:** child does not respond verbally or non-verbally **Eye-Gaze:** child makes eye-contact with adult (may occur with any of the other response options) **Shrug/Non-verbal response:** child shrugs shoulders or nods head **1 Word Response:** child offers a 1 word response (yes, no, or 1 word that satisfies the question) **Full Response:** child responds with more than 1 word – **Brief** = 2-3 words **Elaborated** = more than 1 word to a yes/no question, elaborates on a response to an open-ended question
	Verbal Latency	Duration of time from the start of an interaction segment to speak to a peer or adult.
Objective Codes	Affect	**Flat** = lack of reactivity or emotional expression. Child rarely if at all makes any facial expressions or shows emotional reactions to others. **Reactive** = child exhibits typical emotional expression and reactivity throughout interaction. Smiles and laughs when having fun, shows frustration at game, etc.
	Anxiety	**No Indication of Anxiety** = No overt signs of anxiety. Child plays with others without hesitation and does not appear nervous in any way. **Anxious** = Child may appear hesitant to join play and/or exhibit overt indications of anxiety such as picking at or chewing nails, chewing on clothing, covering mouth, facial apprehension, etc.
	Movement	**Restricted** = child stands or sits in one place for the majority of the interaction. When playing, child moves slowly or hesitantly; may only move the controller slightly. Child does not move around the room often, is more likely to stay in one place. **Appropriate** = child may move about while playing; move entire body with the controller. This child also may exhibit additional movements like jumping up and down, waving arms in air to demonstrate excitement or bending whole body in frustration with the game.

	Behavior	Operational Definition
	Engagement	**Restricted** – child is not playing or engaged at all, or interacts with peers/adult but is following their lead. When interacting, child may appear hesitant or not overtly eager or interested in doing so. **Fully Engaged** = child appears interested in interacting with peers/adult and takes active role in participating. May offer to help set up game or make decisions about the game. May ask questions of others or appear interested in getting to know them.

Physiological Recording.

Heart Rate (HR), Skin Conductance Level (SCL), Skin Conductance Response/Spontaneous Fluctuations (SCR; SCF) and Respiratory Sinus Arrhythmia (RSA) were recorded continuously using the Mindware Ambulatory (wireless) Impedance Cardiograph system and analyzed using Mindware analysis software version 3.0.9. HR, SCL and RSA data were analyzed in 60 second segments. SCRs/SCFs were counted if they occurred within 5 seconds of a specified event (task initiation, and the 12 questions asked by the unfamiliar adults) and fluctuations exceeded .05µS. Following data collection, HR data were edited for artifact.

RESULTS

Behavioral data are presented first followed by the physiological data. Preliminary analysis indicated that the children's behavioral responses were similar when interacting with an unfamiliar adult and unfamiliar peers. Thus, for ease of interpretation, behavioral results were collapsed across interpersonal partner. Individual responses and group data broken down by interaction type are provided in Appendix A.

Behavioral Results

When opportunities to initiate play occurred, children with SM exhibited hesitancy, rather than spontaneous joining behavior (80% vs. 20%). In contrast, children with SP were equally likely to exhibit hesitant or spontaneous play initiation styles (45% hesitancy, 55% spontaneous). TD children were more likely to join spontaneously (70%) rather than hesitate to initiate (30%). Even when hesitancy was exhibited by TD children, it was qualitatively different; typically involving the child physically joining the peers or adult quickly but waiting patiently to be handed the controller. Average latency to play was more than twice as long (164.8 seconds; almost three minutes) for children with SM compared to children with SP (85.4 seconds; almost 1.5 minutes) and TD children (75 seconds; slightly over one minute). Total length of time spent playing across interaction segments was 11491 seconds (out of a possible 12,000 seconds, or 40 minutes) for TD children, compared to 11344 seconds for children with SP and 11124 seconds for children with SM. Although averages do not appear different, consideration of total seconds in play resulted in 220 seconds (over 3 ½ minutes) and 367 seconds (over 6 minutes) more play time for children with SP and TD children, respectively compared to children with SM. It should be noted, however, that latency to play and time spent playing were influenced by one particular child with SM who took almost seven minutes to join play during the first stranger interaction.

With regard to physical proximity, children with SM spent almost half (47.9%) of their play time separated from peers (playing in front or behind the peers) whereas children with SP spent 34.3% of their time separated from peers and adults. Children with SM often initially joined play beside peers but became separated as their peers moved to play and they remained still. In contrast, TD children spent the majority of their play time (79%) beside play peers and adults. Behavioral results for play behaviors are presented in Table 3.

Table 3: Play Behaviors

		Play Initiation		Latency to Play & Play Time		Proximity	
		Hesitant	Spontaneous	Latency to Play	Time Spent Playing	Beside	Separated
Selective Mutism	019 AV	1	3	88	2312	394	1910
	018 RR	4	0	113	2288	2340	0
	016 RF	4	0	84	2316	2022	294
	015 AC	3	1	50	2297	357	1993
	012 SP	4	0	489	1911	947	1385
	TOTAL	**16**	**4**	**824**	**11124**	**6059.81**	**5581.52**
	%	**80.00%**	**20.00%**		**92.70%**	**52.10%**	**47.90%**
	Ave			**164.80**	**2224.8**	**1211.962**	**1116.304**
Social Phobia	017 JH	1	3	45	2355	2093	259
	011 RC	1	3	62	2338	1937	401
	010 GO	3	1	123	2048	1844	490
	006 JDV	4	0	78	2322	0	2165
	001 PD	0	4	119	2281	1646	635
	TOTAL	**9**	**11**	**427**	**11344**	**7520**	**3950**
	%	**45.00%**	**55.00%**		**94.50%**	**65.60%**	**34.40%**
	Ave			**85.4**	**2268.80**	**1504**	**790**
Controls	007 JS	1	3	52	2348	2348	0
	008 GP	1	3	57	2343	1633	710
	009 LK	1	3	130	2261	1904	366
	013 MH	1	3	50	2260	2260	0
	014 TB	2	2	86	2279	972	1342
	TOTAL	**6**	**14**	**375**	**11491**	**9117**	**2418**
	%	**30.00%**	**70.00%**		**95.80%**	**79.00%**	**21.00%**
	Ave			**75**	**2298.2**	**1823.4**	**483.6**

When questioned by an adult, children with SM were most frequently non-responsive (62.9% of the time); in16 out of the 39 non-responses (41%) the child did make eye-contact with the adult, thereby indicating a non-verbal acknowledgement of the question. Other nonverbal responses (shrugging and shaking head yes or no) occurred more frequently (29%) than one word (4.8%) and full (3.2%) verbal responses. Only one child with SM spoke (during the adult interactions only) and offered 3 one word responses and 2 full responses that were brief in nature (2-3 words). In contrast, children with SP most frequently responded to the adult's questions with a verbal response, either a full response (49.2%) or one-word response (32.2%). Of the 29 full responses, 11 (37.9%) were elaborated responses. In fewer than 20% of the opportunities, children with SP responded nonverbally (13.6%) or not at all (5.10%). The majority of responses (94.8%) by TD children were verbal; 70.70% were full responses and 24.10% were one-word answers. Of the 41 full responses made, 20 (48.8%) were elaborated. Finally, TD children exhibited a slightly faster latency to speak (107.6 seconds) than children with SP (140.8 seconds). Results for communication behaviors are presented in Table 4.

Table 4: Communication Behaviors

Group	Participant	Verbal Response to Unfamiliar Adults: No Response	Eye-Gaze	Nonverbal Response	1 Word Response	Full Response	Latency: Latency To Speak	Full Response: Brief	Elaborated
Selective Mutism	019 AV	8	10	4	0	0	2400	0	0
	018 RR	7	11	5	0	0	2400	0	0
	016 RF	3	11	5	3	2	589	2	0
	015 AC	9	3	3	0	0	2400	0	0
	012 SP	12	3	1	0	0	2400	0	0
	TOTAL	**39**	**38**	**18**	**3**	**2**	**10189**	**2**	**0**
	%	**62.90%**	**61.30%**	**29.00%**	**4.80%**	**3.20%**		**100.00%**	**0.00%**
	Average						**2037.8**		
Social Phobia	017 JH	2	3	0	5	5	71	5	0
	011 RC	0	5	5	4	3	236	3	0
	010 GO	0	3	3	1	8	97	4	4
	006 JDV	1	8	0	3	7	191	3	4
	001 PD	0	4	0	6	6	109	3	3
	TOTAL	**3**	**23**	**8**	**19**	**29**	**704**	**18**	**11**
	%	**5.10%**	**39.00%**	**13.60%**	**32.20%**	**49.20%**		**62.10%**	**37.90%**
	Average						**140.8**		
Controls	007 JS	0	5	1	2	8	66	4	4
	008 GP	0	3	0	4	7	78	1	6
	009 LK	1	4	0	2	9	87	3	6
	013 MH	0	3	1	1	10	87	10	0
	014 TB	0	5	0	5	7	220	3	4
	TOTAL	**1**	**20**	**2**	**14**	**41**	**538**	**21**	**20**
	%	**1.70%**	**34.50%**	**3.40%**	**24.10%**	**70.70%**		**51.20%**	**48.80%**
	Average						**107.6**		

Breaking each 10 minute interaction into one minute intervals, coders rated the presence/absence of the following non-verbal behaviors: affect, anxiety, movement, and engagements. As depicted in Table 5, children with SM exhibited flat affect more frequently (67%) than children with SP (40.60%) and TD children (11%). Children with SM were also rated more frequently as anxious (71.5%) than children with SP (29.9%) and TD children (9%). With regard to gross body movement, children with SM and SP were more frequently perceived as restricted (84% and 94.4%, respectively) compared to TD children (62.5%). Finally, children with SM were almost always perceived as restricted (96.5%) in their level of social engagement.

Children with SP were less often perceived as restricted (60.4%), whereas TD were infrequently perceived as restricted (20.5%) when playing with peers and adults. Results for objective codes are presented in Table 5.

Table 5: Objective Codes

		Affect		Anxiety		Movement		Engagement	
		Flat Affect	Reactive	No Anxiety	Anxiety	Restricted	Appropriate	Restricted	Fully Engaged
Selective Mutism	019 AV	26	14	7	33	21	19	40	0
	018 RR	29	11	13	27	40	0	38	2
	016 RF	37	3	19	21	38	2	39	1
	015 AC	4	36	3	37	29	11	37	3
	012 SP	38	2	15	25	40	0	39	1
	TOTAL	**134**	**66**	**57**	**143**	**168**	**32**	**193**	**7**
	%	**67.00%**	**33.00%**	**28.50%**	**71.50%**	**84.00%**	**16.00%**	**96.5%**	**3.50%**
Social Phobia	017 JH	20.00	20	34.00	6	40.00	0.00	16	24
	011 RC	24.00	16	34.00	6	38.00	2.00	38	2
	010 GO	1.00	39	30.00	10	37.00	3.00	11	29
	006 JDV	32.00	5	24.00	13	37.00	0.00	37	0
	001 PD	3.00	37	16.00	24	34.00	6.00	17	23
	TOTAL	**80**	**117**	**138.00**	**59**	**186.00**	**11.00**	**119**	**78**
	%	**40.60%**	**59.40%**	**70.10%**	**29.90%**	**94.40%**	**5.60%**	**60.40%**	**39.60%**
Controls	007 JS	0	40	40	0	19	21	3	37
	008 GP	3	27	34	6	13	27	3	37
	009 LK	2	38	34	6	22	18	0	40
	013 MH	8	32	40	0	31	9	9	31
	014 TB	9	31	34	6	40	0	26	14
	TOTAL	**22**	**178**	**182**	**18**	**125**	**75**	**41**	**159**
	%	**11.00%**	**89.00%**	**91.00%**	**9.00%**	**62.50%**	**37.50%**	**20.50%**	**79.50%**

Self-Report Results

Upon task initiation (the entrance of an unfamiliar adult or play peer), every child provided a SAM rating. Children also rated their overall anxiety for the entire day. Although trends were found such that average SAM ratings were higher for children with SM and SP when interacting with peers than adults, differences are minimal and difficult to interpret as many children exhibited a unique response pattern. However, overall ratings would seem to suggest that children with SP endorsed higher distress than children with SM or the TD group. With regard to the SPAI-C, average total scores were highest for children with SP (28.8) followed by children with SM (19.8) and then TD children (11.8). SAM ratings and SPAI-C scores are presented in Table 6.

Table 6: Individual and Group Averages of SAM ratings and SPAI-C Scores

		BL	Adult	BL	Adult	BL	Peers 1	BL	Peers 2	Overall	SPAI-C
Selective Mutism	012	0	0 (M)	0	0 (F)	0	0 (P1)	0	0 (P2)	0	0
	015	1	0 (F)	0	0 (M)	0	4 (P1)	3	2 (P2)	0	22
	016	1	1 (F)	0	1 (M)	0	2 (P1)	0	0 (P2)	0	37
	018	0	0 (F)	0	0 (M)	0	0 (P1)	0	0 (P2)	0	3
	019	0	3 (M)	2	3 (F)	3	2 (P1)	1	2 (P2)	1	37
	Ave	**.4**	**.8**	**.4**	**.8**	**.6**	**1.6**	**.8**	**.8**	**.2**	**19.8**
Social Phobia	001	0	0 (M)	0	0 (F)	0	1 (P1)	0	1 (P2)	2	19
	006	2	1 (M)	0	0 (F)	0	4 (P1)	3	4 (P2)	3	46
	010	1	1 (F)	0	1 (M)	0	2 (P1)	0	0 (P2)	0	25
	011	0	0 (F)	0	0 (M)	2	0 (P1)	0	0 (P2)	0	29
	017	1	0 (M)	0	0 (F)	1	0 (P1)	0	0 (P2)	0	25
	Ave	**.8**	**.4**	**0**	**.2**	**.6**	**.88**	**.6**	**1.0**	**1.0**	**28.8**
Controls	007	0	0 (F)	0	0 (M)	0	0 (P1)	0	0 (P2)	0	9
	008	1	1 (F)	0	1 (M)	0	1 (P1)	0	1 (P2)	0	15
	009	2	3 (M)	1	0 (F)	1	1 (P1)	2	1 (P2)	1	14
	013	0	1 (F)	0	0 (M)	0	1 (P1)	0	0 (P2)	0	12
	014	0	1 (M)	0	0 (F)	0	1 (P1)	0	0 (P2)	0	9
	Ave	**.6**	**1.2**	**.2**	**.2**	**.2**	**.8**	**.4**	**.4**	**.2**	**11.8**

Physiological Results

Each channel of physiological response (HR, EDA, and RSA) was examined separately. Graphs depicting averages and minute by minute physiological responses are presented for the A-B-A-B (A=baseline, B= interaction with unfamiliar adult, A=baseline, B= interaction with unfamiliar adult) and A-C-A-C (A=baseline, C= interaction with peers, A=baseline, C= interaction with peers) designs to allow comparison with respect to type of situation. Minimum and maximum values of HR, SCL, and RSA (to demonstrate variability and magnitude of change) are included in Appendix B.

Heart Rate.

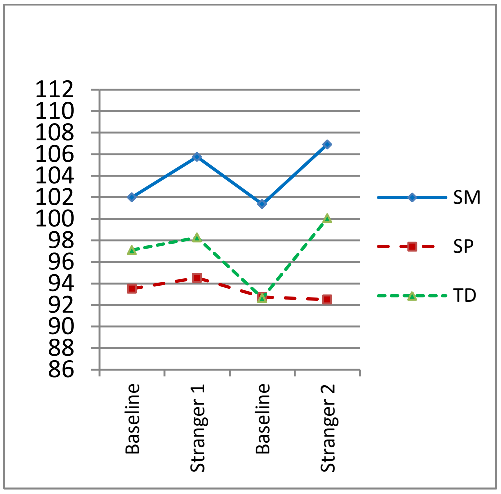

Figure 3: A-B-A-B HR Averages by Group

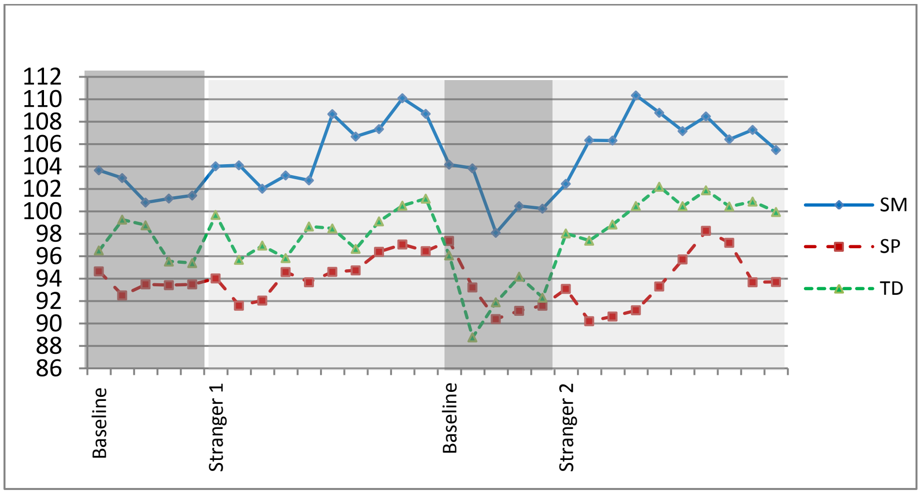

Figure 4: A-B-A-B Minute by Minute Data by Group

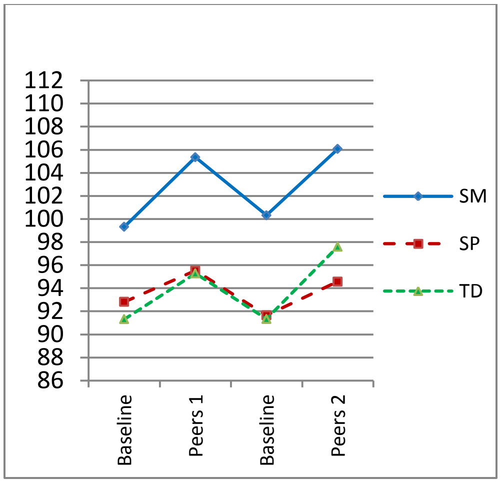

Figure 5: A-C-A-C HR Averages by Group

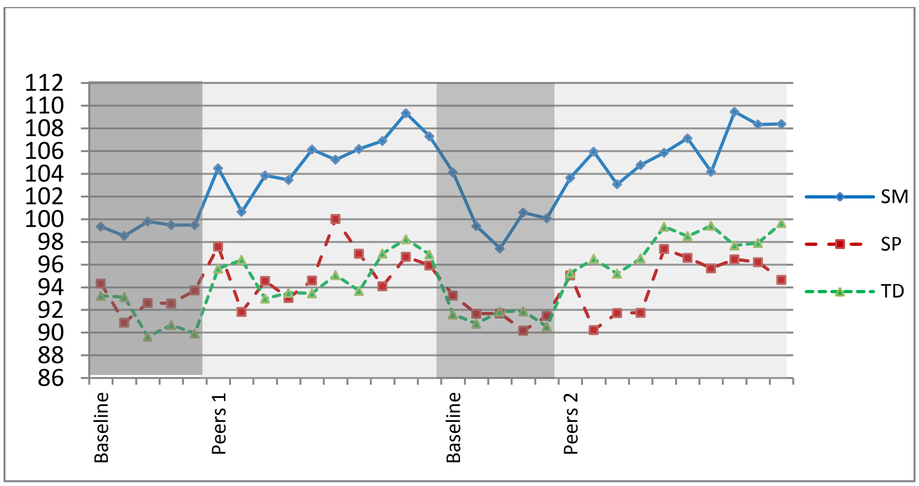

Figure 6: A-C-A-C Minute by Minute HR Data by Group

<u>A-B-A-B HR Results.</u>

Across all intervals (Figure 3), children with SM have elevated HR in comparison to the other groups. Although visual inspection of the graphs suggest that children with SP have lower heart rates in comparison to TD children, it is unlikely that this difference is actually significant across interactions. As expected, decreases in HR occurred for all children when strangers were absent. Minute by minute data (Figure 4) revealed the presence of HR deceleration (an orienting response) within the first 3 minutes of both adult interactions, with the exception of children with SM during the second adult interaction. Peak arousal occurred earlier for all three groups during the second adult interaction relative to the first.

A-C-A-C HR Results.

Similar to results found for A-B-A-B data, children with SM have elevated HR in comparison to other children when interacting with unfamiliar peers. Children with SP show lower HR and values that are more consistent with those exhibited by TD children. Decreases in HR for all three groups occur when peers are absent; however the decrease is greater and more prominent for children with SM (Figure 5). Minute by minute data (Figure 6) revealed that all three groups exhibit an orienting response within the first 3 minutes of the first peer interaction. This is also evident for children with SP during the second peer interaction but is less prominent for children with SM and TD children. In addition, children with SM and TD children show gradual increases in HR with peak arousal occurring toward the end of both interactions. Children with SP show peak arousal earlier in both segments that gradually decreases for the remainder of the interaction. Children with SM and SP appear to show greater variability in HR relative to TD children (see Appendix B for HR ranges).

Skin Conductance Level.

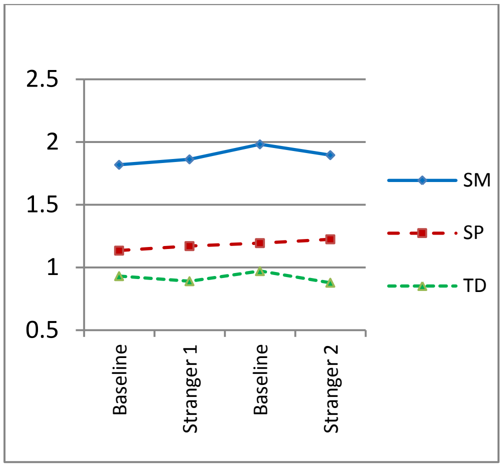

Figure 7: A-B-A-B SCL Averages by Group

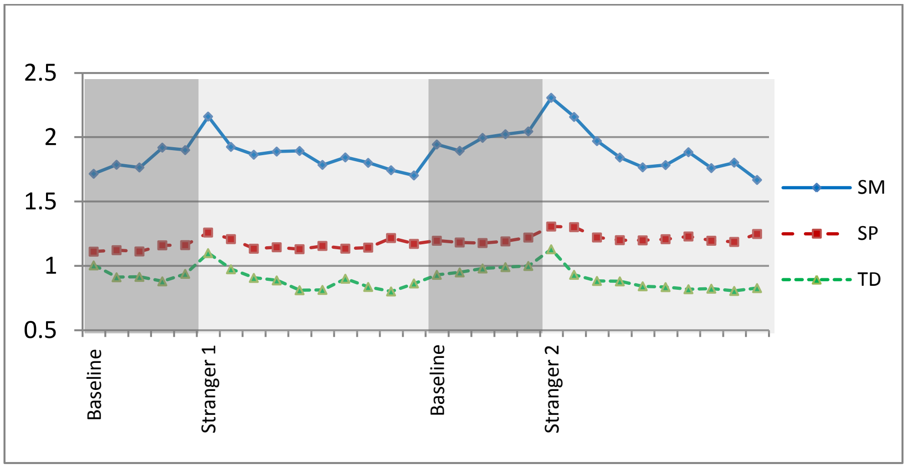

Figure 8: A-B-A-B Minute by Minute SCL Data by Group

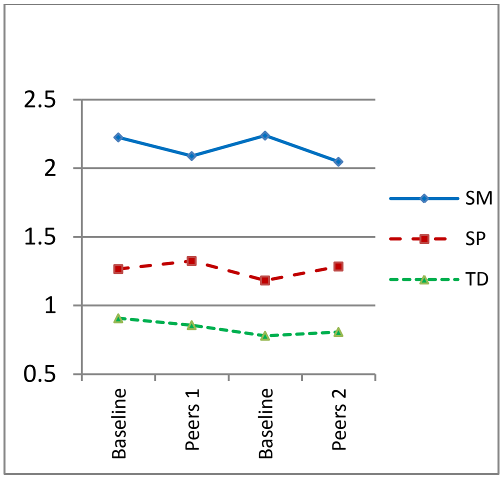

Figure 9: A-C-A-C SCL Averages by Group

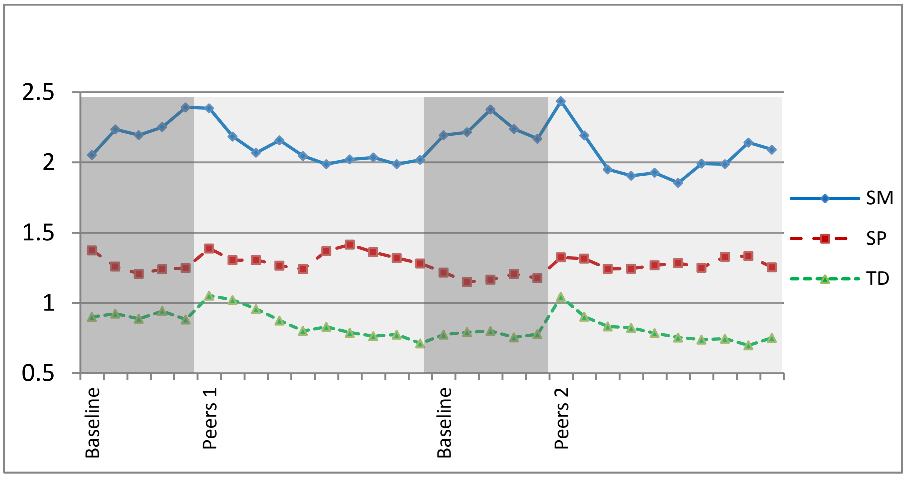

Figure 10: A-C-A-C Minute by Minute SCL Data by Group

A-B-A-B SCL Results.

Figure 7 demonstrates that, similar to HR data, children with SM show elevated SCL in comparison to other children and children with SP show minimally elevated SCL relative to TD children. Minute by minute data (Figure 8) demonstrates increases in sympathetic activity, indicative of an orienting response, for all three groups upon task initiation, albeit minimally so for children with SP. For children with SM, decreases in SCL occur during both interactions with a greater and more rapid reduction in SCL during the second adult interaction. SCL remains relatively stable during and across interactions and baseline segments for children with SP. TD children exhibit a deceleration in SCL during both interactions but with less variability (refer to Appendix B for ranges) relative to children with SM.

<u>A-C-A-C SCL Results.</u>

Similar to A-B-A-B results, children with SM show elevated SCL in comparison to other children and decelerations in SCL during both interactions with peers (Figure 9). Minute by Minute data (Figure 10) shows greater and more rapid reduction in SCL during the second interaction. Children with SP show elevated and stable SCL relative to TD children who exhibit the lowest overall SCL (Figure 9) and gradual decelerations in SCL during peer interactions (Figure 10). All three groups of children exhibit increases in SCL upon task initiation. Figure 9 also shows an interesting difference between groups such that children with SM and SP exhibit an increase and decrease in SCL respectively between interaction segments. This difference was also found between adult interactions for children with SM (Figure 7). Lastly, with the exception of the second peer interaction, children with SM show greater variability in SCL relative to children with SP and TD children (see Appendix B for SCL ranges).

Skin Conductance Resistance.

Due to the nature of the Wii task, non-event related SCRs may reflect both arousal and physical movement. Thus, non-event related SCRs are analyzed during baseline segments only and presented in Figure 11.

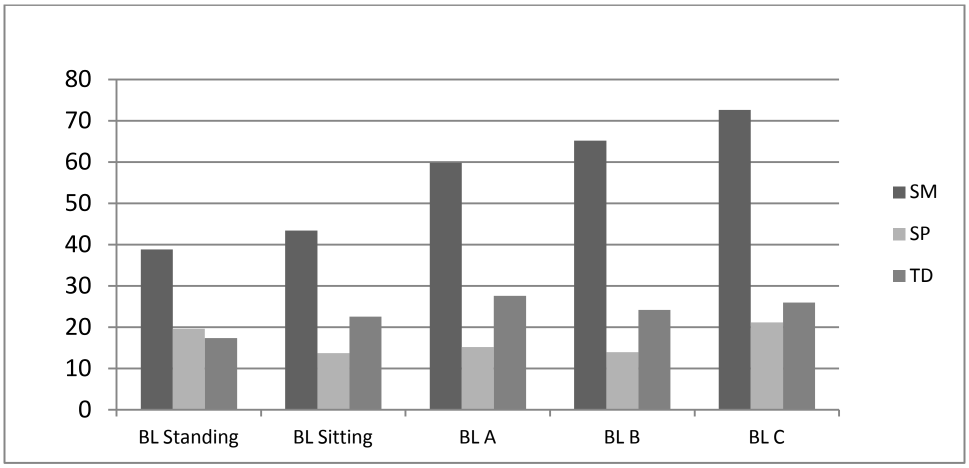

Figure 11: Non-event Related SCRs during Baseline Segments

SCR data during baseline segments revealed that children with SM show consistently more non event-related SCRs than other children. Individual differences within groups are also apparent and depicted in Appendix C.

Event-related SCRs were defined as an increase in SCL that occurred within 5 seconds of a specified event (task initiation and a standard set of 12 questions asked by the unfamiliar adults) with a magnitude of at least .05 μS. Data revealed that children with SM exhibit more ER-SCRs (23) with a higher average magnitude (0.159 μS) relative to children with SP (total ER-SCRs = 6; average magnitude = 0.039 μS) and TD Children (total ER-SCRs = 13; average magnitude = 0.111). Individual differences regarding which questions and tasks elicited ER-SCRs are presented in Table 7. Individual and group data for non-event and event related SCRs are presented in Appendices C and D, respectively.

Table 7: Event-related SCRs by Group

	Play?	Q1 - Closed	Q2 - Closed	Q3 - Closed	Q4 - Open	Q5 - Open	Play?	Q6 - Closed	Q7 - Closed	Q8 - Open	Q9 - Closed	Q10 - Open	F Adult	M Adult	Peers 1	Peers 2	**Total**	**Average Magnitude**
SM	1	1	2	2	1	1	1	4	3	3	0	2	1	1	0	0	**23**	**0.159**
SP	0	2	0	0	0	0	0	0	1	0	1	1	0	0	0	1	**6**	**0.039**
TD	2	2	0	0	2	1	1	0	0	0	2	0	2	1	0	0	**13**	**0.111**

Respiratory Sinus Arrhythmia.

Resting RSA and directional changes in RSA reflect different physiological processes. Resting RSA is typically derived during initial baseline segments. Because differences in RSA are related to position, Figure 12 offers resting RSA values for all three groups while standing and sitting prior to any social interactions.

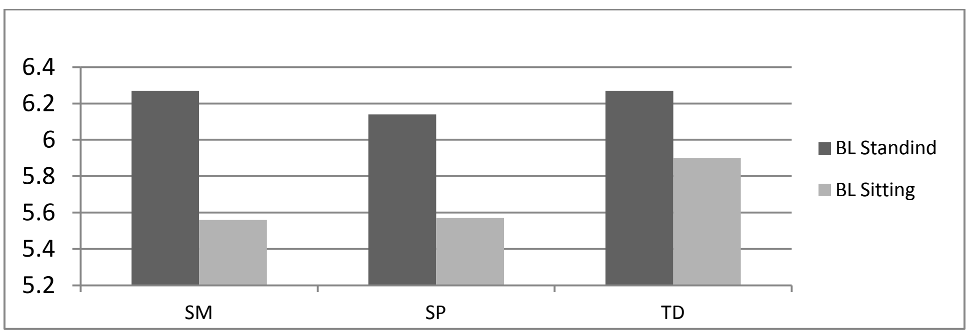

Figure 12: Resting RSA by Group and Position

All three groups exhibited higher resting RSA while standing compared to sitting. While standing, RSA values are similar across groups (SM = 6.27Hz, SP = 6.14 Hz, TD = 6.27 Hz). When sitting, children with SM and SP exhibit similar resting RSA (5.56 Hz and 5.57 Hz, respectively) that is slightly lower than TD children (5.9 Hz). All three groups of children were aware of the social tasks in which they were about to participate. Thus, resting RSA values were likely influenced by anticipatory anxiety. In addition, differences found while sitting are minimal and should be interpreted cautiously. The following graphs display RSA averages and minute by minute RSA regulation between and within interaction segments. Initial baseline values reflect the segment directly prior to the interaction.

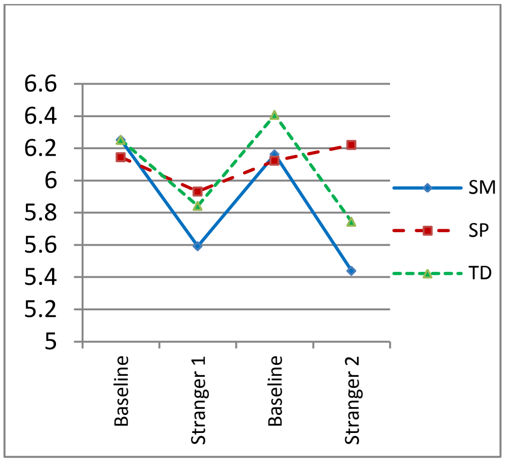

Figure 13: A-B-A-B RSA Averages by Group

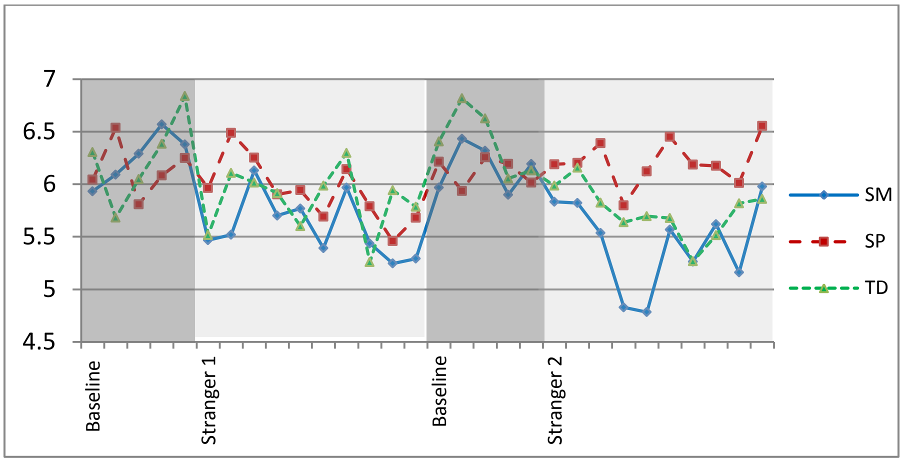

Figure 14: A-B-A-B Minute by Minute RSA Data by Group

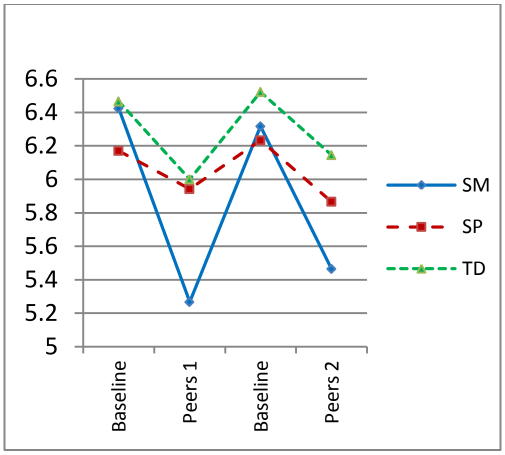

Figure 15: A-C-A-C RSA Averages by Group

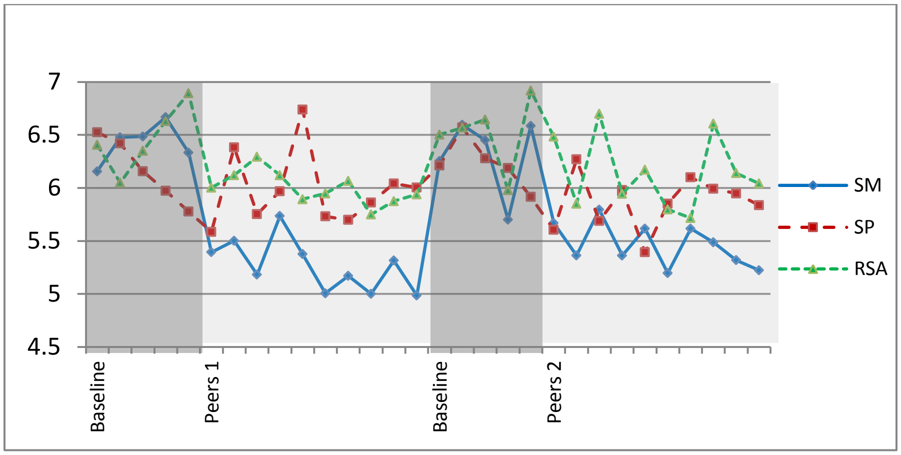

Figure 16: A-C-A-C Minute by Minute RSA Data by Group

<u>A-B-A-B RSA Results.</u>

Overall, Figure 13 demonstrates that children with SM show lower RSA averages across interactions in comparison to other children. Children with SM and TD children exhibit a similar pattern of RSA decreases during interaction segments. Children with SP exhibit this pattern of vagal withdrawal during the first adult interaction but an opposite reaction (RSA acceleration) during the second interaction. The magnitude of vagal withdrawal is greater for children with

SM in comparison to children with SP and TD children during both adult interactions. RSA averages and magnitude of RSA changes are presented in Table 8. Fluctuations in RSA, as noted in Figure 14, occur for all three groups throughout interaction segments without any discernible trends noted.

ACAC RSA Results.

Figure 15 demonstrates that, with the exception of the baseline segment prior to the first peer interaction, children with SM show lower RSA averages across interactions in comparison to other children. All three groups exhibit similar patterns of vagal withdrawal during interaction segments; however children with SM exhibit reductions greater than twice that exhibited by TD children. Large changes in RSA magnitude indicate excessive vagal withdrawal for children with SM. RSA averages and magnitude of RSA changes are presented in Table 9. Similar to A-B-A-B data, fluctuations in RSA occur for all three groups throughout interaction segments, as noted in Figure 16, without any discernible trends noted.

Table 8: A-B-A-B RSA Averages and Magnitudes of Vagal Withdrawal

	Baseline	Adult 1	Magnitude	Baseline	Adult 2	Magnitude
SM	6.252	5.592	- 0.66	6.162	5.439	- 0.72
SP	6.144	5.932	- 0.21	6.123	6.221	+ 0.10
TD	6.252	5.842	- 0.41	6.407	5.744	- 0.66

Table 9: A-C-A-C RSA Averages and Magnitudes of Vagal Withdrawal

	Baseline	Peers 1	Magnitude	Baseline	Peers 2	Magnitude
SM	6.424	5.267	- 1.16	6.317	5.465	- 0.85
SP	6.170	5.942	- 0.23	6.233	5.867	- 0.37
TD	6.466	6.000	- 0.47	6.522	6.145	- 0.37

DISCUSSION

The current study sought to determine if lack of speech, found in children with SM, functioned as an avoidance strategy to decrease physiological arousal during social interactions. Two carefully controlled social situations (a) an unfamiliar adult and (b) two unfamiliar peers allowed for examination of situational demands on behavior and physiology. The results revealed distinctive patterns between and within groups that have potential implications for the conceptualization and treatment of children with SM and SP. Furthermore, temporal sequencing of behavioral and physiological responses highlights the need to use a multi-dimensional approach to understanding this complex behavior.

Behavioral Results

The behaviors exhibited by children with SM and SP are consistent with previous research; children with SM display more affective and behavioral deficits relative to children with SP and TD children (Yageneh et al., 2003). Unlike previous investigations that were dependent upon role play tasks, this investigation used a more naturalistic social interaction – playing the Wii. The results indicated that children with SM exhibit more hesitancy to engage in social interactions (joining play), take longer to begin playing, and are more likely to play physically separated from an unfamiliar adult and unfamiliar peers. Latency to play resulted in a less time engaged in the social interaction (time spent playing), over 6 minutes less for children with SM in comparison to TD children. Latency to join play was particularly longer for one child with SM, however, suggesting the need to interpret averages cautiously. Children with SP exhibited behavioral deficits similar to children with SM but less frequently and less severely.

Although children with SP appeared apprehensive, they joined play more quickly resulting in more time spent playing (over 3.5 minutes more than children with SM). This reluctance to engage may be considered an avoidance strategy that most likely functions to decrease distress and appears functionally useful when physically "fleeing" from a social situation is not an option. Because children with SM are often overlooked (Standart & Couteur, 2003; Viana et al., 2009) early recognition of these maladaptive play behaviors may identify these children earlier, preventing further disruption in the development of social skills and relationships.

With regard to communication, only one SM participant spoke (during the adult interactions) and covered her mouth as she responded with brief 1-3 word responses. More frequently, children with SM stared at the adult and did not verbally respond. Although children could not be interviewed regarding the reason for the stare, this type of behavior is often viewed by others as "defiant" in nature (Beidel & Turner, 2007). It is also possible that eye contact without accompanying vocal expression may be used as a behavior by which to end the social engagement by the other individual. Responding with direct eye contact indicates that the verbal communication was heard but coupled with a lack of speech results in an unsatisfactory social interaction, decreasing the likelihood that further interaction will occur. Thus, this pattern of behavior may represent an active strategy on the part of the child with SM to effectively eliminate/end social interaction. Although verbal responses were not coded with peers, a similar behavioral pattern was noted to occur following peer engagement attempts. Additionally, although children with SP were more verbally communicative than children with SM, speech was often prompted (as opposed to spontaneous) and brief in nature. This was in stark contrast of TD children who were observed to actively engage peers and adults spontaneously and with lengthy responses. Patterns of verbal responding in this investigation are consistent with previous research demonstrating that children with SM are more likely to interact with others non-verbally (Yageneh et al., 2003), whereas children with SP may communicate but under marked distress. For example, Beidel and colleagues (1991) found that, when placed in a distressing social situation, many children with SP report "doing what I was supposed to." One unique difference between children with SM and SP may therefore reflect perceptions regarding the degree of self-involvement regarding speech behavior. This is important to consider as perceptions of self-involvement (and imminent threat) may result in a different emotions (e.g., fear) that may in turn influence physiological responding (Barlow 1991; Craske 1999; Kreibig, 2010).

Raters blinded to group status perceived children with SM as affectively flat, anxious (e.g., behavioral indicators such as hesitancy during play, biting nails, covering mouth), and almost always restricted in movement and social engagement. Children with SP exhibited the same behavioral deficits (including more frequent ratings of restricted movement) but were more affectively reactive and engaged than children with SM. Although children with SP were more engaged and responsive, they still displayed behaviors consistent with commonly observed behavioral responses of children with SP (e.g., stuttering, poor eye contact, mumbling, trembling voice, and nail biting; Albano, DiBartolo, Heimberg & Barlow, 1995).

It is important to note that children with SM are often perceived as more anxious than children with SP and controls (e.g., Bergman, Piacentini, & McCracken, 2002; Cunningham, McHolm, Boyle, & Patel, 2004; Kristensen, 2001). Discrepancies exist (e.g., Anstendig, 1999), however, and have been suggested to occur secondary to skewed perceptions related to the fact that these children are not speaking (Yageneh et al., 2003). In other words, a lack of affective reactivity and speech may lead raters (and parents, teachers, and clinicians) to perceive that these children are highly anxious.

Collectively, behavioral results suggest a continuum of affective and behavioral responses such that children with SM exhibit more frequent and severe deficits relative to children with SP and TD children. Based upon blinded ratings, children with SM do in fact appear frozen with fear. Although deficient behavioral response patterns occur for both groups across all four social situations, the severity and frequency of deficits, coupled with the behavior of not speaking appears to have an additional disruptive effect on peer interactions, and as noted above, perhaps peer *reactions*. Although behavioral results offer important trends and patterns of responding for all three groups; however, definite conclusions cannot be made based upon observational and self-report data alone. As such, physiological data are presented (with consideration of situational demands) followed by an examination of the temporal sequencing of behavioral and physiological responding.

Patterns of Physiological Response to Stressful Social Interactions

The first aim of the study was to determine if children with SM have overall elevated physiological arousal relative to children with SP and TD children. Across baseline and social interaction tasks, children with SM showed elevated arousal (both HR and SCL) and emotional reactivity (SCRs) relative to other children. RSA averages across interaction and baseline segments are consistently lower for children with SM. These lower averages, relative to other children, suggests a temperamentally related predisposition to poor emotion regulation and lessened preparedness to respond during distressful social situations. Vagal withdrawal at task initiation and during interaction segments is similar to that shown by TD children but greater in magnitude. As discussed below, while each measure of arousal offers important physiological information, patterns of responding appear to offer important additional information regarding emotional arousal in relation to emotion regulation strategies observed. The following graphs illustrate patterns of physiological responding exhibited by each group of children. HR, SCL, and RSA are presented as z scores for ease of interpretation.

Patterns of Responding for Children with SM.

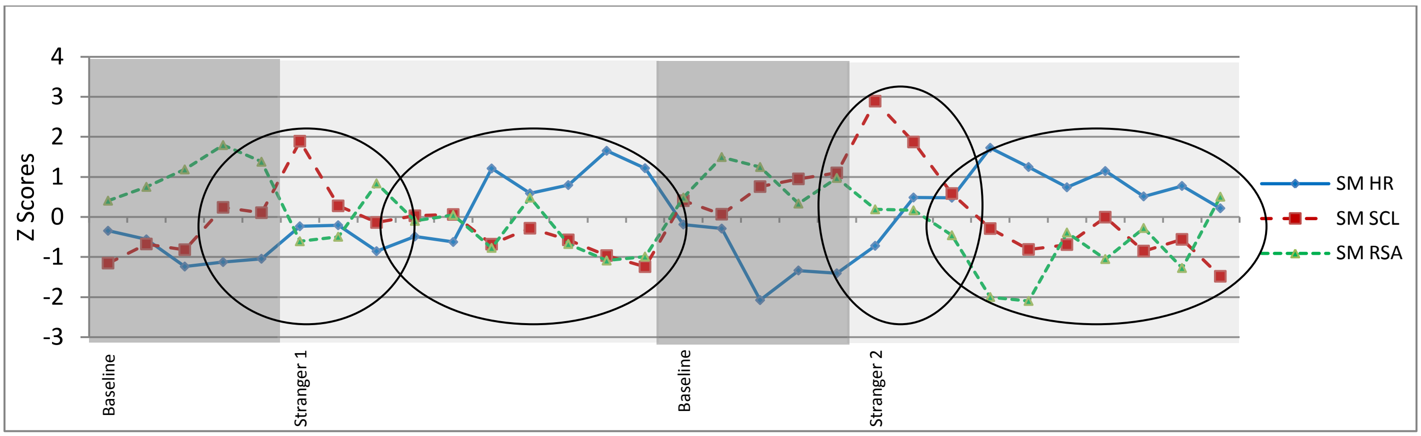

Figure 17: A-B-A-B HR, SCL, and RSA Z Scores for Children with SM

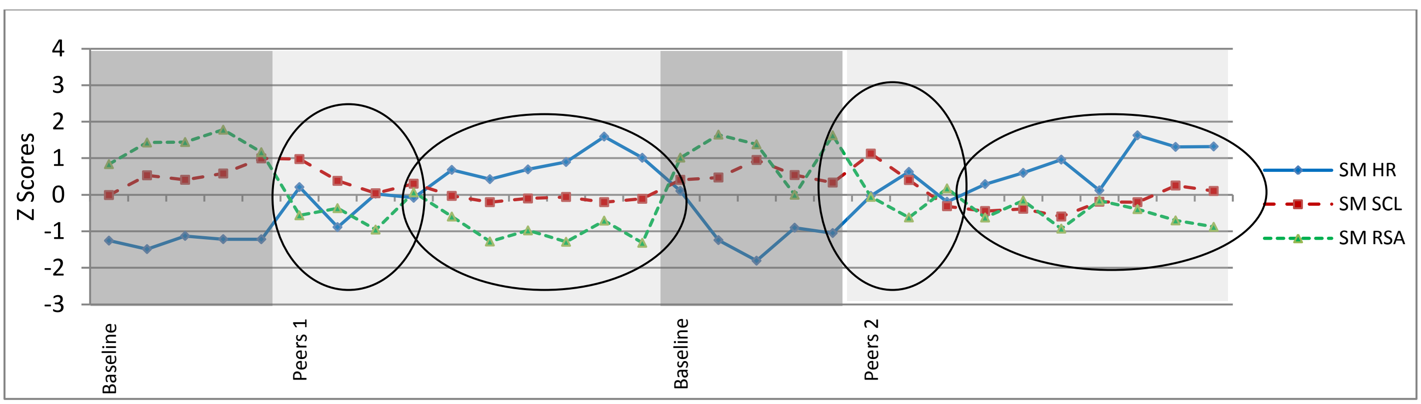

Figure 18: A-C-A-C HR, SCL, and RSA Z Scores for Children with SM

Orienting responses (OR) to potentially threatening situations are typically characterized by HR deceleration and increased sympathetic activity (Lang et al., 2000; Schauer & Elbert, 2010). In the current study, children with SM appear to undergo this period of attentive immobility (Schauer & Elbert, 2010) or "fear bradycardia" (including motor inhibition and increased attentional focus to threat; Campbell, Wood, & McBride, 1997) upon task initiation with the first stranger and first peer interaction. Opposite trends of HR acceleration and SCL deceleration shown during the second adult and peer interactions suggest that this period of threat evaluation is skipped (perhaps because the child recognizes the replication of the situation). The children immediately exhibit an alarm response. This type of response has been found for individuals with PTSD noted to have a hypersensitive alarm system (Rauch et al., 2000). Overall arousal levels (HR and SCL) found for children with SM support the possibility that heightened arousal predisposes these children to be particularly sensitive and reactive to social situations. Markedly restricted affect, movement and engagement, coupled with lack of speech suggests that, not only do these children skip an OR (preventing the opportunity to more accurately perceive the social situation as safe; Porges, 2004) but also skip the flight or flight phase of mobilization. Instead, it may be that the arousal levels of children with SM are so great, that they experience panic and enter the freeze phase characterized by tonic immobility (Schauer & Elbert, 2010).

Patterns of physiological responding following task initiation revealed that, when interacting with adults, children with SM experienced peak arousal earlier during the second interaction with reductions in both HR and SCL that typically indicate relief (Berntson et al., 2007; Kreibig, 2010). Similar trends were found with peers; however peak arousal (HR) occurs more gradually in both interactions without noticeable relief. This difference in patterns may be the result of threat appraisal and situational demands. For example, when first interacting one-on-one with an adult, children with SM may perceive the situation as threatening, but find that avoiding speech eliminates further attempts at interaction, resulting in physiological and subjective relief. When the situation is presented a second time, the avoidant response and reduction in distress occurs more quickly. In contrast, with peers, the additional social demands (e.g., play negotiation, performance, possibility of peer rejection, and uncertainty regarding peer reactions) may result in a more persistent state of general arousal (HR acceleration) and focus on threat. A trend of SCL increases noted to occur at the end of the second peer interaction may further implicate the presence of persistent social demands and a lack of success when utilizing lack of speech.

Across interaction and subsequent baseline segments, lower resting RSA and persistently lower RSA averages for children with SM indicate an overall lessened preparedness for action and emotion regulation (Porges, 2003). Because decreases in SCL have been noted to reflect a decreased need for motor preparation (Porges, 2003) considering both of these measures in tandem suggests that a predisposition to poor emotion regulation and action preparedness (RSA) may inhibit appropriate mobilization responses (e.g., increased SCL in response to perceived threat). The possibility that children with SM are in a state of panic may also be related to an innate tendency for emotional lability and reactivity. This is further supported by SCR results that indicated markedly greater non event-related SCR during baseline segments and more ER-SCRs exhibited in response to adult questioning, relative to other children.

In addition to a predisposition to poor emotion regulation, RSA results suggest that children with SM may experience excessive vagal withdrawal (Beauchaine, 2001). For example children with SM and TD children show similar patterns of vagal withdrawal, but children with SM also exhibit markedly higher general arousal (elevated HR and SCL), more SCRs and greater HRV. That the magnitude of RSA change is larger when interacting with peers versus adults may further implicate the unique social demands of this situation. In contrast, vagal withdrawal exhibited by TD children may reflect optimal physiological responding, affording these children the ability to shift from overly focusing on their internal state to interact appropriately with unfamiliar adults and peers (Porges 2001, 2003). It also may be that because these children are not experiencing marked arousal or distress, the need for vagal withdrawal and HR modulation is less.

Taken together, children with SM appear to be hypersensitive to social situations and are quick to perceive them as threatening, particularly when the social pressure of responding verbally and avoiding rejection persists. Markedly heightened general arousal suggests that these children may experience panic like sensations, preventing the use of active defense mechanisms (i.e., fight or flight/mobilization) to lower arousal. As a result, lack of speech is utilized as a strategy to avoid the distressing social situations. Although restricted by the paradigm (adults did not continue to attempt social engagement if the child did not respond), it is likely that outside of the laboratory, the silence of children with SM is also met with few attempts to continue social interaction. Thus, via the principle of negative reinforcement, silence leads to an end of the social interaction, thereby strengthening this maladaptive behavior. It is likely that initial social experiences in which withholding speech is reinforced by decreased physiological arousal and subjective distress become a learned behavior. With regard to treatment, efforts to reduce physiological arousal, coupled with reinforcement for emitting any type of audible response may function as an initial step toward eliminating this behavior.

Patterns of Responding for Children with SP

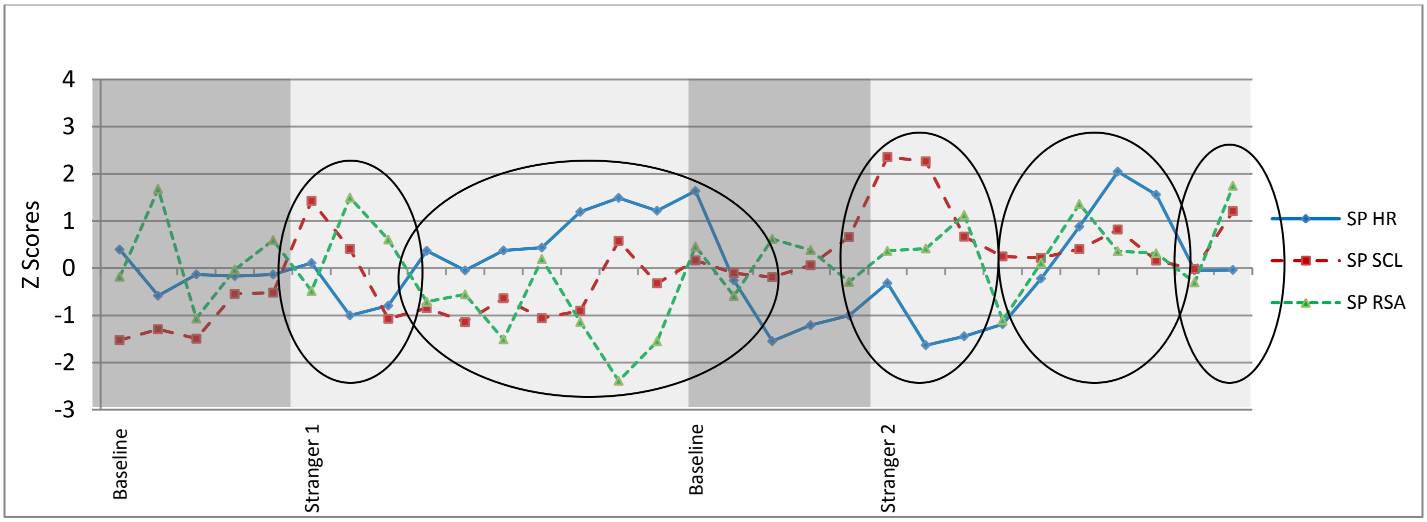

Figure 19: A-B-A-B HR, SCL, and RSA Z Scores for Children with SP

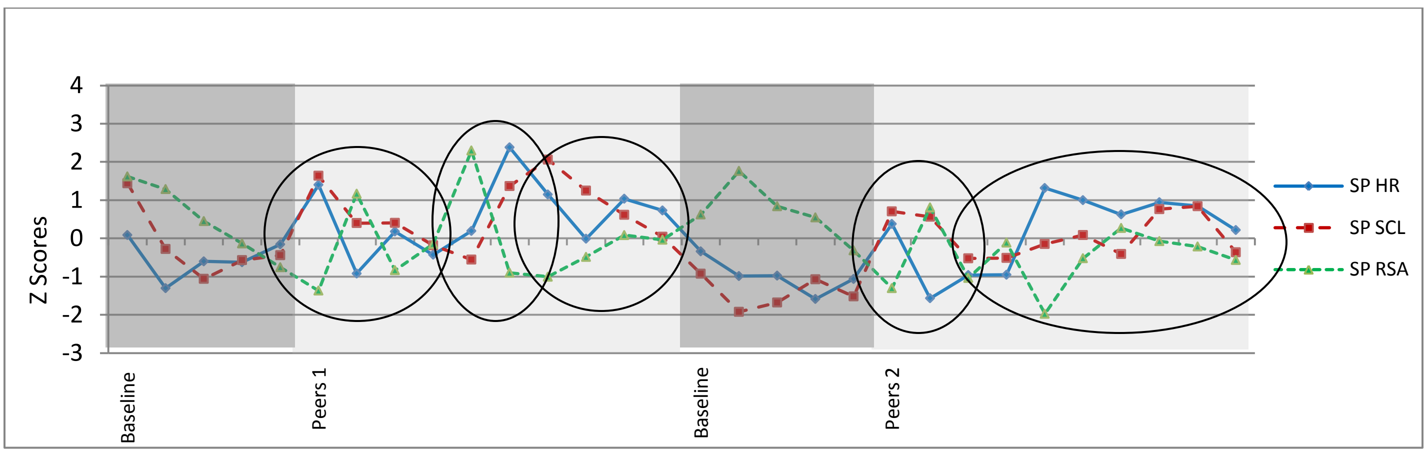

Figure 20: A-C-A-C HR, SCL, and RSA Z Scores for Children with SP

Overall, children with SP exhibit lower general arousal levels relative to children with SM but similar to that exhibited by TD children. Orienting responses characterized by HR deceleration and increased SCL (Lang et al., 2000; Schauer & Elbert, 2010) are exhibited during all four social interactions and appear to occur quickly. When interacting with adults, peak arousal (HR) occurs more quickly and drastically during the second interaction. Peak arousal occurs even earlier when interacting with peers and is followed by HR deceleration that typically indicates relief (Berntson, 2007). Whereas HR fluctuates in each interaction (although less in the first adult interaction), SCL tends to remain elevated but stable.

From this, it appears that children with SP perceive threat relatively quickly in each social situation. Elevated but minimal changes in SCL indicate an overall heightened emotional response but less reactivity. This is further supported by infrequent SCRs during baselines and few ER-SCRs in response to stranger questioning and task initiation. Quicker peak arousal found during peer interactions suggests that the unique social demands of the peer situation (e.g., negotiating game-set up and play, introductions, balancing interactions among two peers, and peer reactions) may be less distressing, particularly as the interaction progresses. For example, because the demands of the peer interactions are less focused on maintaining direct conversation, the social responses exhibited by children with SP (albeit impaired relative to TD children) are enough to "fit in" and avoid negative peer reactions. Thus, once play begins, children with SP may feel less pressured (than when interacting one on one with an adult) to interact socially – there is another interpersonal partner in the room.

RSA results suggest that children with SP exhibit slightly lower RSA values relative to TD children; however differences may be negligible. These children also exhibit vagal withdrawal during each interaction (with the exception of the second adult interaction) that is similar in magnitude, or less than that exhibited by TD children. From this, it may be that changes in RSA exhibited by children with SP do not actually reflect vagal withdrawal. Stable SCL across interaction segments and infrequent SCRs further indicate a lack of motor preparation and reactivity, respectively. For example, when the vagal brake is not disengaged, sympathetic activity is less (Porges, 2003), preventing appropriate behavioral responses that may alleviate distress (Calkins et al., 2007; Porges, 2004). This would make sense as these children exhibit impaired social skills across interactions. That HR acceleration, greater HRV and RSA increases are exhibited during the second adult interaction further supports this hypothesis and implicates poor RSA modulation (which has been found for individuals with anxiety, Movius & Allen, 2005).

Taken together, children with SP appear to perceive each social interaction as threatening, resulting in overall elevated arousal. Slightly lower resting RSA may place these children at risk for being less prepared to regulate emotions and respond in socially appropriate ways. Deficient vagal activity may further prevent the ability to self-soothe and modulate arousal resulting in impaired affective and behavioral responding. In contrast to children with SM, persistently elevated parasympathetic and sympathetic arousal is enough to elicit a defensive fight or flight response (i.e., impaired affective and behavioral responding) but not so extreme that it results in lack of speech.

Patterns of Responding for TD Children

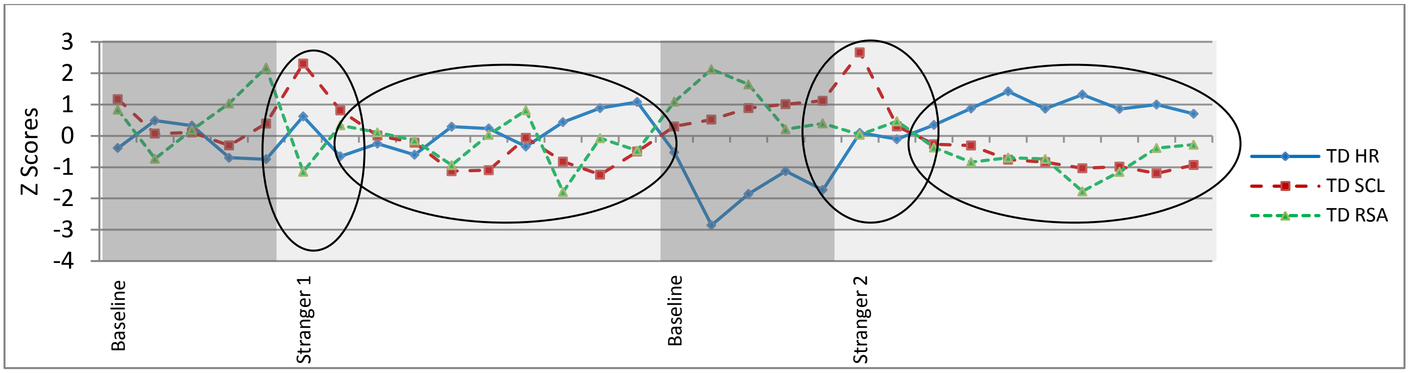

Figure 21: A-B-A-B HR, SCL, and RSA Z Scores for TD Children

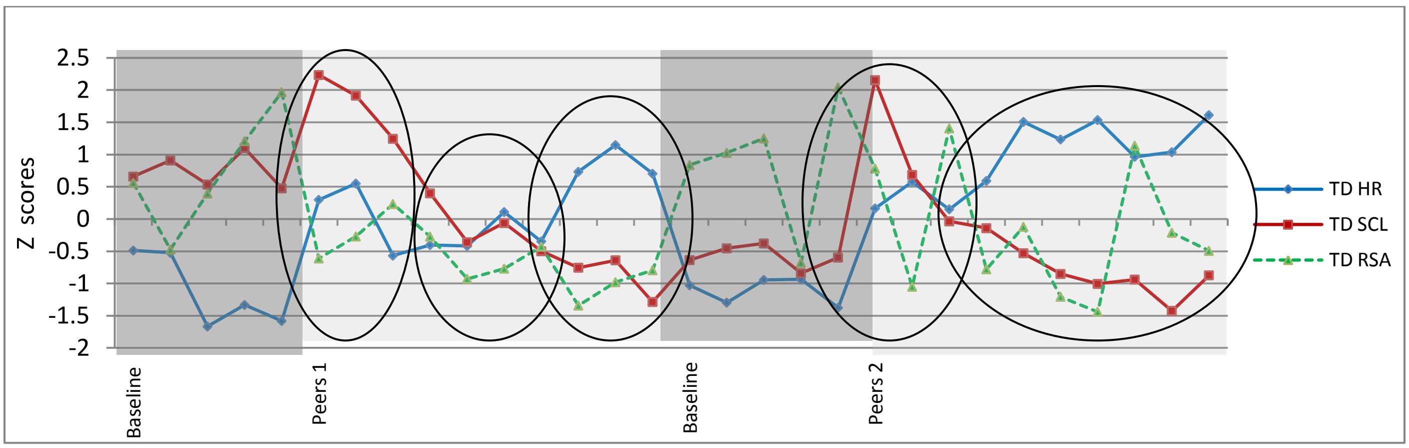

Figure 22: A-C-A-C HR, SCL, and RSA Z Scores for TD Children

TD Children exhibit an OR (SCL acceleration) upon task initiation during all four interactions that is brief in nature. Following an OR response, SCL decreases across all interactions indicating relief (Berntson, 2007) or that these children do not initially perceive the situation as threatening. Behavioral observations and self-reported SAM ratings indicate the latter. In addition, HR fluctuations are minimal and are likely the result of arousal induced by playing as well as physical movement. Vagal withdrawal is exhibited during all four interactions and suggests optimal physiological responding, affording these children the ability to shift from overly focusing on their internal state to interact appropriately with unfamiliar adults and peers (Porges 2001, 2003). It also may be that because these children are not experiencing marked arousal or distress and the need for vagal withdrawal and HR modulation is less.

Demand Characteristics of Social Interactions

The second aim of the study was to assess if the demands of the social encounter affect physiological arousal and behavior. It is important to note some differences in demand characteristics between the adult and peer interactions. In the adult situation, the target child was expected to engage with only one person; however, there was little pressure to start and maintain conversation, negotiate play set up, or avoid rejection. In addition, adults were instructed to ask a specified amount of questions regardless of the target child’s response. Thus, the main challenge of the adult situation was responding to questions and playing the Wii. In the peer situation, the target child was expected to engage with two unfamiliar peers. Thus, a number of additional social demands were present including play initiation, negotiation (setting up the game and choosing characters) and performance, and attempting to fit in with two other children to avoid rejection.

Within and between group differences in physiological responding were found such that interacting with one adult may be less distressing (or arousal is more easily lessened) for children with SM, whereas interacting with two peers may be less distressing and/or more easily handled for children with SP. Specifically, it appears that children with SM may utilize lack of speech as an avoidance strategy in both social situations but only find relief when interacting with an adult. Thus, the main social task of the adult situation (responding to questions) may be avoided to lessen arousal. Physiologically, as the perceived threat is removed, so is a need for motor preparation as indicated by decreases in SCL (Porges, 2001, 2003). It is also possible that a lack of response from the unfamiliar adult was physiologically relieving. In contrast, the additional social pressures (e.g., negotiating game-set up and play, introductions, balancing interactions among two peers), including unfavorable peer reactions, found when interacting with peers, may prevent the successful reduction of arousal. In addition, restricted engagement, affect, and movement coupled with a lack of speech may cause children with SM to “stand out” increasing self-awareness and maintaining arousal. In fact, patterns of responding are consistent with previous research that found SCL deceleration in paradigms including a stronger degree of self-involvement and threat imminence (Kreibig, 2010). Interestingly, these studies also observed immobilization behaviors in participants.

For children with SP, the demands of the adult situation (talking) are constantly present; their responses, albeit how minimal, are met with further verbal interaction from the interpersonal partner, thereby resulting in additional social exchanges. Persistently elevated parasympathetic and sympathetic arousal is enough to elicit a fight or flight response (i.e., inhibited social behaviors and stable SCL) but not so extreme that it results in a lack of speech. The fact that children with SP begin the interaction with heightened SCL but appear to experience some relief approximately ½ way through peer interactions suggests that their arousal may lessen once social roles and game rules have been established and the child is able to “fit in” with peers. Social pressures may also be lessened as the continuation of interacting and playing is not contingent upon their involvement. Although affective and behavioral responses are mostly similar across situations, individual observations suggest less anxiety and broader affect, movement, and engagement as interaction segments progressed. This was particularly noticeable during the second peer interaction and indicates that verbally communicating with others (albeit in a restricted manner) can be an effective strategy to minimize distress over time (i.e., habituation via exposure to the feared situation).

It is important to note that previous experiences likely influenced the differences found between children with SM and SP, particularly during peer interactions. As such, it is probable that the children with SP have had more social and verbal interactions resulting in less overall arousal and a greater ability to cope with distress. In contrast to children with SM, who withhold speech, eliminating additional attempts at social interaction, children with SP respond (and appear distressed when doing so), increasing the likelihood that the interaction will continue. For example, in the current study, peers often did not try to engage the children with SM and/or they gave up quickly when the child was unresponsive. One child was even taunted for not speaking (e.g., "can't you speak, why won't you speak?"). Following unsuccessful engagement attempts, play peers typically played and communicated with one another as the children with SM played separately and quietly. These reactions were not as apparent for children with SP, with the exception of one child who remained seated and separated from peers and both adults while playing. If replicated in a larger study, the reactions of unfamiliar peers may be an important consideration when attempting to understand how SM affects social interactions. Specifically, rather than simply reacting anxiously to verbal communication by others, lack of speech by children with SM may actually function to control the social encounter by punishing attempts to interact with non-response, thereby ending attempts at social interaction.

Lastly, individual response patterns also may result from variations in threat appraisal that elicit inappropriate defense strategies (e.g., withholding speech and other socially deficient behaviors) in safe environments (Porges, 2004). Although the number of children in the current investigation was too small to specifically examine the effects of such demand characteristics, future investigations, using larger sample sizes could determine which situation creates more distress for each individual and examine physiological response accordingly.

Temporal Sequencing of Behavioral and Physiological Responding

The third aim of the study was to assess the temporal sequencing of behavioral and physiological responses to determine if lack of speech functions as an emotion regulation strategy for children with SM. That children with SM exhibit markedly elevated parasympathetic and sympathetic arousal persistently throughout the day suggests that behavioral responses are a function of heightened arousal and deficient regulatory systems. In addition, although children with SM and SP exhibit similar behavioral patterns, deficient affective and behavioral responding is more frequent and severe for children with SM suggesting that the additional distress and arousal experienced by children with SM may be one potential explanation as to why some children with anxiety do not speak in social situations. Lastly physiological relief and increased speech behavior was observed for children with SM during baseline segments when interacting with a parent only. In fact, most children with SM (and SP) spoke freely throughout baseline segments and were perceived by blinded raters as less anxious and restricted in affect and movement, supporting the hypothesis that lack of speech is a unique avoidance strategy utilized by children with SM when placed in inescapable social situations.

Although psychophysiological research for children with SM is relatively new, particularly the examination of patterns of physiological responding of children, theories of acute stress responding offer a solid foundation for basic interpretations in which to structure future research. For example, although children with SM and children with SP show elevated parasympathetic and sympathetic arousal, this coactivation is markedly elevated for children with SM and suggests a panic-like state that prevents or disrupts the activation of effective physiological and behavioral response systems (Porges 2003; Schauer & Elbert, 2010). In other words, when placed in an inescapable threatening situation, children with SM exhibited heightened physiological response which may be so severe as to disrupt or interfere with the activation of effective mobilization (Defense Cascade Model, Schauer & Elbert, 2010) and social engagement systems (Polyvagal Theory, Porges 1995, 2003). As a result, attempts to regulate arousal are excessive and primitive, resulting in immobility (e.g., little affective reactivity, movement and engagement, AND lack of speech). These children appear frozen with fear and in fact may be. Lack of speech leads to the social withdrawal of others, which then leads to decreases in physiological and social distress. Thus, bolstered by negative reinforcement (removal of a negative affective state), children with SM learn to use lack of speech to decrease arousal, with resulting relief, further strengthening the use of this maladaptive behavior. This pattern occurs with adults and peers but additional demands of the peer situation serve to maintain arousal and result in increased distress when not speaking is met with social disapproval.

The defense cascade model further implicates the importance of proximity for threat appraisal and subsequent reactivity (Schauer & Elbert, 2010). For example, flight or fight often occurs as proximity lessens, where immobility may result from a complete reduction of distance (Ogden, Minton, & Pain, 2006; Schauer & Elbert). Thus, the separation during play exhibited by children with SM and SP may reflect evolutionary mechanisms of biological responding techniques. That children with SM are more frequently separated (coupled with little affective and behavioral reactivity) further supports the notion that these children are in a panic-like state that results in primitive behavioral responses such as isolation and lack of speech.

Limitations and Directions for Future Research

This study was not without limitations. First, while physiological data is objective in nature, many factors can influence measures of arousal. For example, changes in HR may be related to general arousal elicited from playing, including movement required to play the game. Additional factors such as posture, age, and activity level can influence RSA, particularly resting RSA (Berntson, 2007). In addition, position varied between baselines and interactions segments such that most children sat during baselines and stood while playing. Future research may therefore benefit from keeping the position of the children and activity levels consistent. Additionally, it may be beneficial to allow time before engaging in play to disentangle arousal responses due to the social situation versus playing the game

Although children with SM exhibit markedly elevated arousal throughout the day, it is unclear the extent to which these children only experience this arousal in social situations. Future research may benefit from monitoring the arousal levels of these children at home to determine if persistently high arousal occurs outside of distressing social interactions. In addition, although the ambiguity of the peer situation was intentional, marked differences in communication between target children and play peers prevented a controlled environment conducive to the behavioral coding of communicative responses. Future research would therefore benefit from structuring this task so that communicative behaviors can be examined more directly.

Lastly, behavioral results may reflect rater biases that children with SM are more anxious secondary to their lack of speech. Future research may therefore benefit from additional observational data that does not include verbal behaviors; for example by removing the sound and only observing non-verbal behavior.

In summary, this is the first investigation to use multiple measures of physiology to examine patterns of physiological arousal. Also unique to the literature and paramount to this study is the examination of the temporal sequencing of behavioral and physiological responses in relation to the demands of two unique social situations. Based upon the results of this study, children with SM do in fact experience heightened arousal and emotional reactivity relative to other children and appear to utilize lack of speech as an avoidance strategy to reduce distress. Children with SP also experience chronic and persistently elevated emotional arousal but to a less frequent and severe extent relative to children with SM. Both groups exhibit deficits in vagal control as well as impaired social behaviors supporting the view that SM is characterized by anxiety and that social anxiety exists on a continuum with SM representing the severe end of the spectrum (Black & Uhde, 1995; Carbone et al., 2010).

APPENDIX A: BEHAVIORAL RESULTS WHEN INTERACTING WITH PEERS AND ADULTS

		Play Behaviors with Peers					
		Play Initiation		Latency & Time Spent Playing		Proximity	
		Hesitant	Spontaneous	Latency to Play	Time Spent Playing	Beside	Separated
SM	019 AV	1	1	50.44	1149.58	12.21	1129.79
	018 RR	2	0	36.20	1163.80	1163.80	0
	016 RF	2	0	37.00	1163.00	869.00	294.00
	015 AC	1	1	17.00	1130.00	328	855
	012 SP	2	0	23.00	1177.00	381	796
	TOTAL	**8**	**2**	**163.64**	**5783.38**	**2754.01**	3074.8
	%	**80.00%**	**20.00%**		**96.40%**	**47.20%**	**52.80%**
	Ave			**32.73**	**1156.68**	**550.80**	**614.96**
SP	017 JH	1	1	23	1177	1013	164
	011 RC	1	1	36	1164	763	401
	010 GO	1	1	46	925	781	373
	006 JDV	2	0	36	1164	0	1164
	001 PD	0	2	34	1166	531	635
	TOTAL	**5**	**5**	175	5596	3088	2737
	%	**50.00%**	**50.00%**		93.30%	53.00%	47.00%
	Ave			35	1119.2	617.6	547.4
TD	007 JS	0	2	32	1168	1168	0
	008 GP	0	2	15	1185	845	320
	009 LK	0	2	55	1136	962	183
	013 MH	1	1	34	1076	1076	0
	014 TB	1	1	47	1118	14	1139
	TOTAL	**2**	**8**	183	5683	4065	1642
	%	**20.00%**	**80.00%**		**94.70%**	**71.20%**	**28.80%**
	Ave			**36.6**	**1136.6**	**813**	**328.4**

		Play Behaviors with Adults					
		Play Initiation		Latency & Time Spent Playing		Proximity	
		Hesitant	Spontaneous	Latency to Play	Time Spent Playing	Beside	Separated
SM	019 AV	0	2	38.00	1162.00	382	780
	018 RR	2	0	76.40	1123.62	1176	0
	016 RF	2	0	47.20	1152.82	1152.8	0
	015 AC	2	0	33.27	1166.75	29	1137.7
	012 SP	2	0	466.00	734.00	566	589
	TOTAL	8	2	660.87	5339.19	3305.8	2506.7
	%	**80.00%**	**20.00%**		**89.00%**	**56.80%**	**43.20%**
	Ave			**132.17**	**1067.84**	**661.16**	**501.35**
SP	017 JH	0	2	22	1178	1080	95
	011 RC	0	2	26	1174	1174	0
	010 GO	2	0	77	1123	1063	117
	006 JDV	2	0	42	978	0	1001
	001 PD	0	2	85	1115	1115	0
	TOTAL	**4**	**6**	252	5568	4432	1213
	%	**40.00%**	**60.00%**		95.70%	78.60%	21.40%
	Ave			50.4	1113.6	886.4	242.6
TD	007 JS	1	1	20	1180	1180	0
	008 GP	1	1	42	1158	788	390
	009 LK	1	1	75	1125	942	183
	013 MH	0	2	16	1184	1184	0
	014 TB	1	1	39	1161	958	203
	TOTAL	**4**	**6**	192	5808	5052	776
	%	**40.00%**	**60.00%**		**96.80%**	**86.80%**	**13.20%**
	Ave			**38.4**	**1161.6**	**1010.4**	**155.2**

		Objective Codes - Peers							
		Affect		Anxiety		Movement		Engagement	
		Flat Affect	Not Flat	No Anxiety	Anxiety	Restricted	Appropriate	Restricted	Appropriate
SM	019 AV	11	9	0	20	9	11	20	0
	018 RR	17	3	6	14	20	0	19	1
	016 RF	19	1	11	9	20	0	20	0
	015 AC	2	18	2	18	16	4	19	1
	012 SP	19	1	9	11	20	0	19	1
	TOTAL	**68**	**32**	**28**	**72**	**85**	**15**	**97**	**3**
		68%	**32%**	**28%**	**72%**	**85%**	**15%**	**97%**	**3%**
SP	017 JH	6.00	14	18.00	2	20.00	0.00	9	11
	011 RC	7.00	13	20.00	0	20.00	0.00	19	1
	010 GO	1.00	19	16.00	4	20.00	0.00	8	12
	006 JDV	20.00	0	12.00	8	20.00	0.00	20	0
	001 PD	3.00	17	10.00	10	19.00	1.00	13	7
	TOTAL	**37**	**63**	**76.00**	**24**	**99.00**	**1.00**	**69**	**31**
		37%	**63%**	**76%**	**24%**	**99%**	**1%**	**69%**	**31%**
TD	007 JS	0	20	20	0	0	20	13	7
	008 GP	0	20	18	2	1	19	1	19
	009 LK	2	18	14	6	0	20	13	7
	013 MH	5	15	20	0	9	11	20	0
	014 TB	9	11	17	3	16	4	20	0
	TOTAL	**16**	**84**	**89**	**11**	**26**	**74**	**67**	**33**
		16%	**84%**	**89%**	**11%**	**26%**	**74%**	**67%**	**33%**

		Objective Codes - Adults							
		Affect		Anxiety		Movement		Engagement	
		Flat Affect	Not Flat	No Anxiety	Anxiety	Restricted	Appropriate	Restricted	Appropriate
SM	019 AV	15	5	7	13	12	8	20	0
	018 RR	12	8	7	13	20	0	19	1
	016 RF	18	2	8	12	18	2	19	1
	015 AC	2	18	1	19	13	7	18	2
	012 SP	19	1	6	14	20	0	20	0
	TOTAL	**66**	**34**	**29**	**71**	**83**	**17**	**96**	**4**
		66%	**34%**	**29%**	**71%**	**83%**	**17%**	**96%**	**4%**
SP	017 JH	14.00	6	16.00	4	20.00	0.00	7	13
	011 RC	17.00	3	14.00	6	18.00	2.00	19	1
	010 GO	0.00	20	14.00	6	17.00	3.00	3	17
	006 JDV	12.00	8	12.00	8	20.00	0.00	20	0
	001 PD	0.00	20	6.00	14	15.00	5.00	4	16
	TOTAL	**43**	**57**	**62.00**	**38**	**90.00**	**10.00**	**53**	**47**
		44%	**57%**	**64%**	**38%**	**90%**	**10%**	**53%**	**49%**
TD	007 JS	0	20	20	0	3	17	6	14
	008 GP	3	17	16	4	2	18	12	8
	009 LK	0	20	20	0	0	20	9	11
	013 MH	3	17	20	0	0	20	11	9
	014 TB	0	20	17	3	10	10	20	0
	TOTAL	**6**	**94**	**93**	**7**	**15**	**85**	**58**	**42**
		6%	**94%**	**93%**	**7%**	**15%**	**85%**	**58%**	**42%**

APPENDIX B: MINIMUM AND MAXIMUM VALUES FOR HR AND SCL

A-B-A-B and A-C-A-C HR Ranges						
	Interaction with Adult 1			Interaction with Adult 2		
	Min (interval)	Max (interval)	Range	Min (interval)	Max (interval)	Range
SM	102.02 (3)	110.097 (9)	8.08	102.46 (1)	110.34 (4)	7.88
SP	91.60 (2)	97.05 (9)	5.45	90.21 (2)	98.27 (7)	8.06
TD	95.69 (2)	101.14 (10)	5.45	97.40 (2)	102.24 (4)	4.84
	Interaction with Peers 1			Interaction with Peers 2		
	Min (interval)	Max (interval)	Range	Min (interval)	Max (interval)	Range
SM	100.65 (2)	109.34 (9)	8.69	103.08 (3)	109.46 (8)	6.38
SP	91.84 (2)	100.02 (6)	8.18	90.23 (2)	97.38 (5)	7.15
TD	93.01 (3)	98.25 (9)	5.24	95.21 (3)	99.67 (10)	4.46

A-B-A-B and A-C-A-C SCL Ranges						
	Interaction with Adult 1			Interaction with Adult 2		
	Min (interval)	Max (interval)	Range	Min (interval)	Max (interval)	Range
SM	1.70 (10)	2.16 (1)	.46	1.67 (10)	2.30 (1)	.63
SP	1.13 (5)	1.26 (1)	.13	1.19 (9)	1.31 (1)	.12
TD	0.80 (9)	1.01 (1)	.21	0.81 (9)	1.13 (1)	.32
	Interaction with Peers 1			Interaction with Peers 2		
	Min (interval)	Max (interval)	Range	Min (interval)	Max (interval)	Range
SM	1.99 (6)	2.39 (1)	.40	1.85 (6)	2.44 (1)	.59
SP	1.24 (5)	1.42 (7)	.18	1.24 (3)	1.33 (9)	.09
TD	.71 (10)	1.05 (1)	.34	.070 (9)	1.04 (1)	.97

A-B-A-B and A-C-A-C RSA Ranges						
	Interaction with Adult 1			Interaction with Adult 2		
	Min (interval)	Max (interval)	Range	Min (interval)	Max (interval)	Range
SM	5.29 (10)	6.13 (3)	.84	4.78 (5)	5.98 (10)	1.2
SP	5.46 (9)	6.45 (2)	.99	5.80 (4)	6.55 (10)	.75
TD	5.26 (8)	6.30 (7)	1.04	5.27 (7)	6.16 (2)	.89
	Interaction with Peers 1			Interaction with Peers 2		
	Min (interval)	Max (interval)	Range	Min (interval)	Max (interval)	Range
SM	4.99 (10)	5.73 (4)	.74	5.20 (6)	5.80 (3)	.60
SP	5.59 (1)	6.74 (5)	1.15	5.39 (5)	6.27 (2)	.88
TD	5.75 (8)	6.29 (3)	.54	5.72 (7)	6.70 (3)	.98

APPENDIX C: NON-EVENT RELATED SCRS DURING BASELINE SEGMENTS

		Non-event Related Individual Totals and Group Averages				
		BL Standing	BL Sitting	BL A	BL B	BL C
Selective Mutism	019 AV	40	49	63	77	93
	018 RR	29	48	59	75	61
	016 RF	24	24	47	58	74
	015 AC	77	67	100	85	107
	012 SP	24	29	30	31	28
	Average	**38.8**	**43.4**	**59.8**	**65.2**	**72.6**
Social Phobia	017 JH	31	20	7	7	1
	011 RC	8	6	15	19	21
	010 GO	25	21	35	30	57
	006 JDV	5	8	6	4	12
	001 PD	29		13	10	15
	Average	**19.6**	**13.75**	**15.2**	**14**	**21.2**
Controls	007 JS	28	31	64	19	2
	008 GP	6	23	15	25	34
	009 LK	5	10	3	5	7
	013 MH	32	33	41	47	68
	014 TB	16	16	15	25	19
	Average	**17.4**	**22.6**	**27.6**	**24.2**	**26**

APPENDIX D: ER-SCR TOTALS AND AVERAGE MAGNITUDES BY GROUP

		ER-SCR Totals and Magnitudes	
		# of ER-SCRs	**Average Magnitude**
Selective Mutism	019 AV	5	0.24
	018 RR	5	0.128
	016 RF	3	0.144
	015 AC	8	0.162
	012 SP	2	0.122
	Total	**23**	
	Average		**0.1592**
Social Phobia	017 JH	2	0.078
	011 RC	3	0.067
	010 GO	0	0
	006 JDV	1	0.052
	001 PD	0	0
	Total	**6**	
	Average		**0.0394**
Controls	007 JS	5	0.191
	008 GP	3	0.063
	009 LK	0	0
	013 MH	4	0.21
	014 TB	1	0.089
	Total	**13**	
	Average		**0.1106**

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