AFFECTIVE EXPERIENCES IN ADOLESCENTS WITH AUTISM: AN EMA STUDY

by

Keiran May Rump

Bachelor of Arts, State University of West Georgia, 2000

Master of Science, Villanova University, 2004

Submitted to the Graduate Faculty of

Arts and Sciences in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

University of Pittsburgh

2010

UNIVERSITY OF PITTSBURGH

ARTS AND SCIENCES

This dissertation was presented

by

Keiran Rump

It was defended on

November 19, 2010

and approved by

Celia Brownell, Professor, Department of Psychology

Susan B. Campbell, Professor, Department of Psychology

Carla A. Mazefsky, Research Assistant Professor, Department of Psychiatry

Jennifer S. Silk, Assistant Professor, Departments of Psychiatry and Psychology

Dissertation Advisor: Mark S. Strauss, Associate Professor, Department of Psychology

AFFECTIVE EXPERIENCES IN ADOLESCENTS WITH AUTISM: AN EMA STUDY

Keiran Rump, Ph.D.

University of Pittsburgh, 2010

Clinical consensus and a limited number of empirical studies indicate that the understanding, awareness, and expression of personal emotional experiences are atypical in individuals with autism; however, the exact nature and magnitude of the atypicality is unclear. The purpose of the current study was to gain a better understanding of how individuals with autism understand and describe their own emotional experiences. This study measured affective awareness and understanding in both the laboratory setting, and in the individual's natural environment using ecological momentary assessment. Nineteen individuals with autism (11-17 years old) and 19 typically developing controls, matched on age and IQ, completed an in-lab task asking them to describe causes of their emotions in addition to self-report measures of depression, anxiety, social skills, and alexithymia. Their parents completed corresponding parent-report forms. Following the lab visit, participants were contacted via cell phone for 14 consecutive days and were asked to rate a subset of emotions from the PANAS-C. Corresponding parent reports were collected for a random subset of these days. Results indicated that on the lab-based measure, the individuals with autism, in contrast to controls, had significantly more difficulty describing appropriate causal contexts for their self-conscious emotions. When reporting on their daily levels of affect, the individuals with autism, in contrast to controls, reported higher intensity negative affect and more lability in positive and negative affect. In comparison to parent report, there was some suggestion that the individuals with

autism, but not controls, were underreporting the intensity of their negative affect. For both groups, intensity and lability of negative affect were related to self-reported depression symptoms, but not to parent reports of child depression or self- or parent-reported anxiety symptoms. In addition, no measures of affective awareness and understanding were related to child or parent reported social skills. The current findings suggest that in adolescence, the manner in which individuals with autism understand, experience, and report on their emotional experiences differs from their typically developing peers in subtle yet notable ways. Potential mechanisms underlying these differences are discussed, and a number of future directions are suggested.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

This research was funded in part by a Dissertation Grant Award from the Society for a Science of Clinical Psychology, as well as an A. David Lazovik Research Award from the Department of Psychology at the University of Pittsburgh,

This project, and the successful completion of my PhD, would not have been possible without the continued professional and personal support of a number of people. First, I would like to thank my advisor, Mark Strauss, for his guidance over the years, the opportunities he provided that helped me refine my own interests, his enthusiasm for this project, and his support in bringing it to fruition. I am also grateful to my committee members, Drs. Celia Brownell, Sue Campbell, Carla Mazefsky, and Jen Silk, who contributed invaluable advice, insights, and assistance throughout the development and implementation of this project. My appreciation also goes to the parents and children who participated in this study. Thank you for allowing us into your lives for two weeks, for willingly giving of your time and energy, and for helping us to advance our understanding of autism spectrum disorders.

I must give special thanks to my lead research assistant, Shannon Hedges, and to all my other research assistants who gave countless day, night, and weekend hours in the name of calling participants, coding transcripts, and entering data; this project would have not been even remotely possible without you. I am eternally grateful for your commitment to this study. Thanks also to Sara Green and Kao-Wei Chau of the PEAS lab for coordinating my research

assistants during my year in Miami, and for always responding so gracefully to my frantic calls and e-mails. My gratitude also goes to my fellow labmate, Holly Gastgeb: your thoughtful feedback and infectious smile was always available when I needed them the most.

I cannot imagine completing this endeavor without the support of my friends and colleagues. I will always treasure my years in Pittsburgh for the people I have known and the friendships I have made. I am grateful to have been a part of each of your lives, to have shared in laughter and tears, and to have made this incredible journey together. I will never forget the late nights in Sennott Square, the celebrations at Point Brugge, and our growing realization that we were Steelers fans. I look forward to many reunions in the coming years.

To my family, thank you for your unwavering support during my graduate experience. Your perpetual enthusiasm and encouragement kept me motivated and reminded me why I entered this field in the first place. Finally, I would like to express my immeasurable appreciation for my husband, John. You have lived every moment of this experience with me and have made sacrifices every step of the way in the name of my graduate career. No words can express how much your support has meant to me. I would not be where I am today without you.

1.0 INTRODUCTION

Autism is a pervasive developmental disorder characterized by qualitative impairments in social interaction and communication, as well as the display of restricted, repetitive and stereotyped patterns of behavior, interests or activities (APA, 1994). Estimated by the Centers for Disease Control to affect approximately one in every 110 children in the United States (Centers for Disease Control, 2009), as yet, autism is a disorder which cannot be prevented and cannot be cured. Thus, it is imperative for researchers and clinicians alike to fully understand the nuances of this complex disorder in order to gain a deeper understanding of individuals with autism and of interventions that could aim to improve their quality of life.

In the earliest conceptualization of the disorder, "[an] inability to form the usual, biologically provided affective contact with people," was viewed as one of its primary features (Kanner, 1943). Since Kanner's first writings, numerous research studies have attempted to further elucidate the components of this complex syndrome. Kanner's original conceptualization has now been expanded, but "disturbances in affective contact" are still cited as a central feature of autistic impairment. Hobson (1990; 2005), echoing Kanner, argues that individuals with autism have an "emotional deficit," or an inability to relate affectively to others, which prevents them from fully grasping the concept of themselves and others as "subjects of experience" and ultimately contributes to a number of impairments associated with autism. Clinicians and parents are also keenly aware of such difficulties, and they often report that in daily interactions,

some of the more prevalent social challenges faced by individuals with autism are in their expression and understanding of emotions (Attwood, 1998; Capps, Kasari, Yirmiya, & Sigman, 1993; Hobson, 2004; Hobson, Chidambi, Lee, & Meyer, 2006).

A "disturbance of affective contact" or "emotional deficit" is not explicitly listed as a key characteristic of any of the three current overarching diagnostic criteria of autism, but it is probably best encompassed under a number of symptoms that comprise "impairments in social interaction," including "marked impairment in the use of nonverbal behaviors to regulate social interaction," as well as "a lack of social or emotional reciprocity" (APA, 1994). To understand this relatively ill-defined "emotional deficit" more clearly, however, there is utility in turning to pre-defined models in the normative developmental literature.

A number of skills are necessary to proficiently relate affectively to others. The developmental literature suggests that in order to become an effective social-emotional partner, a number of abilities must be mastered and then adapted to a constantly changing social environment. In effect, one must attain increasingly higher levels of *affective social competence.* Halberstadt, Denham, & Dunsmore (2001) define affective social competence (ASC) as, "the efficacious communication of one's own affect, successful interpretation and response to others' affective communications, and the awareness, acceptance, and management of one's own affect" (pg. 80). Thus, there are three basic components of ASC: sending affective messages, receiving affective messages, and experiencing affect. Within the three major components of affective social competence are four abilities, which the authors suggest develop sequentially: awareness, identification, working within a social context, and management and regulation. Halberstadt, et al. (2001) argue that to attain high levels of ASC, which in turn contributes to general proficiency in social interaction, one must become competent in all four abilities within each of the three components of ASC and must also be able to integrate each component effectively.

While typically developing children seem to acquire the skills for ASC naturally and apply them rather intuitively, the same cannot be said for individuals with autism. There is little doubt that individuals with autism are poor social-emotional partners (Bauminger, 2002; Church, Alisanski, & Amanullah, 2000). Their own emotional reactions can be unusual or inappropriate, and they often fail to react appropriately to the emotions of others (Attwood, 1998; Church, et al., 2000). To better understand these behaviors, the ASC model provides a concrete framework from which to begin systematically exploring the affective difficulties in individuals with autism.

1.1 AFFECTIVE SOCIAL COMPETENCE IN INDIVIDUALS WITH AUTISM

To date, the majority of research on ASC skills in individuals with autism has focused on "sending affective messages" and "receiving affective messages," with data indicating that they exhibit a variety of impairments in both of these components (for a review, see Begeer, Koot, Rieffe, Terwogt, & Stegge, 2008). Remarkably little work, however, has focused on the "experiencing affect" component of ASC.

This component of the ASC model encompasses not only the awareness that one is experiencing affect and the ability to identify the emotion being experienced and what caused that emotion, but it also includes the effective regulation of one's own emotional expression in the context of an ongoing social interaction (Halberstadt, et al., 2001). It is argued that awareness of one's affective state can be critical for successful social exchanges, as individuals who know what they are feeling are more able to verbalize what they want, indicate what their goals are, and negotiate conflict (Saarni, 2007). Additionally, research demonstrates that children who have a greater awareness and understanding of their own emotions demonstrate

fewer disruptive behaviors (Cook, Greenberg, & Kusche, 1994), are more accepted by peers (Cassidy, Parke, Butkovsky, & Braungart, 1992), and are rated by their parents as having higher social competence compared to children who are less aware of their emotional experiences (Custrini & Feldman, 1989). While *awareness* and *identification* of one's emotion has certainly been linked to positive social outcomes, there is also evidence that the ability to effectively *manage* one's emotional experience is associated with positive social functioning and higher ratings of social competence, both contemporaneously and across time (Eisenberg, 1997a, Eisenberg, 1997b, Murphy, Shepard, Eisenberg, & Fabes, 2004).

Not only does an awareness and ability to identify affect have implications for social functioning, but it is also has clinical relevance. Mood and anxiety disorders by definition have an impact on an individual's affective experience, and the ability to report on these affective states is important for diagnosis. There is a growing awareness of the high prevalence of mood and anxiety disorders in individuals with autism (Mazefsky, Kao, & Oswald, 2011; Leyfer, et al., 2006; Stewart, Barnard, Pearson, Hasan, & O'Brien, 2008; White, Oswald, Ollendick, & Scahill, 2009). Given that many of the diagnostic instruments used to screen for such disorders rely on the individual's self-report of affective experience, it is important to have a better understanding of how these individuals process and report on their affective experiences.

It is evident, then, that the "experiencing affect" component of ASC is highly relevant both to positive social outcomes and to the efficacious diagnosis of mental health issues, and thus it needs to be closely examined in individuals with autism in order to better understand their experiences and guide effective interventions.

Although limited, some research has addressed the awareness of individuals with autism of their own affective experiences and their abilities to identify their feelings and the causes of these feelings. Surprisingly, almost no work to date has examined the ability of individuals with autism to

manage their emotional experiences. To gain a deeper understanding of each of these skills in individuals with autism, further research is clearly warranted. The current study, however, focused on only the first two abilities of the "experiencing affect" component of ASC, namely, awareness of and identification of one's own affect.

In order to gain a clearer picture of the way in which individuals with autism experience and understand affect, it is helpful first to examine the literature from the perspective of how they understand others' emotions in order to contrast that to how they understand their own.

1.1.1 Awareness and Identification of Emotions in Others

Typically developing children begin to understand situations as causes of emotions by the time they are three years old, and by the age of six they demonstrate an understanding of how desires and beliefs can impact emotions (Denham, 1986; Hadwin & Perner, 1991; Harris, Johnson, Hutton, Andrews, & Cooke, 1989; Rieffe, Terwogt, & Cowan 2005). Although somewhat delayed, by the time individuals with autism reach a verbal mental age of six years, they are as successful as typically developing individuals at predicting how situations might induce basic emotions in another person (Baron-Cohen, 1991; Dennis, Lockyer, & Lazenby, 2000; Downs & Smith, 2004; Hertzig, Snow, & Sherman, 1989; Hobson, 1986a; Prior, Dahlstrom, & Squires, 1990), and by the time they reach a verbal mental age of seven, they are able to understand how desires might affect emotions in another (Baron-Cohen, 1991; Downs & Smith, 2004). Although there is evidence that individuals with autism have difficulty understanding emotions that are caused by beliefs (Baron-Cohen, 1991), it is possible that this is restricted to those individuals with a verbal mental age younger than seven, as by the time they reach a verbal mental age of nine, many individuals with autism are indeed able to pass first order theory of mind tasks, which would then facilitate an understanding of the relationship between beliefs and emotions (Happe, 1995).

While a number of studies indicate that individuals with autism can become quite adept at explaining what causes *basic* emotions in others, they seem to exhibit more difficulty with their understanding of *self-conscious* emotions, that is, emotions that require a sense of self and the ability to see oneself from the position of others, such as embarrassment, guilt, and pride (Lewis, Sullivan, Stanger, & Weiss, 1989). Their understanding of embarrassment in others is minimal; they tend to rate scenarios as embarrassing even when they clearly are not, and they provide poorer justifications than typically developing individuals for scenarios in which a protagonist is doing or saying something embarrassing (Hillier & Allinson, 2002). Embarrassment is not the only self conscious emotion for which they show limited understanding. Hobson, et al., (2006) presented individuals with autism and individuals with mental retardation with video vignettes in which the protagonist experienced pride, guilt, or embarrassment, and then asked them to explain what the protagonists were feeling. In general, both groups performed relatively poorly on this task. In both groups, about 25% of individuals were able to provide an account that related to pleasure in one's accomplishment for pride, and responsibility for a negative action for guilt. Only 16% of the individuals with autism and none of the individuals with mental retardation were able to provide accurate accounts of embarrassment. Hobson, et al. also reported that while there was no significant correlation between verbal mental age and performance for the individuals with mental retardation, in individuals with autism, verbal mental age was significantly positively correlated to accounts of guilt and embarrassment.

The findings on understanding emotion in others suggest that individuals with autism, although delayed, are able to perform successfully on tasks measuring their ability to understand basic emotions in others, although for emotions that require an understanding of an evaluation of self, their level of performance drops dramatically. It is important to note that the basic emotions are often induced by universal circumstances (e.g., sadness induced by loss, fear induced by threat of

safety) (Ekman, 2003). While typical children begin to understand these correlations through a natural process of observation, self-monitoring, and verbal feedback (Harris & Olthof, 1982), it is possible that children with autism, who might not learn about the world in the typical way, could begin to compensate by memorizing the 'rules' or prototypic examples of causes of emotion (e.g., people feel happy when it is their birthday; people feel sad when they lose something). While this "rote memory" strategy would allow them to eventually be successful on tasks in which they are asked to describe others' basic emotions, the strategy would be less effective with the self-conscious emotions, which require a strong self-evaluative component and are less explainable by universal circumstances. Additionally, this "rote memory" strategy would not provide them with the tools necessary to reflect upon and expound specific causes of their own emotions if they found themselves outside of the realm of prototypical emotion inducing circumstances. It is also interesting to note that performance on some of the more difficult tasks was related to verbal ability, but only for individuals with autism (Hobson, et al., 2006). It is possible, then, that they are using a verbally mediated compensatory strategy to "hack out solutions" and perform successfully on these tasks (while the individuals without autism who can perform the task are responding more intuitively). Again, while this strategy may be effective in lab tasks when one has to evaluate causes of emotions in others, it may be less effective when evaluating the causes of emotions in oneself, especially with regard to self-conscious emotions.

1.1.2 Awareness and Identification of Emotions in Oneself

While there has certainly been more work examining the understanding of others' emotions in individuals with autism, the work examining awareness and identification of affect in themselves has employed a broader scope of methodologies, primarily with children and adolescents, to address

these questions. Thus, while the limited number of studies makes the conclusions one can draw more tentative, the differing methodologies each begin to provide unique insights into how individuals with autism experience their own affect.

1.1.2.1 Awareness of on-line affect

One method for evaluating an individual's awareness of currently experienced affect is to induce affect, measure physiological reactivity, and at the same time ask the individual to report on his or her subjective experience. Skin conductance response (SCR) studies in children and adults with autism have all shown no significant differences in SCR between the individuals with autism and typically developing individuals when shown positively-valenced, negatively-valenced, and neutral pictures from the International Affective Picture System (IAPS) (Bolte, Feineis-Matthews, & Poustka, 2008; Shalom, Mostofsky, Hazlett, Goldberg, Landa, Faran, et al., 2006). Additionally, neither of the studies found dramatic differences between the two groups' simultaneous reports of affective experience (Bolte, et al., 2008; Shalom, et al., 2006). Of note, in one study adults with autism, despite similar SCR readings, reported significantly higher arousal than typically developing individuals when viewing neutral stimuli, suggesting the possibility of a disconnect between physiological reactivity and subjective experience in situations that typically developing individuals would classify as non-arousing (Bolte, et al., 2008).

In contrast to SCR studies, studies examining heart-rate response to affect-inducing situations in children and adults with autism indicate a differential physiological response to stressors in contrast to typically developing individuals. While the typically developing individuals experience an increased heart rate to stressors, individuals with autism showed little change from baseline. Interestingly, both groups reported similar levels of perceived distress

(Jansen, Gispen-de Wied, van der Gaag, & van Engeland, 2003; Jansen, Gispen-de Wied, Wiegant, Westenberg, Lahuis, & van Engeland, 2006). As with SCR studies, there again appears to be a lack of connection between the physiological experience of affect and the self-perception of experiencing that affect, and it also appears as if individuals with autism are reporting higher levels of affect than are indexed by their physiological responses.

These studies suggest that individuals with autism interpret their affective experience in ways that do not necessarily match their physiological experience. Without further work examining physiological reactions to emotion inducing stimuli and situations in this population, these findings are difficult to interpret, as it is not yet clear if they are misinterpreting their internal signals and "incorrectly" reporting their affective states, or whether a different pattern of physiological responses in comparison to controls creates the same subjective experience in individuals with autism. Some preliminary work indicates, however, that they may indeed have difficulty interpreting their affective states. On a self-report measure, adults with autism, in comparison to typically developing adults, indicated that they have difficulty identifying and expressing their feelings (Berthoz & Hill, 2005; Hill, Berthoz, & Frith, 2004). Unfortunately, no studies have examined whether this insight into their difficulties in identifying emotion is related to their performance on other emotion self-understanding tasks.

1.1.2.2 Identification of causes of emotions in oneself

Of the studies that have examined individuals with autism's understanding of their own emotions, the majority have asked high functioning children with autism to report on whether they had experienced specific emotions and what had made them feel that way (Bauminger, 2004; Bauminger & Kasari, 2000; Capps, Yirmiya, & Sigman, 1992; Jaedicke, Storoschuk, & Lord, 1994; Losh & Capps, 2006; Rieffe, Meerum Terwogt, & Kotronopoulou, 2007). Losh and

Capps measured the length of response that their subjects gave, and also incorporated non-emotional states ("tired" and "sick") into their questioning. Individuals with autism did not differ from controls on either length of response or responses to questions about non-emotional states. When examining responses to the emotion questions, however, some interesting findings emerged. When discussing basic emotions, in comparison to typically developing controls, individuals with autism were more likely to report that they had never experienced a particular emotion, especially anger (Rieffe, et al., 2007), provided fewer examples of social interactions in the causes of their emotions (Jaedicke, et al., 1994; Rieffe, et al.), were less likely to provide specific and personalized causes of emotions (e.g., "I feel sad when people die," versus, "I felt sad when my grandma died last year") (Losh & Capps, 2006; Rieffe, et al., 2007), more frequently referenced behavioral or perceptual facial indices of emotion (e.g., "I was sad when tears started to come) (Losh & Capps, 2006), and more often gave idiosyncratic responses or mentioned preoccupations as causes of emotion (e.g., "hammers make me angry") (Jaedicke, et al., 1994).

Regarding self-conscious emotions, individuals with autism were more likely to describe embarrassment as having an external locus of control and were less likely to cite the presence of an audience (Capps, et al., 1992). They were also less likely to give examples of threat of relationship loss for jealousy (Bauminger, 2004), and they provided fewer specific personal examples of jealousy (Bauminger). Additionally, they did not describe contexts that clearly differentiated between self-conscious emotions (Losh & Capps, 2006), and they required significantly more prompting compared to both typically developing children and compared to the amount of prompting needed to describe basic emotions (Capps, et al., 1992; Losh & Capps, 2006). Not all studies, however, found such notable differences, with some suggestion that

younger children with autism, or those with lower than average IQ, were no worse than matched controls at describing their experiences of self-conscious emotions (Hobson, et al., 2006; Williams & Happe, 2010).

In general, these findings stand in contrast to those examining the understanding of *others'* emotions. Whereas the performance of individuals with autism was indistinguishable from that of typically developing individuals when identifying causes of basic emotions in others, their ability to describe causes of their own basic emotions was somewhat atypical. Their difficulty describing the causes of their own self-conscious emotions was seemingly even more pronounced. These findings cannot simply be attributed to an impairment in discussing causal elements in their own lives, as individuals with autism did not differ in their accounts of causes of non-emotional events (Losh & Capps, 2006). While it does appear that they might still have been employing a "rote memory" strategy, as evidenced by their tendency to provide fewer specific and personalized causes of emotion, this clearly did not hold up sufficiently to allow them to perform on par with typically developing individuals. There are also two additional possible explanations as to why individuals with autism struggled with this task.

The first possibility is that individuals with autism simply do not experience the same emotions that typically developing individuals do, or if they do, they experience them in a qualitatively different way. This would explain their reports of never having experienced some emotions, as well as their difficulty with providing specific accounts of emotional experience. This possibility is unlikely, however, as many individuals with autism did acknowledge having experienced all the emotions listed, and parental reports, as well as a number of experimental studies, indicate that these individuals demonstrate signs of a number of different emotions, including pleasure, anger, sadness, jealousy, and pride (Attwood, 1998; Bauminger, 2004;

Capps, Kasari, Yirmiya, & Sigman, 1993; Hobson, et al, 2006; Kasari, Sigman, Baumgartner, & Stipek, 1993). What is interesting to note, however, is that observations by others suggest that within a particular emotion, individuals with autism may not experience the same *range* of feelings that typically developing children do (Attwood, 1998; Attwood, 2008; Hobson, et al., 2006; Muller & Schuler, 2006; Ricks & Wing, 1975).

In a naturalistic observation of dinner table conversation and behavior, high functioning children with autism or Asperger's syndrome provided the same proportion of references to negative affect as the typically developing children; however, they were much more likely to reference or exhibit intense negative affect, including temper tantrums and "anxiety attacks." The negative affect displayed by their typically developing counterparts was more tempered and usually focused on labeling undesirable foods (Muller & Schuler, 2006). Parents also report that their children with autism often display intense, negative affect (Capps, et al., 1993). Similar behavior has been observed clinically (Attwood, 2008; Ricks & Wing, 1975). Tony Attwood, a leading authority on treating individuals with high functioning autism and Asperger's syndrome, describes a common emotional reaction in these individuals which he calls a "depression attack" (Attwood, 2008). He notes that often, individuals with autism will have a sudden, extreme negative reaction that does not seem warranted based on their behavior immediately prior, will remain highly distressed for a short time, and will then return to baseline. He attributes this to their being less sensitive to the early signals of emotion, which prevents them from effectively regulating negative affect before it becomes extreme. While these preliminary reports suggest that individuals with autism experience fewer gradations of negative affect and are more likely to exhibit only extreme negative affect, studies of the more self-conscious emotions, in particular pride and guilt, suggest that these individuals exhibit such emotions to a much *lesser* degree than

do typically developing individuals (Hobson, et al., 2006). These abovementioned reports are preliminary, and it is important to remember that Attwood's reports have not been validated empirically. However, it is possible that if individuals with autism do not experience or are not *aware* of experiencing a graded range of affect, this deficit would make it difficult for them to form a well-developed concept of these emotional experiences, subsequently making it difficult to link precipitating circumstances to their internal emotion signals.

A second explanation for the difficulties that individuals with autism exhibit in identifying causes of their emotions is that they may have poor memory for emotional events, which again might explain their increased reports of never having experienced an emotion, as well as their difficulty with providing specific accounts of emotional experience. From preschool age, typically developing children readily recall and discuss emotion-laden events from their own lives (Fivush, Berlin, Sales, Mennuti-Washburn, & Cassidy, 2003; Lagutta & Wellman, 2002), and in general, typically developing children recall emotional information from events better than non-emotional information (Davidson, 2006). While individuals with autism have unimpaired long term memory and above average rote memory (Toichi & Kamio, 2002), there is recent evidence suggesting that they have impaired episodic memory (Bruck, London, Landa, & Goodman, 2007; Crane & Goddard, 2008; Millward, Powell, Messer, & Jordan, 2000), and do not show the typical advantage for remembering emotionally significant information (Beversdorf, et al., 1998; Gaigg & Bowler, 2008). It could be argued then, that individuals with autism may have difficulty recalling events and their associated emotions, and this could contribute to their poor performance on tasks requiring them to describe the causes of their emotions.

1.1.2.3 Spontaneous descriptions of affect

While the majority of studies examining individuals' with autism's awareness and identification of their own affect have been conducted in laboratory settings, one study employed an observational study of these individuals in their home environment (Muller & Schuler, 2006). Children between the ages of 8- and 11-years-old were videotaped for two consecutive evenings during a family dinner, and their conversations were analyzed for affective references. The results from this procedure were surprising. In comparison to typically developing children, the children with autism used a higher proportion of affective markers and were more likely to talk about their own affective experiences and less likely to talk about others' affective experiences. This stands in stark contrast to lab based studies where individuals with autism exhibited more difficulty than typically developing individuals in their talk about their own emotions. Unfortunately, this study did not examine whether the affective references the children made were in relation to *causes* of emotion, nor did they code for whether or not the affective references seemed logical and appropriate to context. It does, however, highlight the significance of the context wherein emotion understanding is studied, and it suggests that more ecologically valid studies could provide new insights into the affective experience of individuals with autism.

1.1.3 Current Limitations in the Literature

Although the literature to date provides some insight into the awareness of and ability to identify their affective experiences in individuals with autism, it is hampered by a number of issues. The first is that the majority of the work has taken place in the context of the laboratory where either seemingly unnatural procedures are used to induce momentary affect (e.g., Bolte, et

al., 2008; Jansen, et al., 2006), or individuals are asked to recall and discuss past emotional experiences, a procedure that can be unreliable even for adept typically developing individuals (Moskowitz & Young, 2006). Given the argument that individuals with autism may perform very differently in the laboratory in comparison to real world, on-line social situations (see Klin, Jones, Schultz, & Volkmar, 2003; 2005), and given potential difficulties with episodic memory (Bruck, et al., 2007; Crane & Goddard, 2008; Millward, et al., 2000), it seems imperative that their affective experiences are assessed in more ecologically valid ways.

A second issue of note is that even researchers who have attempted to examine affective experience in a more naturalistic way have yet to examine whether spontaneously expressed affect is expressed in a contextually appropriate way (Muller & Schuler, 2006). Even though it is promising that individuals with autism seem more likely to discuss affective experiences when at home, it is important to examine more closely the specific forms of affect they experience as well as their apparent understanding of those emotions.

A third issue to consider is that much of what is considered clinical lore regarding the emotional experiences of individuals with autism has yet to be empirically validated (Attwood, 1998; 2008). Thus, while researchers often refer to the rapid onset of "emotional meltdowns" in individuals with autism, an affective reaction that could certainly impede their ability to form well developed concepts of negative affect, there is no empirical work that has examined this phenomenon closely.

Finally, no one has yet begun to relate performance on measures of affective awareness and ability to identify affect to broader measures of social functioning. As discussed earlier, greater awareness of one's emotional experiences predicts to better social outcomes in typically

developing individuals (e.g., Cassidy, et al., 1992; Custrini & Feldman, 1989), but it is unclear if this relationship holds for individuals with autism.

1.1.4 Ecological Momentary Assessment (EMA)

One methodology that could begin to address some of the above-mentioned limitations (particularly, issues one through three) is that of ecological momentary assessment (EMA). EMA is "a non-invasive method of gathering real-time data. It incorporates multiple daily assessments, which allows for the detection of incremental variability in subject responses" (Axelson, et al., 2003). In essence, research participants are contacted several times per day (via telephone or some other method) and asked to report on their current affective state and recent behaviors. Not only does EMA allow one to collect real time data on affective experience while the participant is in his or her natural environment, but it has been demonstrated to be a more valid method of capturing day-to-day variability in affect than retrospective reports, which are subject to recall bias and reconstructed memories (Moskowitz & Young, 2006; Stone & Shiffman, 1994). EMA methodology has been used effectively with participants of a broad age range and has shown to provide reliable measures of daily reports of affect (Moskowitz & Young, 2006).

A number of studies have effectively used EMA methodology to examine the affective experiences of typically developing children and adolescents. While to date the majority of studies have used some form of randomly programmed alarm to alert participants to write down their current affective states using pencil and paper self-reports (e.g., Larson, 1989; Larson & Lampman-Petraitis, 1989; Schneiders, et al., 2006; Silk, Steinberg, & Sheffield Morris, 2003), others have found comparable results having participants enter reports into electronic handheld

diaries (e.g., Whalen, et al., 2006), or providing live reports via cellular telephones (Axelson, et al., 2003; Silk, et al., 2007).

EMA studies with typically developing children and adolescents have yielded a number of interesting results. Individuals with no mood disorders report variable levels of positive affect (Axelson, et al., 2003; Haviland-Jones, Gebelt, & Stapley, 1997), and low, stable levels of negative affect (Axelson, et al., 2003; Haviland-Jones, et al., 1997; Silk, et al., 2007). Also, age seems to play a role in the reporting of affect. Younger adolescents (5^{th} to 7^{th} grade) are more likely to report low, stable levels of negative affect and extreme positive states, but older adolescents (9^{th} to 12^{th} grade) report a slightly wider range as well as a higher average level of negative affect, and they are more likely to rate their positive affect towards the middle of the emotional range (Haviland-Jones, et al., 1997; Larson & Lampman-Petraitis, 1989; Larson, Moneta, Richards, & Wilson, 2002). In comparison to adults, adolescents report more negative affect, more extreme positive affect, and greater variation in affective states (Larson, Csikszentmihalyi, & Graef, 1980).

EMA has also been used to examine the affective experiences of children and adolescents with mood disorders. Children and adolescents with depression report more negative affect (Larson, Raffaelli, Richards, Ham, & Jewell, 1990; Silk, et al., 2007; Silk, et al., 2003; Whalen, Jamner, Henker, & Delfino, 2001), less positive average affect (Larson, et al., 1990), greater variability in negative affect (Costello, Benjamin, Angold, & Silver, 1991; Larson, et al., 1990; Silk, et al., 2003), more intense feelings of anger and sadness (Silk, et al., 2003), and a lower ratio of positive to negative affect (Silk, et al., 2007). Age was also somewhat related to depression and affect in that individuals' self-reported depression on the Child Depression

Inventory (CDI) was related to their daily reports of affect, but only from 7th grade onward. Younger children's CDI scores and daily reported affect were unrelated (Larson, et al., 1990).

1.2 CURRENT STUDY

Understanding the degree to which individuals with autism are aware of and able to identify their emotions and their causes is important not only for predicting social functioning, but also for clinical practice and the diagnosis of mood and anxiety disorders. Some research has begun to examine these issues, but to date much of the work is acontextual (e.g., Jaedicke et al., 1994; Jansen, et al., 2006; Losh & Capps, 2006) and imposes potentially confounding memory demands (e.g., Losh & Capps; Rieffe, et al., 2007). In addition, descriptions of these individuals' affective experiences are often presented in the literature as de facto, despite the fact that their daily affective experiences have yet to be examined empirically (e.g., Atwood, 2008). Also, almost no work has examined the relationship between affective experience and social functioning in individuals with autism. Finally, the majority of previous work has been conducted with children between the ages of eight and 12 years old, thus it is unclear if prior findings generalize to older age groups. As such, the purposes of the current study were to gain a better understanding of how *adolescents* with autism report on their own affective experiences, to develop a clearer clinical picture of their typical daily affect, and assess whether awareness of their own affect was related to social and emotional functioning.

1.2.1 Specific Aims

Specific aims of the current study were:

1) To replicate, in an adolescent sample, previous findings regarding individuals with autism's ability to report on their emotions in a laboratory setting.

2) To assess whether individuals with autism were better able to report on the causes of their emotions in situ in comparison to in the laboratory setting.

3) To determine whether individuals with autism reported experiencing the same number of discrete emotions on a weekly basis in comparison to typically developing individuals, and whether they provided any in situ reports of experiencing self-conscious emotions.

4) To examine the self-reported intensity and lability of positive and negative affect in individuals with autism in comparison to typically developing individuals.

5) To identify if measures of affective understanding and awareness were related to social behavior in individuals with autism.

6) To examine the relationship between daily self-reported affect and parent and self-reported depression and anxiety symptoms.

To expand upon the current literature, this study employed a more ecologically valid methodology for assessing affective experience: ecological momentary assessment (EMA). Utilizing both laboratory based measures as well as EMA methodology allowed performance on reports of causes of emotions in both contexts to be compared. EMA methodology also allowed us to examine reported levels of affect as it was occurring, thereby presenting a clearer picture of the day to day affective experiences of individuals with autism.

1.2.2 Hypotheses

Based on the reviewed literature, the following hypotheses were proposed:

Hypothesis 1a

Compared to typically developing peers, when probed on the causes of their emotions in a lab setting, individuals with autism would be less likely to report they had felt an emotion, would be less likely to describe contexts that clearly differentiated between self-conscious emotions, and would be less likely to provide specific causes of emotion. When probed on the causes of non-emotional experiences (i.e., tired, hungry) in a lab setting, individuals with autism would not differ from their typically developing peers in the appropriateness of causes they described.

Hypothesis 1b

If memory difficulties were indeed hampering the performance of individuals with autism when in the lab, then when probed about the causes of their emotions in situ they would be: a) less likely to report that they did not know the cause of the emotion, and b) more likely to provide specific causes of emotion.

Hypothesis 2

Compared to typically developing peers, when probed in situ, individuals with autism would report experiencing fewer discrete emotions over the course of the study and would endorse experiencing self-conscious emotions significantly less often.

Hypothesis 3

Individuals with autism would report greater intensity and lability of negative affect in comparison to typically developing individuals.

Hypothesis 4

Compared to typically developing individuals, individuals with autism would have lower parent-rated scores of concurrent social skills. In both typically developing individuals and individuals with autism, both self-reported impairment in cognitive processing of their own emotions, and poor performance on lab measures of their own emotion understanding, would predict to lower concurrent social skills as measured by parent reports and by self-reports.

2.0 METHOD

2.1 PARTICIPANTS

Participants were 19 individuals with high-functioning autism and 19 typically developing controls recruited by the Pittsburgh Autism Center for Excellence (ACE) at the University of Pittsburgh. The typically developing control group was matched to the autism group on chronological age, full-scale IQ, verbal IQ, and performance IQ. Table 1 summarizes the participants' demographic characteristics. No significant differences existed between the autism and control groups on any of the demographic variables.

Participants with autism were administered a diagnostic evaluation consisting of the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) with confirmation by expert clinical opinion (for ADOS means see Table 1). Additionally, the Autism Diagnostic Interview-Revised was administered to a parent (ADI-R; Lord, Rutter, & LeCouteur, 1994). The ADOS was scored using the DSM-IV/ICD-10 Autism Diagnosis Algorithm (Lord, Rutter, DiLavore, & Risi, 2003). Individuals who fell below the cutoff for "Autism" on the algorithm were excluded. Participants with autism were also required to be in good medical health, free of seizures, have a negative history of traumatic brain injury, and have an FSIQ > 80 and VIQ > 80 as determined by the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). The IQ limit was implemented for two reasons. First, the nature of the study required verbal comprehension

abilities that may not be present in lower functioning individuals with autism. Second, studying high-functioning individuals with autism allows for the discovery of potential deficits that are specific to autism and not the non-specific consequences of mental retardation.

Control participants were volunteers recruited from the community. Parents of potential control participants completed questionnaires of demographic and family information to determine eligibility. Control participants were required to be in good physical health, free of past or current neurologic or major psychiatric disorders, have a negative family history of first degree relatives with major psychiatric disorders, and have a negative family history of autism spectrum disorder in first and second degree relatives. Control participants were also excluded if they had a history of poor school attendance or evidence of a disparity between general level of ability and academic achievement suggesting a learning disability.

Table 1: Demographic Characteristics of Autism and Control Groups

	Autism Group (n = 19)			Control Group (n = 19)		
	Mean	*SD*	Range	Mean	*SD*	Range
Age (years)	14.68	1.92	11-17	14.11	1.6	11-17
Full Scale IQ	106	13	87-127	111	9	97-128
Verbal IQ	103	14	80-139	109	9	97-131
Performance IQ	108	14	86-142	111	9	95-125
ADOS						
Total Score	14	3	10-20			
Communication	5	1	3-8			
Social	9	2	6-12			
Res/Rep Behaviors	3	2	0-6			
Gender (M:F)		16:3			17:2	

2.2 PROCEDURE

2.2.1 In Laboratory

Each participant first attended a session in the laboratory. During this session, parental consent and participant assent were obtained. Participants then completed the *Emotional Experiences* task, as well as questionnaires measuring alexithymia, depressive symptoms, anxiety symptoms, and social skills. Parents completed measures of their children's depressive symptoms, anxiety symptoms, and social skills. A more complete description of the above-mentioned scales is presented below.

After completion of these tasks, the PI explained the EMA procedure to both the participant and the parent. At the conclusion of the session, each participant was given an answer-only cellular phone and provided with a demonstration on how to use the equipment. In addition, a "mock call" was practiced with the child in order to familiarize him or her with the format of the interview as well as to ensure the child understood each question being asked. Finally, the parent was provided an addressed, prepaid envelope in which to return the cellular phone at the end of the data collection period.

3.2.1.1. Emotional Experiences

3.2.1.1.1. Procedure

Personal accounts of emotional experiences were elicited through a procedure adapted from Losh and Capps (2006). Participants were given a list of basic emotions (happy, sad, angry, afraid, nervous), self-conscious emotions (proud, embarrassed, guilty), and non-emotions

(tired, sick, hungry). Non-emotions were included as a control condition to help ascertain whether any group difference that might emerge were specific to emotional experiences, or if there were differences when describing *any* type of causal experience. Participants were asked to define each emotion and then tell the experimenter about a time when they felt that way. If they were unable to provide an accurate definition of an emotion/non-emotion, a standardized definition was provided for them to ensure that they were aware of the meaning of the emotion/non-emotion before providing an account of their experience (see Appendix A).

This interaction with the participant was videotaped and transcribed verbatim. Coding conventions were adapted from Losh and Capps (2006) and Rieffe, et al. (2007). Each transcript was coded by two research assistants, at least one of whom was blind to participant diagnosis. Coders were trained by the principal investigator and were required to achieve intercoder agreement of 80% or higher with the PI. Intercoder reliability was computed for a subset of the data (35%). All intercoder agreements fell within acceptable ranges (mean percent agreement above 84% for all variables). All disagreements were discussed and resolved, and all data reflects consensus codes.

3.2.1.1.2. Coding

Participant responses for each emotion/non-emotion were coded on the following variables (for a coding key see Appendix B):

1) Specific vs. Non-Specific Cause

References which focused on a specific event that occurred in the past were coded as "specific" (e.g., "I felt sad when my dog died"). References that contained no reference to a specific event, or that were presented in present tense, were coded as "non-specific" (e.g., "people make me angry," "I feel sad when people die").

2) Appropriateness of Causal Context

There were three codes for "context":

a. Incorrect/inappropriate context

Included references involving actions and events that, without further explanation, would not typically elicit the emotion/non-emotion in question (e.g., "I was sad one time when I got a birthday present").

b. Context with appropriate valence

Included references to episodes that would tend to elicit feelings of appropriate valence but did not contain sufficient details or explanation for distinguishing the specific emotion/non-emotion from similarly valenced feelings (e.g., "I was proud when my mom gave me a present").

c. Appropriate context

Included references describing unambiguously evocative contexts (e.g., "I was happy when I went to the zoo with my friends yesterday").

2.2.2 Ecological Momentary Assessment (EMA)

2.2.2.1 Procedure

EMA telephone calls began the first Thursday after the visit to the laboratory (if the visit occurred on a Thursday, calls began that day). Data collection spanned 14 consecutive days. On weekdays, to avoid interrupting the school day, two calls were made between the hours of 4:00pm and 10:00pm (with the first occurring randomly between 4:00pm and 7:00pm, and the second occurring randomly between 7:01pm and 10:00pm). On Saturday and Sunday, five calls were made each day between the hours of 10:00am and 10:00pm (with one each occurring

randomly within the following time-blocks: 10:00am to 11:00am; 12:01pm to 3:00pm; 3:01pm to 5:00pm; 5:01pm to 7:00pm; 7:01pm to 10:00pm). If the participant did not answer on the first attempt, a second attempt was made again after approximately 10 minutes, and a third attempt was made 10 minutes after that. If the participant did not answer on the third attempt, that time point was logged as missing data. If the participant failed to answer the phone after three consecutive time blocks, a secondary telephone number (provided by the parent during the consent process) was contacted to ascertain whether the phone provided to the participant was still in working order. In total, each participant received 40 data collection calls over the duration of the study.

The compliance rate for both the autism and control groups was 78%, respectively, with participants completing an average of 31 of 40 calls (Autism group: *SD* = 4.2, Range: 24-39; Control group: *SD* = 4.6, Range: 22-37). Previous studies with participants in the same age range have reported that their participants provided reports for a mean of 76% to 84% of data collection time points (e.g., Larson, et al., 2002; Schneiders, et al., 2006; Silk, et al., 2003), indicating that the current sample's compliance rate is comparable to other studies. Minimum numbers of completed reports required for inclusion in analysis have ranged from 15 to 24 (Larson, et al., 2002; Silk, et al., 2003). For this study, participants who completed fewer than 24 calls (60%) were considered non-completers. Data from one control participant could not be analyzed for this reason. In addition, one participant with autism who answered 29 calls but refused to provide responses to any protocol questions for the last 14 calls was also considered a non-completer.

Based on the work of Axelson, et al. (2003) and Silk, et al. (2003), during each telephone call, participants reported on four basic domains: 1) location, activity, and duration of activity at

the moment of the call, 2) social context at moment of call (i.e., with whom the participant was currently interacting, including electronic forms of interaction such as Instant Messaging), 3) current affect ratings (including both positive and negative affect) at the time of the call and 4) most negative and most positive affective experience over the past hour, when it occurred, and what caused it. For the purposes of this study, only data from domain 3 were examined. Participant responses were recorded by hand by the research assistant making the telephone call, and they were also recorded using a digital voice recorder to ensure protocol fidelity. Average call duration for the Autism group was 4.6 minutes (*SD* = 1.6; Range: 1 – 12) and for the Control group was 4.2 minutes (*SD* = 1.0; Range: 2 – 10). A copy of the child telephone script (Axelson, et al., 2003; Silk, et al., 2007) can be found in Appendix C.

To assess parents' perceptions of their child's daily affective responses, each child's parents were called shortly after the final child call on 10 of the 14 days of the protocol. Parents were contacted at a telephone number they specified during the lab visit, and the parent reported to have spent the most time with the child on that day was asked to respond to the questions. If a parent did not answer on the first call attempt, they were re-contacted the following evening. On average, parents of the Autism group completed 8 calls (*SD* = 1.4; Range: 6 – 10) and parents of the Control group completed 7 calls (*SD* = 1.4; Range: 5 – 10). Parents were asked whether their child exhibited any "high intensity" affective responses that day (at a rating of "4" or "5"), and if so, what time the response occurred, what precipitated that response, and who the child was with when the response occurred. A copy of the parent telephone script can be found in Appendix D.

2.2.2.2 Measurement of in situ affect

Affective ratings comprised a subset of 9 items from the Positive and Negative Affect Schedule for Children (PANAS-C; Laurent, et al., 1999), plus the addition of one additional self-

conscious emotion, embarrassed. Items on the PANAS-C are rated on a 5-point scale, where 1 = very slightly or not at all, 2 = a little, 3 = moderately, 4 = quite a bit, and 5 = extremely. For this study, the code for 1 was changed from "very slightly or none at all" to "none at all" to simplify the distinction between a code of 1 and 2 for the individuals with autism. Each participant was provided with a graphical representation of the scale to aid in conceptualizing the difference between each code (see Figure 1). Such graphical representations are particularly helpful for individuals with autism when discussing gradations of affect (Attwood, 1998; 2008).

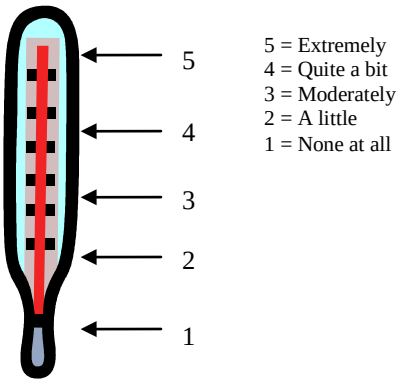

Figure 1. Graphical Representation (Thermometer) of PANAS-C Scale

Each of the affective items was asked on each call to assess *current* affect. If the participant endorsed a 4 or higher for the following items: happy, sad, angry, scared, nervous, proud, embarrassed, or guilty, they were asked, "What made you feel quite a bit/extremely X?"

2.2.2.3 Indices of in situ affect

The following indices of affect were constructed:

1. *Total number of current emotions*

The total number of discrete items on the PANAS-C subscale that the participant endorsed experiencing at a score of 2 (a little) or higher was summed. The participant was only given credit for each item once, regardless of how many times he/she endorsed experiencing that item. Thus, scores could range from 0 (never endorsed any of the items) to 10 (endorsed each of the items at least once).

2. *Proportion of current self-conscious emotions*

The proportion of times that self-conscious items (guilty, proud, embarrassed) were endorsed as being experienced at a score of 2 (a little) or higher were calculated from the total number of times that self-conscious emotions were probed. Thus, the total number of times self-conscious items endorsed could range from 0 (never endorsed a self-conscious item) to 120 (endorsed all three self-conscious items at each of the 40 times points). Proportion was calculated by dividing the total number of times endorsed by the total number of times probed.

3. *Intensity* (Silk, et al., 2003)

Intensity was calculated separately for each of the 10 items by averaging current affect ratings for each item across all time points. Intensity reflected the mean level of each item the participant experienced over the 14 day period.

4. *Global Negative Affect* (Silk, et al., 2007)

Global Negative Affect was calculated by averaging across current angry, nervous, sad, and upset ratings across all time points.

5. *Lability* (Larson, 1989)

Lability was calculated separately for each of the 10 items by calculating the standard deviation of the current affect rating across all time points. Lability reflected the typical degree of fluctuation within the emotion over the course of two weeks.

In addition to the above-mentioned variables, each response to the question, "What made you feel quite a bit/extremely X?" was coded using the same coding conventions noted under *Emotional Experiences*.

2.2.3 Parent Report Coding

Each parent report was coded against the completed child calls from that day. If a parent reported that his or her child experienced a high intensity emotion on a given day, he or she was asked to approximate the time of day this occurred. This parent report was then compared to the first child report completed after that reported time, but only if they occurred no more than 60 minutes apart. If no child report was completed within that time frame, the parent report was excluded from analysis for that emotion. For the purposes of this study, each emotion on the parent reports was coded for the following variables:

1) Incident Proximity

a) Child report occurred within 60 minutes following parent reported incident

b) Child report occurred within 120 minutes following parent reported incident

c) Child report occurred more than 120 minutes following parent reported incident

2) Level Match

If codeable (i.e., Incident Proximity was within 60 minutes):

a) Parent rating was lower than child rating

b) Parent rating was same as child rating

c) Parent rating was higher than child rating

2.3 IN-LAB MEASURES

2.3.1 Child Measures

The Child Depression Inventory (CDI) is a 27-item self-report measure used to assess the number and severity of symptoms of depression in children and adolescents (Kovacs, 1992). Each of the 27 items comprises three responses, in order of increasing severity from 0 to 2. Participants are instructed to select the response that best describes themselves over the past two weeks. Composite scores can range from 0 to 54, and are then converted to T-Scores, with higher scores representing more reported depressive symptomatology. The CDI is the most widely used measure to assess depressive symptomatology in children and adolescents, and it demonstrates adequate internal consistency (Cronbach's alpha = .80 -.88) and test-retest reliability (r =.70 - .88) (Brooks & Kutcher, 2001).

Screen for Child Anxiety Related Emotional Disorders -- Child (SCARED-C) is a 41-item self-report measure used to assess the number and severity of symptoms of anxiety in children and adolescents (see Appendix E; Birmaher, et al, 1999). Participants are instructed to circle the response that best describes their experience over the past three months. Items are rated on a 3-point scale (0 = Not True or Hardly Ever True; 1 = Somewhat True or Sometimes True; 2 = Very True or Often True). Composite scores can range from 0 to 82, with higher scores representing greater anxiety symptomatology. A total score greater than or equal to 25 may indicate the presence of an Anxiety Disorder. The SCARED-C demonstrates adequate internal consistency

(Cronbach's alpha = .74 -.90), test-retest reliability (r =.70 - .90) and good discriminant validity (Birmaher, et al., 1997; 1999).

Social Skills Rating System for Students (SSRS-Student) is a 39-item self-report measure for the target child and assesses cooperation, assertion, empathy, and self-control (Gresham & Elliott, 1990). Participants are instructed to circle the response that indicates how often they do the behavior described. Items are rated on a 3-point scale (0 = never; 1 = sometimes; 2 = very often). Raw scores were converted to Standard Scores, and higher scores represent higher levels of prosocial behavior. The SSRS-Student demonstrates adequate internal consistency (Cronbach's alpha = .83) and test-retest reliability (r = .68). The SSRS-Student has been used successfully with high functioning children and adolescents with autism (Vickerstaff, Heriot, Wong, Lopes, & Dossetor, 2007).

Toronto Alexithymia Scale-20 for Children (TAS-20 C) is a self-report of cognitive processing of emotions (Rieffe, Oosterveld, & Meerum Terwogt, 2006). The child version was adapted from the adult TAS-20 (Bagby, Parker, & Taylor, 1994) and is a 20-item scale that assesses three components of emotion processing: difficulty identifying feelings, difficulty describing feelings, and externally oriented thinking (see Appendix G). Items are rated on a 3-point scale (0 = not true; 1 = a bit true; 2 = true), with some items being negatively keyed. Higher scores indicate higher impairment in cognitive processing of emotions. The TAS-20 C demonstrates acceptable internal consistency (Cronbach's alpha >.75) (Rieffe, et al., 2006). The TAS-20 has been used successfully with samples of high functioning adults with autism (Berthoz & Hill, 2005; Hill, et al., 2004).

2.3.2 Parent Measures

Child Depression Inventory for Parents is a reworded version of the CDI designed so the parent can rate his/her child on 17-items (Wierzbicki, 1987). The parent is instructed to select the response that best describes his/her child over the past two weeks. Composite scores can range from 0 to 51, and are then converted to T-Scores, with higher scores representing more depressive symptomatology. Previous studies demonstrate that the CDI-P has adequate internal consistency (Cronbach's alpha = .85-.89; Cole & Martin, 2005; Wierzbicki, 1987) and evidence of moderately high convergent validity (Cole, Truglio, & Peeke, 1997; Wierzbicki, 1987).

Screen for Child Anxiety Related Emotional Disorders -- Parent (SCARED-P) is a 41-item parent-report measure used to assess the number and severity of symptoms of anxiety parents perceive in their children and adolescents (see Appendix F; Birmaher, et al, 1999). Parents are instructed to circle the response that best describes their child's experience over the past three months. Items are rated on a 3-point scale (0 = Not True or Hardly Ever True; 1 = Somewhat True or Sometimes True; 2 = Very True or Often True). Composite scores can range from 0 to 82, with higher scores representing greater anxiety symptomatology. A total score greater than or equal to 25 may indicate the presence of an Anxiety Disorder. The SCARED-P demonstrates adequate internal consistency (Cronbach's alpha = .74 -.90), test-retest reliability (r =.70 - .90) and good discriminant validity (Birmaher, et al., 1997; 1999).

Social Skills Rating System for Parents (SSRS-Parent) is a 40-item self-report measure for the target child's parent and assesses cooperation, assertion, responsibility, and self-control (Gresham & Elliott, 1990). The parent is instructed to circle the response that indicates how often his/her child does the behavior described, using the same scale described for the SSRS-Student. The SSRS-Parent also has an additional Problem Behaviors subscale which comprises

12 items assessing behaviors which might interfere with social skills performance. The same 3-point rating scale is used. The SSRS-Parent demonstrates adequate internal consistency (Cronbach's alpha = .90) and test-retest reliability (r = .87).

3.0 RESULTS

Results are presented in the following sequence: 1) comparison of autism and control group performance on in-lab measures, including questionnaires and the Emotional Experiences task; 2) examination of hypotheses related to in-lab versus in-situ descriptions of causes of emotion; 3) comparison of autism and control group performance on EMA reports, and 4) relationship between in-lab measures and EMA reports.

3.1 IN-LAB MEASURES

3.1.1 Parent and Self-Report Measures

Descriptive statistics for all in-lab parent and self-report variables are presented in Table 2. To investigate differences between groups on parent and child reports on in-lab measures, mixed ANOVA's were conducted with Group (Autism vs. Control) as the between-subjects condition, and Source (Child vs. Parent) as the within-subjects condition.

For child depression symptoms as measured by the CDI, there was a main effect of Group, with parents and children in the autism group reporting significantly more child depression symptoms than parents and children in the control group, F (1, 36) = 23.74, $p < .001$. There was also a significant main effect of Source, with parents reporting more child depression

symptoms than their children, F (1, 36) = 5.83, $p < .05$. The interaction of Group and Source was not significant, F (1, 36) = 2.00, $p = .17$. On average, children in the autism group and their parents reported child depression levels in the *average* range, while children in the control group and their parents reported child depression levels in the *slightly below average* range. A total of four children in the autism group reported depression symptoms above the cut-off for "at risk" for depression, while only one child in the control group was above cut-offs. Fisher's exact test indicated the two groups did not differ significantly in this regard ($p = .34$). A total of seven parents in the autism group reported child depression symptoms above the cut-off for "at risk" for depression, while only one parent in the control group reported symptoms above cut-offs. Fisher's exact test indicated there were significantly more parents in the autism group who rated their children as "at risk" for depression ($p < .05$).

Results were somewhat similar for child anxiety symptoms as measured by the SCARED. There was a significant main effect of Group, with parents and children in the autism group reporting significantly more child anxiety symptoms than parents and children in the control group, F (1, 36) = 26.48, $p < .001$. There was also a main effect of Source, but in contrast to depression symptoms, parents reported *less* child anxiety symptoms than their children did, F (1, 36) = 11.38, $p < .01$. Again, the interaction of Group and Source was not significant, F (1, 36) = 0.02, $p = .89$. A total of 12 children in the autism group reported anxiety symptoms above the cut-off for a potential anxiety disorder, while only four children in the control group were above cut-offs. Fisher's exact test indicated this difference was significant ($p < .05$). A total of five parents in the autism group reported child anxiety symptoms above the cut-off for a potential anxiety disorder, while no parents in the control group reported symptoms above cut-

offs. Fisher's exact test indicated there were significantly more parents in the autism group who rated their children above cut-offs for a potential anxiety disorder ($p < .05$).

For parent and child ratings of child social skills as measured by the SSRS, there was again a significant main effect of Group, with parents and children in the autism group reporting significantly *lower* child social skills than parents and children in the control group , F (1, 35) = 23.63, $p < .001$. There was also a main effect of Source, F (1, 35) = 8.07, $p < .01$, however, this was qualified by a significant interaction, F (1, 35) = 9.60, $p < .01$. Follow-up t-tests indicated that children in the autism group rated their own social skills significantly higher than their parents did (t = 4.56, p < .001), while children and parents in the control group did not differ in their ratings of child social skills (t = -0.17, p = .87). On average, children in the control group and their parents reported that the child exhibited slightly *more* social skills than the population, while children in the autism group and their parents reported that the child exhibits *just as many* social skills as the population.

Reports of alexithymia, or impairment in cognitive processing of emotions (TAS-20 C) were completed by the children only. Children in the autism group reported significantly higher impairment than controls did (t = 2.59; $p < .05$).

Table 2: Descriptive Statistics for Self-Report Data for Autism and Control Groups

	Autism Group (N = 19)			Control Group (N = 19)		
	Mean	*(SD)*	Range	Mean	*(SD)*	Range
CDI Child Score [a]	47	(5.2)	41-58	42	(5.3)	35-55
CDI Parent Score [a]	52	(7.8)	42-75	43	(5.0)	37-56
SCARED Child Score	28	(12.7)	5-48	13	(10.0)	0-35
SCARED Parent Score	19	(17.0)	2-65	5	(3.6)	0-11
SSRS Student Score [b]	105	(10.6)	92-132	114	(13.8)	80-130
SSRS Parent Score[b]	94	(10.7)	75-114	115 [c]	(9.4)	98-130
TAS-20--C Total Score	18	(8.0)	4-28	13	(4.8)	6-23

Note:
[a] T-Score
[b] Standard Score
[c] N = 18
CDI = Child Development Inventory; SCARED = Screen for Child Anxiety Related Emotional Disorders; SSRS = Social Skills Rating System; TAS-20-C = Toronto Alexithymia Scale for Children

In order to examine associations between in-lab measures, bivariate correlations were conducted for the in-lab parent and child self-reports. First, each variable was tested to assess whether it was normally distributed. Distributions of variables were inspected graphically (using frequency distributions) and tested for normalcy using the Kolmogorov-Smirnov test. All

variables appeared normally distributed in both groups except for the CDI-Child (in both groups), and the SSRS-S (in the autism group). To correct for skewness in the CDI-Child data, a log transformation was performed prior to running correlation analyses. To maintain a consistent unit of measurement, the log transformation was performed on both the child and parent CDI data, and follow-up tests indicated the transformations resulted in normally distributed data for autism and control groups on both variables. No transformation was able to improve the distribution of the SSRS-S data, thus Kendall's tau is reported for correlations with this variable. Bivariate correlations are presented in Table 3.

For the autism group, there were no significant correlations between age and any of the measures. There was a significant negative relationship between verbal IQ and difficulty with cognitive processing of emotions (r = -.50, p < .05), and between performance IQ and parent report of child anxiety symptoms (r = -.57, p < .05). There were no significant relationships between any child and parent reports. The only significant relationships that emerged between reports were between parent report of child depressive symptoms and parent report of child anxiety symptoms (r = .79, p < .01), and between child report of anxiety symptoms and child report of difficulty with cognitive processing of emotions (r = .59, p < .05).

As with the autism group, the control group showed no significant correlations between age and any of the measures. For the control group, parent and child report was significantly correlated on several measures. Parent and child report of child depressive symptoms were significantly related (r = .58, p < .01), as were parent and child report of child social skills (τ = .37, p < .05). Parent report of child social skills also had a significant negative relationship with child report of depressive symptoms (r = -.50, p < .05). Similar to the autism group, child report of anxiety symptoms was significantly related to child report of difficulty with cognitive

processing of emotions (r = .54, p < .05). Finally, parent reports of child depressive symptoms showed a significant negative relationship with parent reports of child social skills(r = -.69, p < .01; child), and child reports of depressive symptoms showed a significant negative relationship with child reports of social skills (τ = -.46, p < .01).

Broadly, the data from parent and child reports indicated higher mood and anxiety symptoms, but lower social skills, in the individuals with autism. In addition, while parent and child reports in the control group were sometimes significantly related, this was never the case in the autism group.

Table 3: Correlations Among Self-Report Data for Autism and Control Groups

Autism Group (N = 19)	1	2	3	4	5	6	7	8	9
1. Age									
2. VIQ	.24								
3. PIQ	-.26	.25							
4. CDI Child	.22	.03	-.34						
5. CDI Parent	.12	-.12	-.23	- .16					
6. SCARED Child	.02	-.16	-.57*	.26	.08				
7. SCARED Parent	.20	.10	-.30	-.05	.79**	.19			
8. SSRS Student+	-.03	-.06	.18	.03	.07	-.02	.02		
9. SSRS Parent	-.09	.12	.26	-.03	-.22	.12	-.33	.28	
10. TAS-20 C Total	-.35	-.50*	-.33	.21	.14	.59**	.09	-.02	.03
Control Group (N = 19)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Age									
2. VIQ	-.20								
3. PIQ	-.24	.58**							
4. CDI Child	.38	.02	-.01						
5. CDI Parent	.16	-.07	-.16	.58**					
6. SCARED Child	.21	-.03	.27	.41	.16				
7. SCARED Parent	-.33	.29	.04	-.29	.11	-.22			
8. SSRS Student+	-.01	-.24	-.22	-.46**	-.30	-.15	.02		
9. SSRS Parent	-.06	-.30	-.22	-.50*	-.69**	.21	-.08	.37*	
10. TAS-20 C Total	-.20	.30	.29	.53*	.11	.54*	-.26	-.31	.05

Note: $N = 18$ for Control Parent SSRS; * $p \leq .05$; ** $p \leq .01$; + Kendall's tau

3.1.2 Emotional Experiences Task

3.1.2.1 Never felt/ Don't know cause of emotion

A series of Fisher's exact tests were conducted to test the hypothesis that the individuals with autism would be more likely than controls to report they had never felt one of the probed emotions. No significant differences were found with regard to the number of individuals with autism versus controls who reported never having felt one or more of the probed emotions (6 in the autism group and 5 controls), nor were there significant differences when responses were examined for basic emotions (2 in the autism group and no controls) and self-conscious emotions (4 in the autism group and 5 controls), respectively (all *p*'s > .46). There were no particular emotions that individuals in either group were more likely to report they had never felt. Additionally, although more individuals overall denied feeling a self-conscious versus a basic emotion, this difference was not significant ($p = .38$).

Several individuals reported they had experienced particular emotions, but they were unable to describe what had caused the emotion (i.e., coded "I don't know"). Fisher's exact tests were conducted to determine if the number of individuals providing these responses differed by group, and again, no significant differences were found, both overall (5 in the autism group, 2 in the control group), and when responses were examined for basic emotions (1 in the autism group and no controls) and self-conscious emotions (4 in the autism group and 2 in the control group) separately (all *p*'s > .67). In addition, when examined as a function of the *proportion* of times they endorsed feeling an emotion but could not describe a cause, individuals with autism did not differ significantly from controls ($M = 5.4\%$ vs. $M = 1.4\%$), $t = 1.34$, $p = .19$. Again, while more individuals overall were unable to describe the cause of self-conscious versus basic emotions, the difference was not significant ($p = .16$).

3.1.2.2 Appropriateness of causal context

To determine whether the causes of emotion provided by individuals with autism differed from controls in their overall contextual appropriateness, and also to examine whether this differed by account type, a mixed ANOVA was conducted, with Group (Autism vs. Control) as the between group variable, and Emotion Type (Basic vs. Self-Conscious vs. Non-Emotion) as the within group variable. In order to account for the different number of exemplars within each type of emotion and non-emotion, mean appropriateness scores were calculated for each account type. Significant main effects were found for both diagnosis, F (1, 36) = 5.98, p <.05 and emotion type, F (2, 72) = 6.69, p < .01. More importantly, results indicated a significant interaction between the Group and Emotion Type variables, F (2, 72) = 4.80, p <.05. The mean scores are presented in Figure 2.

To understand this interaction, post-hoc Bonferroni corrected simple effects analyses revealed that, consistent with hypotheses, individuals with autism provided significantly fewer contextually appropriate causes of self-conscious emotions than controls (p < .05), marginally fewer contextually appropriate causes of basic emotions (p = .09), and did not differ in their accounts of non-emotions (p = .42). Additionally, a one-way ANOVA indicated the performance of the autism group differed significantly by emotion type, F (2, 36) = 8.55, p <.01, with the post-hoc test indicating that their performance on self-conscious emotions was significantly worse than for non-emotions (p < .05), and marginally worse than for basic emotions (p = .08). This difference in performance by emotion type was not seen in the control group, F (2, 36) = 0.48, p = .62.

To determine if performance on this task was related to age or cognitive ability, bivariate correlations were conducted for age, verbal IQ, and performance IQ. There were no significant correlations in either group (all *p*'s > .37).

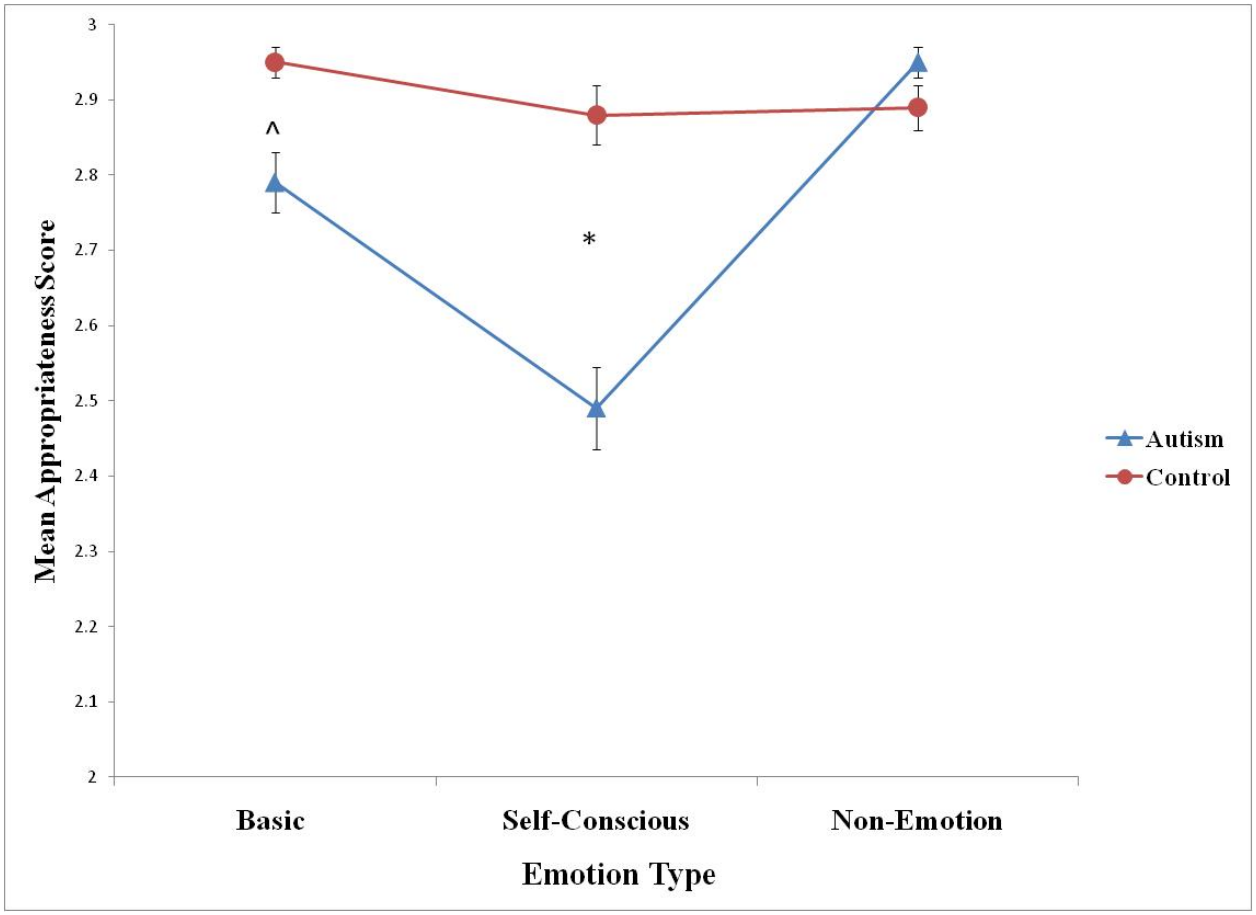

Figure 2. Mean Appropriateness Scores by Condition (* p < .05; ^ p = .09)

3.1.2.3 Specific, personalized causes of emotion

To examine the hypothesis that individuals with autism would be less likely to provide specific, personalized causes of emotion, the percentage of an individual's responses that were coded as "specific" was utilized as the dependant measure of interest. Contrary to expectations, individuals with autism were actually more likely to provide specific, personalized causes (*M* =

61.2%) rather than non-specific causes (M =38.8%), and this difference approached significance, t = 1.66, p = .11. Results were similar for the control group, with controls being significantly more likely to provide specific, personalized causes (M = 72.3%) than non-specific causes (M = 27.7%), t = 3.6, p <.01. When comparing the two groups, results indicated no significant difference in the percentage of specific, personalized causes described, t = -1.21, p = .23.

To determine whether the reporting of specific, personalized causes differed for basic and self-conscious emotions, and also to compare the responses for non-emotions, a mixed ANOVA was conducted, with Group (Autism vs. Control) as the between subjects variable, and Emotion Type (Basic vs. Self-Conscious vs. Non-Emotion) as the within subject variable. As with the appropriateness of context analyses, to account for the different number of exemplars within each type of emotion and non-emotion, percentage scores were calculated for each account type. There was a significant main effect of Emotion Type, F (2, 70) = 3.98, p < .05, and Bonferroni corrected post-hoc comparisons showed that individuals across both groups provided significantly more specific, personalized causes of self-conscious emotions (M = 76.3%) than of basic emotions (M = 62.7%) (p < .05). Self-conscious emotions and basic emotions did not differ from non-emotions (M = 65.7%) (p > .23 for both comparisons). Results showed no significant main effect of group (F (1, 35) = 0.72, p = .40), and the Group x Emotion Type interaction for specific, personalized causes of emotion was also non-significant (F (2, 70) = 0.52, p = .59).

To determine if performance on this task was related to age or cognitive ability, bivariate correlations were conducted for age, verbal IQ, and performance IQ. There were no significant correlations in either group (all p's > .13).

Overall, results from the Emotional Experiences task provided partial support for our hypotheses. Contrary to expectations, there were no differences between groups in how

frequently they denied having felt an emotion or knowing its cause. They also did not differ in the proportion of specific, personalized responses they provided. Consistent with hypotheses, the autism group was more impaired than the control group in describing appropriate causal contexts for emotions, but not for non-emotions. A sample of participant responses can be seen in Appendix H.

3.2 EMA DATA

Two individuals, one in the autism group and one in the control group, were considered non-completers and were excluded from all EMA data analyses. The non-completer in the autism group did not differ from the completers in the autism group on any demographic variables (age, IQ, ADOS scores) or on any parent report or child self-report measures. The non-completer in the control group was female, but otherwise did not differ from completers in the control group on any demographic variables. The non-completer did, however, have significantly higher scores on both the child and parent CDI than non-completers ($p < .05$), although these scores still fell within the *average* range of depression compared to the CDI normative sample.

3.2.1 In Situ Assessment of Emotional Experiences

3.2.1.1 Preliminary analyses

During the EMA procedure, each time an individual endorsed experiencing either happy, sad, angry, nervous, scared, guilty, embarrassed, or proud (i.e., one of the emotions that was also probed during the in-lab Emotional Experiences task) at "high-intensity" (at a level 4 or 5;

"quite a bit" or "extremely), they were probed as to the cause of that emotion. Table 4 presents descriptive data on the number of responses that were probed.

A mixed ANOVA of Group (Autism vs. Control) by Valence (Positive vs. Negative) indicated that individuals in both groups endorsed significantly more positively than negatively valenced high intensity emotions, F (1, 33) = 302.0, $p < .001$. To determine whether descriptions of causal contexts differed for positively and negatively valenced emotions, responses were compared by group. No significant differences emerged (all p's > .17), thus data was collapsed across valence for subsequent analyses.

When responses were examined as a function of the number of opportunities available to endorse each emotion type (i.e., basic or self-conscious), both groups endorsed a significantly higher proportion of high-intensity basic emotions than high-intensity self-conscious emotions, F (1, 34) = 31.8, $p < .001$. Also, while all but one individual with autism and all controls endorsed at least one or more high-intensity basic emotions, six individuals with autism and nine controls failed to endorse at least one or more high-intensity self-conscious emotions. Given the resulting discrepancies in cell sizes for basic versus self-conscious emotions, further analyses were run separately for each emotion type. Also, when comparing data for in lab versus in situ performance, only those subjects who had data from both test phases were included in the analyses. Descriptive data for all coded variables is presented in Table 5.

Table 4: Descriptive Statistics for EMA Current Emotions that were Endorsed as "High Intensity"

	Autism Group (N = 18)			Control Group (N = 18)		
	Mean	*(SD)*	Range	Mean	*(SD)*	Range
Total # HI Reports	19.8	(17.6)	0-64	15.3	(11.2)	1-38
Total # Basic HI Reports	15.1	(11.3)	0-35	14.44	(10.6)	1-37
Total # Self-Conscious HI Reports	4.8	(8.5)	0-29	0.9	(1.2)	0-4
% of all Basic probed that were HI	9.5	(7.0)	0-23	9.1	(6.3)	1-20
% of all Self-Conscious probed that were HI	5.1	(8.9)	0-31	1.0	(1.3)	0-4

Note:
HI = High Intensity

Table 5: Descriptive Statistics for Emotional Experience Variables both In-Lab and In Situ

	Autism Group (Basic: N = 18; SC: N = 12)				Control Group (Basic: N = 18; SC: N = 9)			
	In Lab		In Situ		In Lab		In Situ	
	Mean	*(SD)*	Mean	*(SD)*	Mean	*(SD)*	Mean	*(SD)*
SPECIFIC								
% of All Emotions	61.8	(31.0)	85.2	(19.0)	71.4	(27.4)	90.1	(13.0)
% of Basic	59.1	(31.4)	86.5	(18.6)	66.7	(32.1)	89.0	(15.1)
% of Self-Conscious	73.6	(32.9)	78.0	(33.7)	74.1	(27.8)	92.6	(22.2)
APPROPRIATENESS								
Basic	2.78	(.30)	2.60	(.71)	2.94	(.11)	2.83	(.34)
Self Conscious	2.63	(.47)	2.53	(.51)	2.83	(.52)	2.74	(.52)

3.2.1.2 Don't know cause of emotion

When probed on the causes of high intensity emotions experienced in situ, only two controls and one individual with autism could not identify the cause of an emotion they endorsed. All three instances occurred when the individuals endorsed feeling "happy" at high intensity. Fisher's exact tests were conducted to determine if the number of individuals providing these responses differed by group and by situation (i.e., in-lab versus in situ), and no significant differences were found (all p's > .24). While the number of individuals in each group unable to identify the cause of an endorsed emotion did not differ by situation, when examined

as a function of the *proportion* of times they endorsed feeling an emotion but could not describe a cause, consistent with hypotheses, individuals with autism were significantly less likely to endorse an emotion in situ and then not provide a cause (M = 0.4%) than they were to endorse an emotion in the lab and not provide a cause (M = 5.4%), t = 1.77, $p < .05$. The pattern was the same in the control group, with a trend towards significance (M = 0.6% vs. M = 1.4%), t = 1.33, p = .10.

3.2.1.3 Appropriateness of causal context

In situ

To compare whether the contextual appropriateness of causes of emotions provided in situ by individuals with autism differed from controls, *t*-tests were conducted for basic and self-conscious emotions (Bonferroni correction was employed to account for multiple comparisons). Groups did not differ significantly for either emotion type (Basic: t = -0.94; p = .35; Self-conscious: t = -1.09; p = .29).

In-lab versus in situ

To determine if individuals' performance differed in-lab versus in situ, a mixed ANOVA was conducted, with Group (Autism vs. Control) as the between subjects variable, and Setting (Lab vs. In Situ) as the within subject variable. Separate analyses were conducted for basic and self-conscious emotions. Means are presented in Table 5. For basic emotions, there was a marginally significant main effect of Group, F (1, 34) = 3.93, p = .08, with the autism group performing worse than the control group at describing contextually appropriate causes for basic emotions. The effect of Setting (F (1, 34) = 2.09, p = .16) and the interaction (F (1, 34) = 0.01, p

= .95) were non-significant. There were no significant main effects and no significant interaction for self-conscious emotions (Group: F (1, 19) = 1.89, p = .19; Setting: F (1, 19) = 0.82, p = .38; Interaction: F (1, 19) = 0.03, p = .86).

3.2.1.4 Specific, personalized causes of emotion

In situ

When describing causes of their emotions in situ, individuals with autism were significantly more likely to provide specific causes (M = 85.2%) than non-specific causes (M = 14.8%), t = 7.64; p < .001, and this was also true of the control group (M = 90.1% vs. M = 9.9%), t = 13.1; p < .001. As with the in-lab findings, there was no difference between the two groups in the percentage of specific accounts they provided for either basic or self-conscious emotions (t = -.31, p = .76; t = -1.13, p = .27).

In-lab versus in situ

To determine if, as hypothesized, individuals with autism would be more likely to provide specific, personalized causes of emotions when probed in situ versus in the lab, a mixed ANOVA was conducted, with Group (Autism vs. Control) as the between subject variable, and Setting (Lab vs. In Situ) as the within subject variable. Separate analyses were conducted for basic and self-conscious emotions. Means are presented in Table 5. For basic emotions, there was a significant main effect of Situation, with significantly more specific accounts provided in situ, across groups, F (1, 32) = 14.99, $p \leq .01$. The main effect of Group (F (1, 32) = 0.71, p = .41) and the interaction (F (1, 32) = 0.15, p = .70) were non-significant. For self-conscious

emotions, the main effects and interaction were non-significant (Group: F (1, 19) = 0.59, p = .45; Situation: F (1, 19) = 1.62, p = .23; Interaction: F (1, 19) = 0.62, p = 0.44).

Overall, results from the in situ assessment of emotional experiences provided partial support for our hypotheses. In situ, individuals with autism were significantly less likely to endorse an emotion and then not provide a cause than they were when in the lab. Also, even in situ, individuals with autism provided fewer contextually appropriate causes for the emotions they endorsed than controls did, although the finding was only significant for basic emotions. Results also indicated that the individuals with autism provided more specific, personalized causes of emotions in situ in contrast to in the lab, although this was only significant for basic emotions. Contrary to expectations, this pattern of results for specific, personalized emotions was the same, albeit attenuated, for controls.

3.2.2 Emotions In Situ: Number & Frequency Endorsed

To test the hypothesis that individuals with autism would report experiencing fewer discrete emotions than controls over the course of two weeks, groups were compared on the total number of discrete emotions they endorsed as experiencing at a level 2 (“a little bit”) or higher. Descriptive data is presented in Table 6. A mixed ANOVA (Group x Emotion Type) was conducted to compare the proportion of discrete basic emotions endorsed (out of 7) to the proportion of discrete self-conscious emotions endorsed (out of 3). There was a main effect of Emotion Type, F (1, 34) = 6.43, $p < .05$, showing that individuals endorsed experiencing a higher proportion of the basic emotions than the self-conscious emotions. There was also a main effect of Group, F (1, 34) = 4.0, $p \leq .05$, but contrary to expectations, individuals with autism

endorsed experiencing a higher number of discrete emotions than controls did. The interaction was not significant F (1, 34) = 1.74, p = .20.

Although the individuals with autism endorsed experiencing an overall higher number of discrete emotions over the course of the study, it was important to examine the *frequency* with which both groups endorsed experiencing each emotion type (basic versus self-conscious), as an individual could endorse experiencing each emotion only one time over the two weeks, and still end up with a high score in the above analysis. Descriptive data is presented in Table 6. A mixed ANOVA (Group x Emotion Type) indicated a main effect of Emotion Type, F (1, 34) = 6.06, p < .05, showing that individuals endorsed experiencing basic emotions more frequently than self-conscious emotions. There was no main effect of diagnosis (F (1, 34) = 1.99, p = .17) and no significant interaction (F (1, 34) = 1.12, p = .30), indicating that, on average, individuals with autism endorsed experiencing emotions at a Level 2 or higher just a frequently as controls did.

To explore which emotions were endorsed most frequently, and if this differed by group, a mixed ANOVA (Group x Emotion) was run for basic and self-conscious emotions, respectively. For basic emotions, there was a main effect of Emotion, F (6, 154) = 264.88, p < .001, and Bonferroni corrected post-hoc comparisons indicated individuals endorsed Happy significantly *more* than any other emotion (p < .001), and Scared significantly *less* often than any other emotion ($p \leq .05$). Happy was followed by Upset, which was endorsed significantly more often than Lonely (p < .01). Sad, Angry, and Lonely did not differ significantly from each other (all *p's* > .20). For basic emotions, there was no main effect of Group (F (1, 34) = 0.72, p = .40), and no significant interaction (F (6, 154) = 0.53, p = .73). For self-conscious emotions, there was a main effect of Emotion, F (2, 40) = 45.62, p < .001, with individuals endorsing Proud

more frequently than Guilty and Embarrassed ($p < .001$). The main effect of group F (1, 34) = 2.53, $p = 0.12$) and the interaction were not significant (F (2, 40) = 0.20, $p = 0.70$.

Overall, these results failed to support our hypotheses and instead indicated that individuals with autism endorsed feeling a higher number of discrete emotions over two weeks than controls did. Additionally, they endorsed experiencing self-conscious emotions with the same frequency that controls did.

Table 6: Total EMA Current Emotions Endorsed at Level 2 or Higher

	Autism Group (N = 18)			Control Group (N = 18)		
	Mean	*(SD)*	Range	Mean	*(SD)*	Range
Total Discrete Emotions Endorsed [a]	8.11	(1.97)	4-10	6.61	(2.95)	2-10
Total Discrete Basic Endorsed [b]	5.78	(1.31)	4-7	4.94	(2.21)	1-7
Total Discrete Self-Conscious Endorsed [c]	2.33	(0.84)	0-3	1.67	(0.97)	0-3
% Basic Endorsed [d]	29.58	(15.25)		25.46	(13.85)	
Happy	98.29	(2.6)		98.99	(1.7)	
Upset	23.32	(20.22)		17.10	(23.27)	
Sad	23.02	(23.13)		14.74	(18.56)	
Angry	20.61	(19.41)		16.79	(22.92)	
Nervous	18.44	(22.01)		13.66	(18.13)	
Lonely	11.65	(19.60)		9.24	(13.78)	
Scared	11.70	(18.28)		7.71	(11.81)	
% Self-Conscious Endorsed [e]	26.05	(21.02)		16.61	(13.83)	
Proud	53.14	(38.55)		41.38	(34.11)	
Guilty	14.44	(19.57)		3.95	(6.77)	
Embarrassed	10.57	(17.37)		4.50	(10.66)	

Note:
[a] Out of 10; [b] Out of 7; [c] Out of 3
[d] Of all Basic assessed, % endorsed
[e] Of all Self-Conscious assessed, % endorsed

3.2.3 Emotions In Situ: Intensity and Lability

To assess the hypothesis that individuals with autism would report greater intensity and lability in negative affect, a series of repeated measures analyses were computed. To examine intensity, data were analyzed using repeated measures linear mixed effects models. This analytic strategy accounts for the nested structure of the data (i.e., observations were nested within individuals) as well as the fact that the number of observations varies across individuals. Given that the lability score is inherently a summary score (standard deviation of current affect rating across time points for each emotion), *t*-tests or ANOVAs were used to compare lability across the groups.

Given the relatively infrequent endorsement of experiencing "lonely," "scared," "guilty," and "embarrassed," these emotions were excluded from the intensity and lability analyses. In addition, given that "proud" was the only remaining self-conscious emotion, it too was excluded from analyses. Data for the remaining emotions are presented in Table 7.

3.2.3.1 Intensity

Separate models were computed for "upset," "sad," "angry," and "nervous," as well as the summary score of "Global Negative Affect." In addition, a model was computed for "happy" to explore if any trends that emerged for negative affect were similar for positive affect. Each model included only the main effect of diagnosis. The Bonferroni correction was applied to account for multiple comparisons ($\alpha < .008$). Means are presented in Table 7. There was a significant main effect of diagnosis for "upset" (F (1, 876) = 11.10; $p \leq .001$; 95% CI = .05 - .19),

"sad" (F (1, 666) = 9.72; $p \leq .002$; 95% CI = .03 - .14), "nervous" (F (1, 756) = 11.36; $p \leq .001$; 95% CI = .04 - .15), and "Global Negative Affect" (F (1, 851) = 13.40; $p \leq .001$; 95% CI = .04 - .14), with individuals with autism reporting significantly higher overall intensity of the emotions than controls. After correcting for multiple comparisons, diagnosis was not related to intensity of "angry" (F (1, 740) = 2.88; p = .09; 95% CI = -0.009 - .12). Unlike for negative affect, controls reported a higher intensity of "happy" than individuals with autism did, although after correcting for multiple comparisons, the main effect of diagnosis was not significant (F (1, 1093) = 3.96; p = .05; 95% CI = -.22 - -.002). In addition, the effect size of this difference was negligible.

3.2.3.2 Lability

To assess whether lability of negative affect differed between groups and also by emotion, a mixed ANOVA of Group (Autism vs. Control) by Emotion (Upset vs. Sad vs. Nervous vs. Angry) was conducted. Means are presented in Table 7. There was a significant main effect of Diagnosis, F (1, 34) = 5.88; $p < .05$, but this was subsumed by a significant interaction, F (3, 98) = 3.70; $p < .05$ (see Figure 3). Bonferroni corrected post-hoc simple effects analysis found that individuals with autism had greater lability than controls in their reports of "upset" and "sad" ($p < .01$), but no significant differences in their lability for "nervous" and "angry" (p's > .12). In addition, for the individuals with autism, lability differed significantly by emotion (F (3, 51) = 4.55, $p < .01$), with Bonferroni corrected post-hoc tests indicating significantly more lability for "upset" than "nervous" ($p < .05$). This was not true for controls, with no significant differences by emotion (F (3, 41) = 0.54, p = .63). A t-test comparing groups on Global Negative Affect found that individuals with autism had greater negative lability overall, t = 2.47, $p < .05$. Finally, a t-test indicated that individuals with autism also showed greater lability in their reports of "happy," t = 2.45, $p < .05$.

Overall, results were consistent with hypotheses and indicated that, in general, the negative affect reported by individuals with autism was higher in intensity and showed more lability than controls. Positive affect ("happy") was also more labile in individuals with autism.

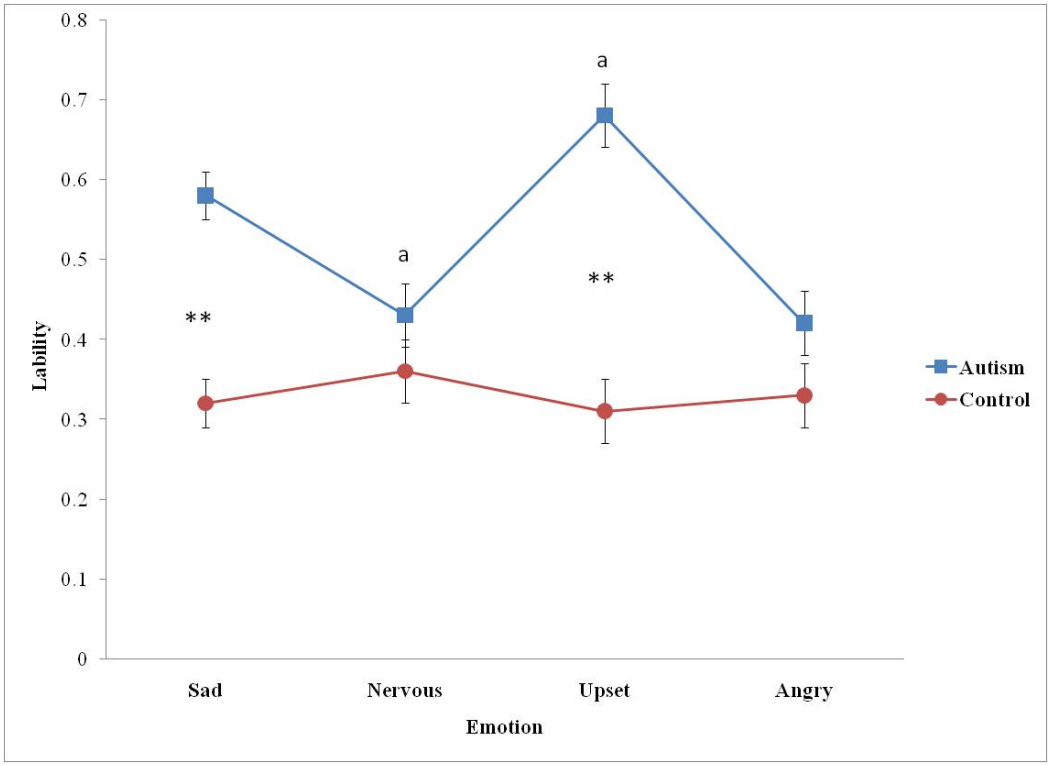

Figure 3. Mean Lability of Negative Affect by Group ($p < .01$)**

Table 7: Intensity and Lability of EMA Current Emotions

	Autism Group (N = 18)			Control Group (N = 18)			
	Mean	*(SD)*	Range	Mean	*(SD)*	Range	*d*
Intensity							
Happy	3.39	(1.06)	2.24 - 4.87	3.50	(0.84)	2.71 - 4.92	-0.11
Upset	1.38	(0.83)	1.00 - 2.24	1.19	(0.46)	1.00 – 1.86	0.28
Sad	1.33	(0.70)	1.00 - 2.24	1.17	(0.44)	1.00-1.71	0.27
Angry	1.33	(0.76)	1.00 - 1.88	1.22	(0.57)	1.00-2.36	0.16
Nervous	1.27	(0.64)	1.00 - 2.09	1.17	(0.49)	1.00-1.59	0.18
Global Negative Affect	1.33	(0.57)	1.02 – 1.96	1.19	(0.35)	1.00 – 1.87	0.30
Lability							
Happy	0.76	(0.22)	0.28 – 1.22	0.60	(0.19)	0.26 – 0.97	0.78
Upset	0.68	(0.37)	0.00 – 1.30	0.31	(0.27)	0.00 – 0.82	1.14
Sad	0.58	(0.28)	0.00 – 1.07	0.32	(0.25)	0.00 – 0.77	0.98
Angry	0.58	(0.42)	0.00 – 1.31	0.37	(0.33)	0.00 – 1.10	0.56
Nervous	0.44	(0.34)	0.00 – 1.00	0.36	(0.30)	0.00 – 0.94	0.25
Global Negative Affect	0.61	(0.30)	0.14 – 1.15	0.38	(0.26)	0.00 – 0.74	0.82

d = effect size, calculated using Effect Size Generator from Clintools 4.1C (Devilly, 2005)

3.2.4 Gradations of Affect

To assess whether the autism and control groups differed in their use of the rating scale for reporting current affect, the proportion of reports for which they used each number on the

scale (1, 2, 3, 4, and 5) was calculated for Global Negative Affect (i.e., collapsed across "upset," "sad," "angry" and "nervous") as well as for "happy." Descriptive statistics for these variables are presented in Table 8. To compare groups, a mixed ANOVA with Group (Autism vs. Control) by Rating (Level 1, Level 2, Level 3, Level 4, Level 5) was conducted.

For Global Negative Affect, there was a significant main effect of Rating, F (4, 39) = 291.64, $p < .001$. Bonferroni corrected post hoc comparisons indicated that Level 1 ("none at all") was endorsed significantly more often than all other levels (all p's < .001), followed by Level 2 ("a little bit"), which was endorsed significantly more often than the Levels 3, 4, and 5 (all p's $\leq$ .001), followed by Level 3 ("moderately"), which was endorsed significantly more often than Levels 4 and 5 (all p's $\leq$ .001), followed by Level 4 ("quite a bit") and Level 5 ("extremely), which did not differ significantly from each other. The main effect of Group and the interaction were not significant (Group: F (1, 34) = 1, p = .32; interaction: F (4, 39) = 0.68, p = .43).

The same mixed ANOVA was calculated for "happy." Again, there was a significant main effect of Rating, F (4, 83) = 17.17, $p < .001$. Bonferroni corrected post-hoc comparisons indicated that Level 3 ("moderately") was endorsed significantly more often than Levels 1, 2, and 5 (all p's < .05), and marginally more often than Level 4 (p =.07). Next were Level 4 ("quite a bit"), Level 5 ("extremely"), and Level 2 ("a little"), all of which were endorsed significantly more often than Level 1 (all p's < .05). The main effect of Group and the interaction were not significant (Group: F (1, 34) = 1, p = .32); interaction: F (4, 83) = 1.44, p = .24).

Overall, these results suggest that the groups did not differ in the manner in which they utilized the scale for rating their emotions.

Table 8: Descriptive Data for the EMA Emotion Rating Scale

	Autism Group (N = 18)			Control Group (N = 18)		
	Mean	*(SD)*	Range	Mean	*(SD)*	Range
Global Negative Affect						
% Level 1	78.5	18.7	35-98	84.4	19.1	28-100
% Level 2	14.0	12.4	0-43	12.2	16.4	0-59
% Level 3	4.8	5.4	0-16	2.9	3.8	0-13
% Level 4	1.7	2.8	0-11	0.5	0.7	0-2
% Level 5	1.0	1.6	0-6	0	0.2	0-.1
Happy						
% Level 1	1.7	1.9	0-6	1.0	1.7	0-4
% Level 2	18.2	21.0	0-70	7.6	12.0	0-38
% Level 3	39.6	26.7	0-92	47.8	27.5	0-93
% Level 4	20.3	15.8	0-60	30.5	20.5	6-67
% Level 5	20.2	27.7	0-97	13.1	26.2	0-91

3.2.5 Relationship Between Child and Parent Reports

To determine how parent ratings of their child's affect compared to the child's ratings on a given day, the percentage of each code for the "Level Match" variable was compared across groups for "angry," "nervous," "sad," "upset," and "happy." For each emotion, a mixed ANOVA of Group (Autism vs. Control) and Level Match (1 (Parent Rated Lower) vs. 2 (Parent

Rated Same) vs. 3 (Parent Rated Higher)) was conducted. Means are presented in Figures 4A and 4B.

There was no main effect of Group for any of the five tested emotions (for all: F (1, 34) = 0; p = 0.98).

For "angry," there was a main effect of Level Match, F (2, 54) = 189.6; p < .001, with parents providing a "Same" rating significantly more often than a "Lower" rating or a "Higher" rating (p's < .001). Parents provided a "Higher" rating marginally more often than a "Lower" rating (p = .06). The interaction of Diagnosis and Level Match was not significant, F (2, 54) = 1.96; p = 0.16.

For "nervous," there was a also main effect of Level Match, F (2, 43) = 262.8; p < .001, with significantly more parent ratings of "Same" than both "Lower" and "Higher" (p < .001). Parent ratings of "Higher" also occurred significantly more often than "Lower" (p < .01). There was a trend towards significance in the Diagnosis by Level Match interaction, F (2, 43) = 2.68; p = .10. Exploratory Bonferroni corrected post-hoc simple effects analysis indicated that parents of the autism group were significantly more likely than parents of the control group to provide a higher rating of "nervous" than their child did (p < .05).

For "sad," there was a main effect of Level Match, F (2, 52) = 261.5; p < .001. Again, parents provided significantly more occurrences of "Same" ratings than both "Lower" and "Higher" ratings (p's < .001). The latter two ratings did not differ significantly from each other (p = .49). The interaction of Diagnosis and Level Match was marginally significant, F (2, 52) = 3.27; p = .06. Exploratory Bonferroni corrected post-hoc simple effects analysis indicated that parents of the autism group were significantly more likely than parents of the control group to provide a higher rating of "sad" than their child did (p < .05).

For “upset,” there was a main effect of Level Match, F (2, 42) = 168.3; $p < .001$, but this was subsumed by a significant interaction of Diagnosis and Level Match, F (2, 42) = 9.91; $p < .01$. Bonferroni corrected post-hoc simple effects analysis indicated that parents of the autism group were significantly more likely than parents of the control group to provide a higher rating of “upset” than their child did ($p < .001$), and significantly less likely than parents of the control group to provide the same rating of “upset” than their child did ($p < .05$).

Finally, for “happy,” there was a main effect of Level Match, F (2, 67) = 8.77; $p < .001$. Following the pattern for negatively valenced emotions, parents provided significantly more occurrences “Same” ratings than both “Lower” and “Higher” ratings ($p < .01$). The latter two ratings did not differ significantly from each other ($p = 1.0$). The interaction of Diagnosis and Level Match was not significant, F (2, 42) = 0.55; $p = .58$.

Overall, these data suggest that in general, parents of both groups were most likely to rate the intensity of their children’s affect, both positive and negative, at the same general level that their children did. However, there was a consistent pattern of results suggesting that parents in the autism group, in contrast to control parents, were more likely to rate the intensity of their children’s negative affect, particularly for “sad” and “upset,” at a higher level than their children did.

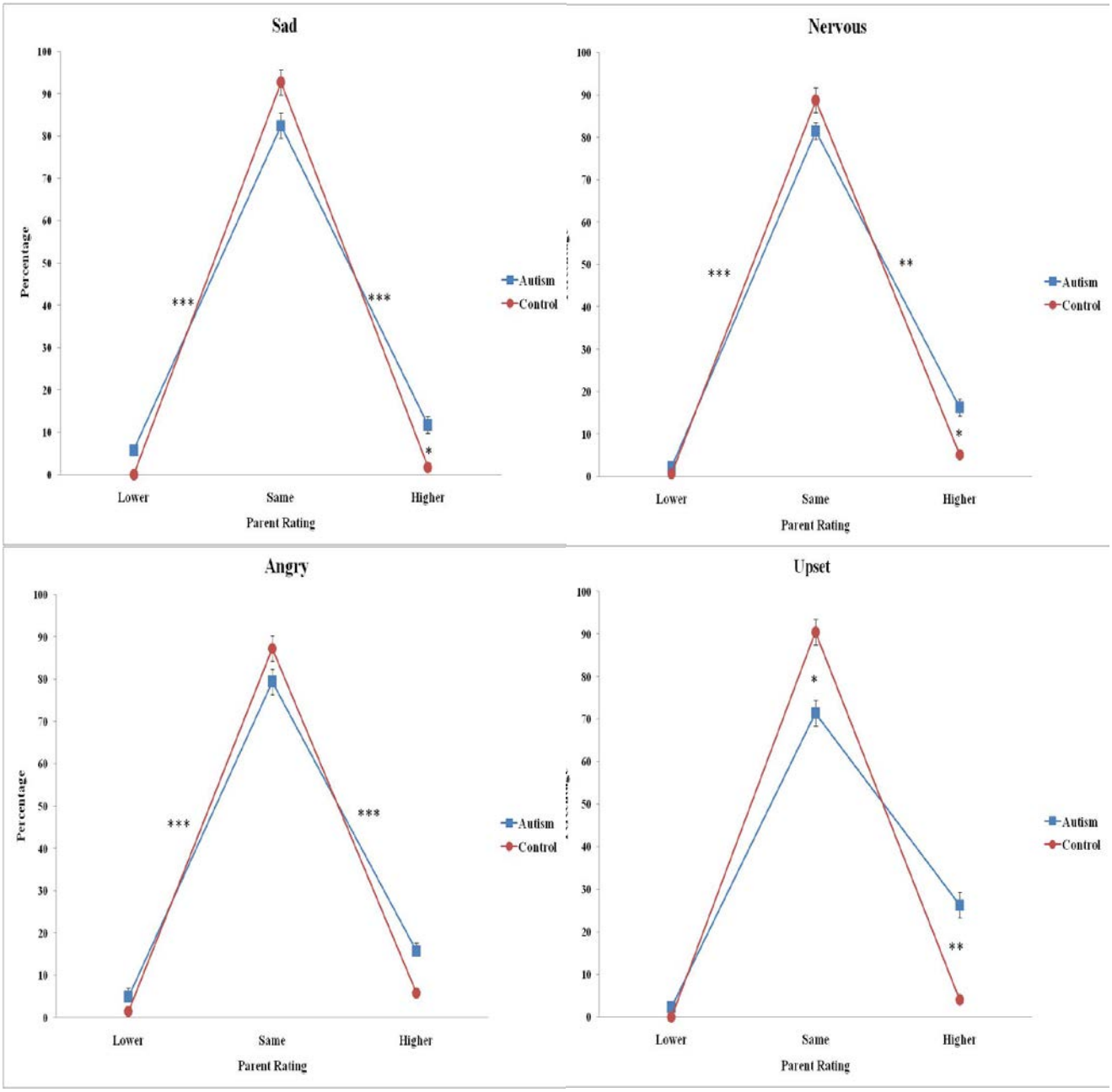

Figure 4A. Parent Rating Comparisons for Negative Emotions (*p < .05; **p < .01; ***p < .001)

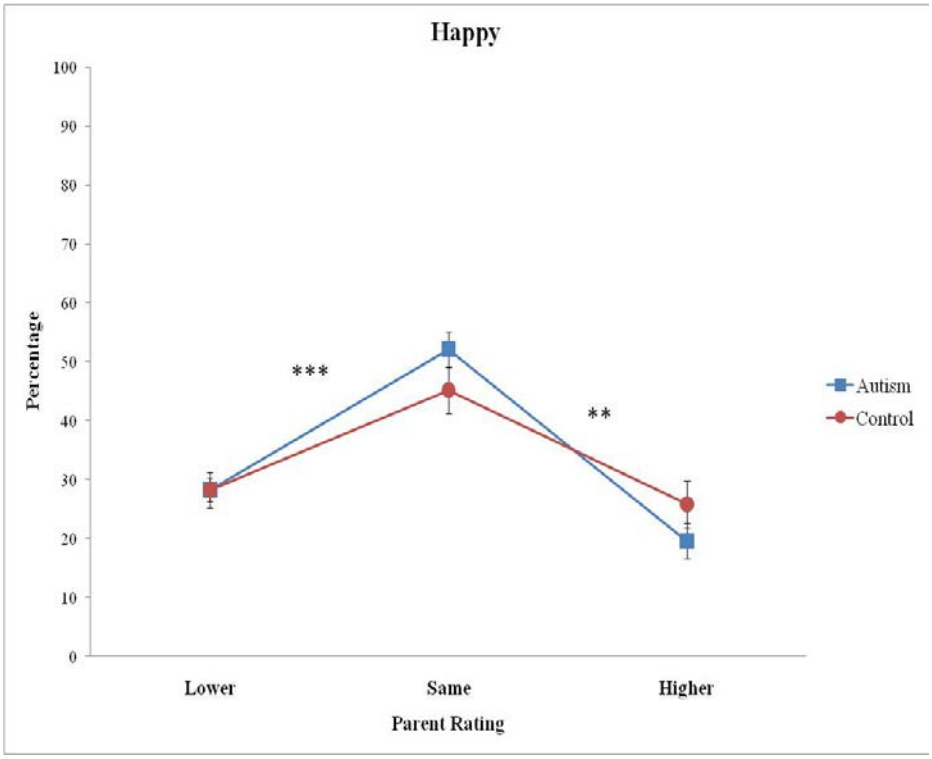

Figure 4B. Parent Comparison Ratings for "Happy" (p < .01; ***p < .001)**

3.3 RELATIONSHIP BETWEEN LABORATORY MEASURES AND IN SITU AFFECT

3.3.1 Affective Understanding/Awareness and Social Behavior

It was hypothesized that for both groups, affective understanding and awareness, measured both in the lab and in situ, would be related to social behavior. Measures of affective understanding and awareness that were of interest included 1) difficulty with cognitive processing of emotion (TAS-20 C scores), 2) ability to describe appropriate contexts for basic emotions in the lab, 3) ability to describe appropriate contexts for self-conscious emotions in the

lab, and 4) ability to describe appropriate contexts for basic emotions in situ. Social competence measures of interest included both parent and child ratings on the SSRS. Other than TAS-20 C scores and parent ratings on the SSRS, all other measures were non-normally distributed and could not be normalized. For these measures, nonparametric correlations (Kendall's tau) were utilized. Correlations are presented in Table 9.

Overall, contrary to hypotheses, no measures of affective awareness and understanding were significantly related to parent or self-rated social skills in either group.

Table 9: Non-Parametric Correlation Matrix of Self-Rated Social Skills and Measures of Affective Awareness

Autism Group (N = 19)	**1**	**2**	**3**	**4**	**5**	**6**
1. [+]Age						
2. [+]SSRS Parent	-.09					
3. SSRS Student	-.03	.28				
4. [+]TAS-C-20	-.35	.03	-.02			
5. IL-ACB [a]	-.15	-.18	.29	-.18		
6. IL-ACSC [b]	.08	.07	.09	.07	.08	
7. EMA-ACB [c]	.16	-.14	.01	-.14	.16	-.13
Control Group (N = 19)	**1**	**2**	**3**	**4**	**5**	**6**
1. [+]Age						
2. [+]SSRS Parent	-.06					
3. SSRS Student	-.02	.37*				
4. [+]TAS-C-20	-.20	.02	-.31			
5. IL-ACB [a]	.04	.03	-.13	-.20		
6. IL-ACSC [b]	-.04	.30	.29	-.02	-.21	
7. EMA-ACB [c]	.33	.27	-.03	.29	-.20	.31

Note: * $p \leq .05$

[+]Correlation between Age, SSRS Parent, and TAS-C-20 is Pearson's R

[a] In-Lab: Appropriateness of Context Basic

[b] In-Lab: Appropriateness of Context Self Conscious

[c] EMA: Appropriateness of Context Basic

3.3.2 In Situ Affect and Depression and Anxiety

To investigate whether in situ reports of affect related to self- and parent-reports of depression and anxiety symptoms for both groups, a series of regression models were tested with self- and parent-reported CDI and SCARED scores as dependent measures of interest. Predictors of interest included intensity and lability of global negative affect. In addition, diagnosis was examined as a possible moderator of any relationship between the predictor and the outcome in question. A log transformation was performed for intensity scores for Global Negative Affect to correct for skewness. Bivariate correlations between variables of interest are shown in Table 10. Analyses were conducted using centered variables.

Table 10: Correlation Matrix of Predictors of Depression and Anxiety

	1	2	3	4	5	6	7
1. Diagnosis [a]							
2. Age	.17						
3. Child CDI	.48**	.34*					
4. Parent CDI	.59**	.21	.42**				
5. Child SCARED	.56**	.17	.51**	.41*			
6. Parent SCARED	.52**	.18	.19	.73**	.38*		
7. GNA Intensity [b]	.25	.27	.53**	.21	.37*	.08	
8. GNA Lability [b]	.39*	.14	.57**	.42*	.37*	.21	.85**

Note: $N = 36$
$* p \leq .05; ** p \leq .01$
[a] 0 = Control Group; 1 = Autism Group
[b] GNA = Global Negative Affect

3.3.2.1 In situ affect and depression

Child report

For child reported CDI scores, two separate regression models were tested, one for each predictor of interest. In each case, current age and diagnosis were entered in Step 1, the predictor of interest was entered in Step 2, followed by the interaction of diagnosis and the predictor of interest in Step 3. The respective models are presented in Table 11.

After controlling for age and diagnosis, intensity of negative affect ($\beta = .30$, $p < .05$), and lability of global negative affect ($\beta = .30$, $p < .05$) emerged as significant predictors of child reported depressive symptoms in their respective models. Both interactions of diagnosis and predictor were non-significant (all p's $\geq .13$).

Parent report

For parent-reported CDI scores, the same two predictors of interest were entered into two separate regression models. The respective models are presented in Table 12. Both predictors and interactions of diagnosis and predictor were non-significant (all p's $\geq .15$).

3.3.2.2 In situ affect and anxiety

Child report

As with CDI scores, two separate regression models were tested for child reported SCARED scores, one for each predictor of interest. The respective models are presented in Table 13. After controlling for age and diagnosis, all predictors and the interactions of diagnosis and predictor were non-significant (all p's $\geq .13$).

Parent report

For parent-reported SCARED scores, the same two predictors of interest were entered into two separate regression models. The respective models are presented in Table 14. Both predictors and interactions of diagnosis and predictor were non-significant (all p's $\geq .41$).

Overall, results from the regression models indicated that while intensity and lability of Global Negative Affect was related to child reported depression symptoms in both groups, these variables were not related to parent reports of child depression, or to parent or child reports of anxiety.

Table 11: Hierarchical Regression Analysis Predicting CDI-Child Scores from In Situ Child Emotion Ratings with Diagnosis as a Moderator (N = 36)

		ß	ΔR^2
Model 1			
Step 1	Age	.26$^{\wedge}$	.35***
	Diagnosis	.47**	
Step 2	GNA Intensity [a]	.30*	.08*
Step 3	Diagnosis x GNA Intensity	-.18	.01
Model 2			
Step 1	Age	.26$^{\wedge}$	.35***
	Diagnosis	.47**	
Step 2	GNA Lability	.30*	.08*
Step 3	Diagnosis x GNA Lability	-.33	.04

* $p < .05$; ** $p < .01$; $^{+}$ $p = .08$; $^{\wedge}$ $p = .1$
[a] GNA = Global Negative Affect

Table 12: Hierarchical Regression Analysis Predicting CDI-Parent Scores from In Situ Child Emotion Ratings with Diagnosis as a Moderator (N = 36)

		ß	ΔR^2
Model 1			
Step 1	Age	.05	.42***
	Diagnosis	.63**	
Step 2	GNA Intensity [a]	.04	.002
Step 3	Diagnosis x GNA Intensity	-.05	.001
Model 2			
Step 1	Age	.05	.42***
	Diagnosis	.63**	
Step 2	GNA Lability	.12	.03
Step 3	Diagnosis x GNA Lability	-.01	.001

** $p < .01$; *** $p < .001$; [a] GNA = Global Negative Affect

Table 13: Hierarchical Regression Analysis Predicting SCARED-Child Scores from In Situ Child Emotion Ratings with Diagnosis as a Moderator (N = 36)

		ß	ΔR^2
Model 1			
Step 1	Age	.11	.31**
	Diagnosis	.52**	
Step 2	GNA Intensity [a]	.24	.05
Step 3	Diagnosis x GNA Intensity	-.25	.02
Model 2			
Step 1	Age	.11	.31**
	Diagnosis	.52**	
Step 2	GNA Lability	.18	.03
Step 3	Diagnosis x GNA Lability	-.07	.002

** $p < .01$; [a] GNA = Global Negative Affect

Table 14: Hierarchical Regression Analysis Predicting SCARED-Parent Scores from In Situ Child Emotion Ratings with Diagnosis as a Moderator (N = 36)

		ß	ΔR^2
Model 1			
Step 1	Age	.04	.30**
	Diagnosis	.53***	
Step 2	GNA Intensity [a]	-.07	.004
Step 3	Diagnosis x GNA Intensity	.12	.006
Model 2			
Step 1	Age	.04	.30**
	Diagnosis	.53***	
Step 2	GNA Lability	-.002	.001
Step 3	Diagnosis x GNA Lability	.14	.008

*** $p < .001$
[a] GNA = Global Negative Affect

4.0 DISCUSSION

4.1 SUMMARY OF CURRENT RESULTS

Clinical consensus and a limited number of empirical studies indicate that the understanding, awareness, and expression of personal emotional experiences are atypical in individuals with autism; however, the exact nature and magnitude of the atypicality is unclear. The purpose of the current study was to gain a better understanding of how individuals with autism understand and describe their own emotional experiences. This study measured affective awareness and understanding both in the laboratory setting as well as in the individual's natural environment. Using ecological momentary assessment (EMA), this study was the first to attempt to elucidate how adolescents with autism understand and describe their emotional experiences on a daily basis, and how this relates to their self-reports and emotion understanding performance in the lab.

This study had five specific aims. The first was to replicate previous findings in the literature regarding the ability of individuals with autism to discuss the causes of their emotional experiences in the laboratory setting using an adolescent sample. In line with hypotheses, individuals with autism had the most difficulty describing appropriate causal contexts for their self-conscious emotions. They had less difficulty describing appropriate causal contexts for their basic emotions, although they were not quite as proficient as controls. Their difficulties

describing appropriate causal contexts for their self-conscious emotions stood in contrast to their intact ability to describe appropriate causal contexts of non-emotional experiences, such as tired and hungry. These findings provide further evidence that their deficits on this task were specific to emotion concepts, particularly to self-conscious emotions, and were not related to a general difficulty describing causal contexts.

The hypothesis that individuals with autism would have difficulties providing specific, personalized causes of emotions was not supported. Rather, there was a trend for them to provide a higher proportion of specific rather than nonspecific causes of their emotions, and they were no different from controls in the number of specific causes they provided overall. Also contrary to hypotheses, individuals with autism were no more likely than controls to deny feeling a specific emotion or to fail to provide a cause for an emotion they endorsed as having experienced.

The second aim of the current study was to determine whether the ability of individuals with autism to describe the causes of their emotions improved when they were probed in situ in contrast to in the lab. When reporting on the causes of their basic emotions in situ, individuals with autism, although not significantly worse than when probed in the lab, still showed a trend towards providing less appropriate causal contexts than controls did. This suggests their ability to identify or interpret the causes of basic emotions, whether occurring in the past or in the moment, is somewhat less well developed than typically developing individuals. Although no differences were found between groups or setting for those individuals who endorsed experiencing self-conscious emotions in situ, these findings must be interpreted with extreme caution given the relatively low number of individuals who reported experiencing high intensity self-conscious emotions in situ.

The hypothesis that individuals with autism would provide a higher proportion of specific causes of emotions when probed in situ was partially supported. Overall, the results suggested that while individuals with autism did benefit from being probed on the causes of their emotions in situ and were able to provide more specific, personalized responses, this was only clearly demonstrated for basic emotions. Additionally, this was not unique to their diagnosis, as the same benefit was conferred on the controls. In the subgroup of individuals in both groups who reported experiencing high intensity self-conscious emotions in situ, there was no difference in their ability to provide specific, personalized causes when in the lab versus when probed in situ. As noted above, however, these findings must be interpreted with caution, given the notably reduced sample size that provided in situ data on high-intensity self-conscious emotions.

It was also hypothesized that individuals with autism, when probed in situ, would be less likely than when probed in the lab to report that they did not know the cause of their emotions. Although the absolute number of individuals with autism reporting in situ that they did not know the cause of their emotional experience was no different from in the lab, the overall proportion of responses for which they could not provide a cause in situ was significantly lower, indicating that if they did endorse that they were experiencing a high intensity emotion, they were generally able to provide some cause for that emotion.

The third aim was to assess whether, in comparison to controls, individuals with autism reported experiencing the same number of discrete emotions over the course of two weeks, whether they endorsed experiencing emotions at the same frequency, and whether they provided any spontaneous reports of experiencing self-conscious emotions. Contrary to expectations, individuals with autism reported experiencing *more* discrete emotions over the course of the study than controls did. Also, while they endorsed a greater proportion of the basic emotions

probed than the self-conscious emotions probed at a Level 2 or higher, spontaneous endorsement of self-conscious emotions was certainly not absent. Overall, the frequency with which they endorsed emotions at a Level 2 or higher, both for basic and self-conscious emotions, did not differ significantly from controls.

The fourth aim was to examine the intensity and lability of reported affect over the two week study. Although, on average, both groups reported generally low levels of negative affect, hypotheses were supported in that, overall, the intensity of negative affect reported by individuals with autism was significantly higher than that of controls. The effect sizes for these findings, however, were generally small. As predicted, individuals with autism were also significantly more labile in their reports of negative affect. This finding was emotion specific, with significantly more fluctuations than controls in their reports of "upset" and "sad," but not "nervous" or "angry." Although no specific hypotheses were postulated, individuals with autism demonstrated more fluctuation than controls in their ratings of positive affect ("happy").

There were two other findings of interest related to Aim 4. First, individuals with autism used the rating scale for reporting of current affect in generally the same manner as controls. That is, they were no more likely overall to use the extreme ends of the scale, and no less likely to use the midpoint of the scale. Second, when parents of both groups were asked to reflect on their children's emotional experiences, the parent ratings matched those provided by the child a majority of the time. A pattern did emerge, however, such that parents of the autism group were significantly more likely than parents of the control group to provide higher ratings of "sad," "nervous," and "upset" than their children did. This finding was most pronounced for reports of "upset," where over 20% of time, parents of the autism group rated their child's experience of upset at a higher intensity than the child did.

The fifth aim was to ascertain if measures of affective awareness were related to either parent or child reported social behavior in either controls or individuals with autism. Contrary to expectations, results indicated no relationship between these measures for either group.

The sixth aim was to examine the relationship between negative affect reported in situ and parent and child ratings of child anxiety and depression symptoms. No relationship was found between indices of child negative affect and parent reports of child anxiety or depression. After controlling for age and diagnosis, intensity and lability of negative affect were significantly related to child reported depression symptoms, but not to child reported anxiety symptoms. Diagnosis did not significantly moderate any of these relationships.

Although not a specific aim of this study, several important findings emerged from the lab-based parent and child reports. First, groups differed on all measures, with the autism group reporting significantly higher levels of anxiety and depression, and the control group reporting significantly better social skills. Second, across groups, parents endorsed more child depression symptoms than their children did, but the children reported higher levels of anxiety symptoms than their parents did. Third, children in the autism group endorsed significantly higher social skills that their parents did, while in the control group, parent and child reports on child social skills did not differ. Finally, while child and parent reports in the autism group were unrelated, in the control group they were significantly and positively associated for both child depression symptoms and child social skills.

Together, the results of the current study provide evidence that in some ways, at least at the surface level, individuals with autism appear to understand and convey their emotional experiences, both in the lab and in their natural environments, in a manner similar to controls. Contrary to expectations, in the lab they were no more likely to deny feeling a particular emotion

and no less able to provide a cause for an emotion they endorsed. In addition, the responses they provided were just as specific and personalized as those of controls. When reporting on their emotions in their natural environments, their use of the rating scale was not significantly different from controls, they endorsed experiencing some form of emotion just as frequently as controls did, and their general pattern of reporting for specific emotions was the same. Also, the strength and direction of the relationship between their reported affect in situ and their reports of depression symptoms in the lab was similar to controls. Finally, similar to controls, the majority of parents' ratings of their children's levels of affect in situ matched their children's own ratings. Despite these similarities, a number of notable differences did emerge that provide important evidence to support the notion that the understanding, awareness, and expression of personal emotional experiences are different, and at times impaired, in individuals with autism.

4.2 IDENTIFYING CAUSES OF OWN EMOTION

4.2.1 Reporting Appropriate Causal Contexts

Consistent with prior literature, individuals with autism were less adept than controls at describing appropriate causal contexts for their own emotions (Bauminger, 2004, Capps, et al., 1992; Jaedicke, et al., 1994; Losh & Capps, 2006; Rieffe, et al., 2007). This was true for both basic and self-conscious emotions, although their level of performance was only marginally worse than controls for basic emotions, but was significantly pronounced for self-conscious emotions. In addition, although this difficulty was most evident in the lab setting, individuals with autism showed no clear evidence of improvement when discussing these emotions in situ.

Overall, they were no less likely than controls to endorse that they were feeling or had felt a particular emotion, thus their poor performance cannot be attributed to the fact that they were being asked to describe causes of emotions that they felt were unfamiliar to them. The question then, is if individuals with autism do believe they experience a broad range of emotions, what interferes with their ability to effectively describe appropriate causal contexts of these emotions when prompted?

Widen and Russell's (2003, 2010a, 2010b) Differentiation Model proposes that children initially understand emotions in broad mental categories (pleasure versus displeasure). Through their experiences with observing varied facial expressions, noting contexts that elicit emotions, and connecting emotional experiences to the behaviors that result, children develop a script for each emotion, and their emotion categories gradually become more differentiated and adult-like. Since self-conscious emotions are difficult to recognize from facial expressions and require a strong self-evaluative component, it is more difficult to understand these emotions by only observing others, and thus children's emotion scripts for self-conscious emotions should take longer for children to clearly differentiate from similarly valenced basic emotions. Indeed, Widen and Russell (2010a) showed that through the age of six years, children are more likely to assimilate self-conscious emotions such as compassion, shame, and embarrassment into appropriately valenced basic-level categories, but by the age of nine, they are more able to differentiate them.

Given the above model, children with autism are at a distinct disadvantage when it comes to developing emotion scripts. A large body of work indicates that individuals with autism have difficulty processing faces (Dawson, Webb, & McPartland, 2005; Newell, Best, Gastgeb, Rump, & Strauss, 2010). Young children with autism are significantly less adept than typically

developing peers at recognizing basic emotional expressions (Rump, Strauss, & Minshew, 2009), and even as adolescents and adults, they have more difficulty than controls at recognizing more complex, self-conscious expressions (Baron-Cohen, et al., 1997; Heery, et al., 2003). In addition, given that understanding self-conscious emotions requires a clear differentiation of self from other (Tracy & Robins, 2004) as well as the ability to see oneself from the position of others (Lewis, et al., 1989), the role of theory of mind is thereby clearly implicated in the development of self-conscious emotion understanding (Wellman & Lagattuta, 2000). Given the known deficits in theory of mind in individuals with autism, it is likely that this plays a contributing factor in their difficulties identifying and understanding self-conscious emotions, particularly when they are younger and theory of mind deficits are most prominent (Happe, 1995). Finally, there is increasing evidence that individuals with autism have difficulty abstracting prototypical representations of categorical information (e.g., Gastgeb, Rump, Best, & Strauss, 2009; Klinger & Dawson, 2001), suggesting that even in the absence of emotion recognition and theory of mind deficits, their ability to abstract information from social scenarios in order to develop well differentiated emotion categories may be impaired. These three deficits, in combination, could very likely cause individuals with autism to be delayed, at the least, in their ability to differentiate emotion categories.

Results from the current study suggest that by the time they reach adolescence, individuals with autism are sufficiently capable of differentiating basic emotions in themselves such that they can usually provide at least one example of a time they experienced a particular emotion; however, they are not yet quite as proficient as controls. Their ability to differentiate their own self-conscious emotions, however, is significantly less well developed, and given the additional demands inherent in differentiating self-conscious emotions, this is not surprising.

This was evident during the in-lab Emotional Experiences task, and also likely reflects the unexpected finding that when reporting on their emotions in situ, the individuals with autism endorsed experiencing a higher number of discrete self-conscious emotions than controls did. It is important to note that for the Emotional Experiences task, their self-conscious emotion categories were clearly not atypical (reflected by the fact that overall, their mean scores were closer to a score of "3", which represents a clearly differentiated causal explanation, than to a score of "1," which represents more idiosyncratic responding), and that several individuals were at ceiling for this task and were able to provide appropriate causal contexts each time they were probed. This suggests that some individuals with autism do have the capacity to reach "typical" levels of differentiation for self-conscious emotions. While the current study found no association between performance on this measure and age or cognitive ability, future work should begin to examine these individual differences more closely to elucidate what factors contribute to more advanced emotion differentiation.

4.2.2 Reporting Specific, Personalized Causes of Emotion

While previous work has indicated that, when tested in the lab, individuals with autism are less able than controls to provide specific, personalized causes of their emotions (Bauminger, 2004; Losh & Capps, 2006) and are more likely to deny having ever experienced an emotion (Rieffe, et al., 2007), these results were not found in the current study. It is important to note that being probed in situ did provide an advantage to the individuals with autism in that if they endorsed experiencing a high intensity emotion, they were significantly less likely than when in the lab to deny knowing the cause of that emotion. Being probed in situ also provided a clear

advantage for individuals with autism given the increased proportion of specific, personalized responses they provided.

It was suggested that prior findings in individuals with autism may have been driven by poor autobiographical memory or memory for emotionally salient events (e.g., Bruck, et al., 2007; Crane & Goddard, 2008; Gaigg & Bowler, 2009), and the current results provide some support for this given that they performed less well when having to recall emotional events rather than report on current emotional events. However, given that in the current study, the overall pattern of results was the same for controls, albeit attenuated, it is unclear if these findings provide support for an in situ advantage that is specific to autism. It is also possible that the in situ advantage for the individuals with autism was reflective of a different underlying difficulty that impacted their performance in the lab. Since they only had to report on the causes of high intensity emotional events when probed in situ, it may be that their ability to link specific causes to particularly salient events is relatively intact, but if they were asked to identify what was causing them to feel "a little bit" sad, their responses may have been vaguer. Similarly, although their performance in the lab was no different than controls, it is possible that they were able to recall one particularly salient event for some emotions and in turn provide a specific response, rather than selecting a response from one of many they could recall. A brief qualitative review of their responses provides some support for this notion:

> "I felt proud when I was in a concert in the 5th grade" (Participant A: currently in 10th grade)
>
> "When I was 5 years old I stole a bar of chocolate and I felt super guilty and started crying and stuff" (Participant B: currently 15 years old)

"When I was 5 and I got lost in the store, I was afraid" (Participant C: currently 15 years old)

In contrast, no responses from the controls referenced a specific event that occurred when they were much younger. Thus, although the individuals with autism in the current study were able to provide as many specific, personalized causes of emotions as controls when probed in the lab, this may explained by the possibility that, once individuals with autism reach adolescence, the nature of the current task is no longer sensitive enough to sufficiently tap into the underlying impairments in emotion concepts that emerged in prior studies. Future work should attempt to disentangle their ability to encode and recall specific exemplars of high intensity emotional events from their ability to reflect on their own emotional experiences in the context of well defined emotion concepts.

4.3 REPORTING ON EMOTION IN SITU

This was the first study to use EMA methodology with individuals with autism. Results are encouraging in suggesting that this is a viable methodology to use with this population. Individuals with autism were just as likely to complete the protocol, averaged the same number of completed calls, and were willing to remain on the telephone for the same mean length of time as controls. Anecdotally, parents of the individuals with autism were more likely to indicate that they had to remind their children to charge the phone each night and take it with them each day, although they did not report that this was an undue burden on them.

Broadly, affective reports in situ of both the individuals with autism and the controls were consistent with previous work with individuals in a similar age range. Both groups

reported generally low levels of negative affect (Axelson, et al., 2003; Haviland-Jones, et al., 1997; Silk, et al., 2007), variable levels of positive affect (Axelson, et al., 2003; Haviland-Jones, et al., 1997), and rated their positive affect towards the middle of the scale's range (Haviland-Jones, et al., 1997, Larson & Lampman-Petraitis, 1989; Larson, et al., 2002). Given the relative similarities between the two groups and the general consistency with previous research, it appears as if the individuals with autism were not haphazard or erratic in their responding, and that their patterns of results and any respective divergence from controls can be given some credence.

The autism group differed from the control group in two important ways. The first divergence was in the intensity of their reported affect. Individuals in the autism group reported significantly higher levels of negative affect than controls. This was not true for positive affect. The finding of slightly lower but statistically similar levels of positive affect, in contrast to higher levels of negative affect, indicates that the results cannot simply be attributed to the fact that individuals with autism provided higher intensity ratings for *all* emotions. Also, although the overall magnitude of their negative affect was low and the effect sizes small, the divergence from the control group is notable. While it does not capture the parental and clinical descriptions of "intense negative affect" in children with autism (Attwood, 2008; Capps, et al., 1993, Ricks & Wing, 1975), it does reflect some minimal awareness of a heightened level of negative affect in this group. Based on daily parental report, however, there is some indication that the individuals with autism showed a pattern of under-reporting the intensity of their negative affect, particularly for reports of "upset" and "sad." Given that parent reports were retrospective and the design of the study could not ensure that parent and child were reporting on the same event, the finding of child underreporting in the autism group may be spurious. It is also possible that parents in the

autism group were over-reporting their children's negative affect. However, given that the general pattern of parent report results was the same for "sad," "nervous," and "upset," but not for "angry," and also that there is an emerging finding in the literature that parents report higher levels of negative affect in their children with autism than the children themselves do (Lopata, et al., 2010; Mazefsky, et al., 2011), it is quite possible that this finding reflects a true impairment in the ability to accurately recognize the *magnitude* of one's negative affect in the individuals with autism.

The second area of divergence from controls was in the lability of affect reported by the individuals with autism. They were significantly more labile than controls in their reports of "upset," "sad," and "happy," but not in their reports of "angry" and "scared." This again provides evidence that they were not simply more labile in their reporting of *all* emotions. While the magnitude of their lability for each emotion did not reflect enormous fluctuations in affect across the week, the medium to large effect sizes indicate that the observed differences are noteworthy. The finding is consistent with the clinical impression that individuals with autism, in contrast to controls, show significantly greater fluctuations in their negative affect on a day to day basis (e.g., Attwood, 2008), and it is the first to lend empirical support to this notion. This data is also encouraging in that it indicates that, at least by adolescence, individuals with autism can perceive and report on varying levels of affect. Although the accuracy of the *intensity* of that reporting is still unclear, it suggests they can introspect sufficiently to detect a change in their base level of affect. Interestingly, data was consistent with previous work with typically developing populations showing that greater intensity and lability in negative affect was associated with higher levels of depressive symptoms (Costello, et al., 1991; Larson, et al., 1990; Silk, et al., 2003). This relationship was upheld in the current study for child reports of

depressive symptoms, and a diagnosis of autism did not moderate this relationship. This does not necessarily indicate that individuals with autism who are more labile have higher levels of depression, but more likely suggests that individuals with autism who are able to *recognize* some fluctuations in their affect on a daily basis are also somewhat more able to detect and report on symptoms associated with depression.

Despite these encouraging findings, it is important to keep in mind that overall, the magnitude of fluctuations in negative affect, although significantly greater than controls, was still relatively small. This could suggest that while individuals with autism are generally more labile than controls in adolescence, the more *extreme* fluctuations described anecdotally in the literature (e.g., Muller & Schuler, 2006; Ricks & Wing, 1975) are more apparent in younger children. Alternatively, it may be that, as with intensity of emotion, individuals with autism are aware of fluctuations in their levels of negative affect, but are not skilled in interpreting the *degree* of this fluctuation. Future work that takes a developmental approach and that examines how reported emotional lability relates to other indices of affect fluctuation, such as emotion regulation, can begin to address some of these questions.

4.4 USE OF SELF-REPORT MEASURES

Understanding how individuals with autism understand and report on their emotions is highly relevant to conceptualizing how to diagnose psychiatric comorbidities in this population. As the literature base continues to grow, there is increasing evidence that mood and anxiety disorders are highly comorbid with autism spectrum disorders (Stewart, et al., 2008; White, et al., 2009). It is also established that, in typically developing individuals, correlations between

parent and child reports on child behavioral and emotional problems is low, at best, and that it is important to take into account both parent and child reports when evaluating for the presence of psychiatric comorbidities (e.g., Achenbach, McConaughy, & Howell, 1987; Jensen, et al., 1999). Thus, it is important to understand the implications of impaired emotional awareness and understanding in individuals with autism on how they report on their own mood and anxiety symptoms.

Findings in the current study regarding reports of symptoms of depression were generally consistent with previous literature. Parents of children with autism reported higher levels of depression symptoms in their children than control parents did (Lopata, et al., 2010; Nicpon, Doobay, & Assouline, 2010), and were more likely to endorse "at risk" levels of child depression than their children were (Lopata, et al., 2010, Nicpon, et al., 2010; Mazefsky, et al., 2011). In addition, parent and child reports in the autism group were not correlated (Mazefsky, Oswald, & Lainhart, 2008). In contrast to previous studies, the children in the autism group reported higher levels of depressive symptoms than the children in the control group. However, this was not driven by the individuals in the autism group reporting above average levels of depression, but rather was attributed to below average levels of depressive symptoms reported in the control group; thus, overall levels of depressive symptoms reported by the autism group were consistent with previous work (Lopata, et al., 2010; Nicpon, et al., 2010). Previous studies have attributed lower child than parent ratings of depression to a lack of awareness of internal emotional signals. Current results from in situ affective reports suggest that perhaps there is not a complete *lack* of awareness, but rather difficulty interpreting the intensity of the emotional experience. Thus, if symptoms of depression are only mildly elevated, then while they may be apparent to parents, they may be less discernable or relevant to the individuals with autism. The finding that intensity

of negative affect in situ predicted to depression symptoms reported in the lab provides some support for this notion and suggests, as discussed earlier, that perhaps individuals with autism who are more able to recognize and report on the intensity of their emotions on a day to day basis are also more able to recognize and report on more subtle levels of depressive symptoms.

Results from the anxiety measures were somewhat similar in that again, parents of children with autism endorsed higher levels of child anxiety than control parents did (e.g., Lopata, et al., 2010, Weisbrot, Gadow, DeVincent, & Pomeroy, 2005). As with depression symptoms, the individuals with autism endorsed significantly higher levels of anxiety than controls. In contrast to the findings with the depression reports, this difference was not just due to reports of lower than average anxiety in the controls, but rather due to particularly high levels of reported anxiety in the individuals with autism. The literature indicates that individuals with autism may be generally more aware of their anxiety symptoms than their depressive symptoms (Mazefsky, et al., 2010), and they have been shown to report levels of anxiety that that are comparable to typically developing individuals with anxiety disorders (e.g., Farrugia & Hudson, 2006; Russell & Sofronoff, 2005). What was surprising, however, was that the children with autism reported significantly higher levels of anxiety than even their parents did, which is inconsistent with prior findings. While this may reflect a tendency for the children to *over report* on lab-based measures, it stands in contrast to their pattern of reporting for depression symptoms. Also, while this could be attributed to an artifact of the measured used, the only published study utilizing the SCARED with this population indicated higher parent than child ratings (Reaven, et al., 2009). Finally, this could be a reflection of the age of the current sample (previous studies showing higher parent than child reports of anxiety had samples with individuals in the 10 to 13 year range). Perhaps anxiety symptoms in individuals with autism at this age are significantly

more prominent or physiologically based than depression symptoms, and by virtue of the fact that these symptoms are more perceptible to them, they may be more aware of them and thus interpret and report them as being high intensity. The finding in both groups of a significant positive relationship between difficulty with cognitive processing of emotions and levels of reported child anxiety provide some support for this conjecture. This suggests that individuals who are less able to cognitively reflect on their affect may use other indices to determine how they are feeling, thus they may be more aware of any physiological arousal associated with anxiety and in turn rate it as occurring more frequently. Of note, however, is that their in situ reports of feeling "nervous" were low and stable. It is possible that they did not link term "nervous" with the same experiences they endorsed on the SCARED (e.g., "I worry about being as good as other kids;" " I get stomach aches at school"), and that these experiences are better reflected in their ratings of "upset." Even so, the intensity and lability of negative affect reported in situ was not significantly related to their in-lab reports of anxiety. Thus, whatever factors led to the high levels of anxiety reported in the lab do not appear to consistently influence their reporting of affect on a day to day basis. Further work examining awareness of anxiety in adolescents with autism is clearly warranted.

Results from the current study support previous work that suggests that self-reports of individuals with autism on their behavioral and emotional difficulties must be interpreted with caution, as they may, particularly for depression, underestimate true symptoms levels. However, the data also suggest that relying on parent reports alone is not sufficient, as they may fail to capture a child's perceived level of distress. Thus, as with typically developing individuals, it will continue to be important to evaluate both parent and child reports until we have a firmer

grasp on the relationship between symptom expression and symptom report in individuals with autism.

4.5 AWARENESS OF AFFECTIVE EXPERIENCE AND AFFECTIVE SOCIAL COMPETENCE

The affective social competence model predicts that awareness and identification of one's own affective experience is positively related to proficiency in social interaction. Previous work has found support for the affective social competence model in typically children using a variety of measures (for a review see Trentacosta & Fine 2010). In addition, it has been shown that individuals with autism who were better at "receiving" affective signals (i.e., recognizing facial expressions of emotion) had higher social functioning by parent report (e.g., Garcia-Villamisar, Rojajn, Zaja, & Jodra, 2010; Stichter, et al., 2010). As such, it was predicted that measures of affective awareness collected during this study would predict to concurrent social competence. Although groups differed on many of the measures of interest (e.g., individuals with autism performed worse on the in-lab appropriateness of contexts tasks; individuals with autism reported higher TAS-20 C scores suggesting more difficulty with cognitive processing of emotion; controls and their parents reported higher social skills), the current study found no relationship between any measures of affective awareness and understanding and either parent- or self-reported social skills for both groups.

The current findings should not be taken as evidence that the affective social competence model is not relevant to the autism population, and rather that the measures used in the current study were not able to capture the skills relevant to adolescent affective social competence.

First, the relatively restricted range of scores on the appropriateness of context tasks, in conjunction with a small sample size, may be insufficient to discriminate within group differences. It is also possible that many of the prosocial skills assessed by the SSRS (e.g., ability to cooperate with family rules, ability to initiate conversations, ability to demonstrate regard for others property) are less susceptible to emotion awareness difficulties tapped by the appropriateness of context tasks and the TAS-20 C. Perhaps measures that better capture levels of social-emotion awareness and reciprocity, such as the Social Responsiveness Scale (Constantino & Todd, 2003) would be able to better elucidate potential relationships between the current affective awareness measures and parent report of daily social functioning.

4.6 LIMITATIONS

The current study, although adding to our understanding of how individuals with autism report on their affective experiences, has several limitations. First, the sample size was small and limited the power to detect relevant relationships between variables and significant differences between groups. In addition, there is growing awareness of important significant intragroup variation in the autism population, but the small sample size did not allow for adequate exploration at the subgroup level. Second, there is a possibility of selection bias for the autism group. Individuals with autism who were either uncomfortable talking on the phone or who were averse to discussing their emotions may have been less willing to participate in the study, thus the data might not be representative of those who have the *most* difficulty reporting on their affect. Third, participants in the autism group were all high functioning. As such, the current results may not be representative of individuals with autism who have cognitive impairments.

Fourth, this study did not measure and account for the potential effects of social skills intervention in the autism group. Professionals and parents are often aware of the difficulties that individuals with autism exhibit in emotion understanding and expression, thus it is possible that some individuals in the autism group may have received targeted intervention in emotion understanding at some point prior to enrolling in the study. If so, these individuals may have been able to describe their emotions more effectively than individuals who did not receive any such intervention. Fifth, with only one parent completing the in-lab measures, there was no way to account for the possibility of over- or under-reporting. Sixth, although this study demonstrates significantly more ecological validity than previous studies, the restriction that calls could only occur outside of school hours limits our understanding of their emotional experiences during the school day where there is the potential for a number of emotionally evoking situations (e.g., difficulties with peers). Seventh, we did not systematically investigate the relevance of missed calls. It is possible that calls were not answered, particularly for the individuals with autism, if they occurred during moments of intense affect (e.g., during a "meltdown" or an "anxiety attack"). Thus, we may have missed the opportunity to capture peak affective experiences in the moment. Finally, the method by which parent reports were collected in situ was susceptible to error. Given that parent calls occurred at the end of each day, parents may not have been able to accurately recall the exact time of day at which the event they were describing occurred, particularly on weekends when the parent was asked to recall events that had occurred over a whole day rather than an afternoon. As such, there may have been instances when a parent report was inadvertently compared to the incorrect child report.

4.7 FUTURE DIRECTIONS

This study took the first step in examining how individuals with autism understand and report on their affective experiences on a day to day basis, and how this relates to performance on in-lab and self-report measures. As such, it raises a number of unanswered questions and avenues for future research. First, it will be important to conduct further work in this area using larger samples. Autism symptomotology is incredibly heterogeneous, and the influence of specific underlying genetic and neurological profiles continues to elude researchers. Larger samples would allow us to explore individual differences in emotion processing skills, increase our potential to identify factors associated with deficits in this area, and perhaps intervene on a more individualized level.

Second, future work should strive to take a developmental approach. Previous work in another domain relevant to affective social competence, (i.e., emotion recognition) has demonstrated that the degree of impairment in individuals with autism relative to controls is related to developmental level and is more subtle in adolescence and adulthood (Rump, Strauss, & Minshew, 2009). Thus, it will be important to use consistent methodological techniques in child, adolescent, and adult groups in order to systematically explore how impairments in emotion understanding and awareness manifest at different ages.

Third, it will be important to design tasks to test emotion awareness and understanding that are more difficult and in turn make the use of compensatory strategies less successful. As discussed earlier, individuals with autism may be able to recall particularly high intensity emotional events, and in turn perform well on task where they can discuss them, yet still have generally poorly developed emotion categories. Perhaps if they had been asked to provide several examples of when they had experienced a particular emotion, specific deficits would have been more pronounced.

Fourth, future studies should employ multiple informants for each measure in order to better understand potential systematic over- or under-reporting that may occur. Teachers would be a particularly good source of information given that they are more likely to see a broader sampling of "typical" behavior than many parents might, and as a result have a better metric by which to judge certain characteristics, such as social skills. In addition, symptoms of anxiety may be more likely to manifest in a school setting giving the constantly shifting task demands and social environment. As such, teachers may be able to provide unique insights into a child's apparent levels of anxiety.

Sixth, given the apparent underreporting by individuals with autism in most affective domains assessed in situ, the need for corresponding parent reports is tantamount. It will be important not only to acquire more frequent parent reports, but also to develop methods to ensure more accurate temporal relationships between reports. One strategy could be to prompt parents (by beeper or some other noninvasive measure) to complete a report on their child's current affect at the same time their child receives each call. In this way, accuracy of both intensity and lability can be examined more closely.

Finally, it is clear that ecological momentary assessment is a promising methodology for future use in this population. Not only do the data present a more ecologically valid representation of how individuals with autism report on their affect on a day to day basis, but the nature of the repeated sampling allowed us to detect important differences between groups that could never be captured in one or even several lab visits. Given the rich nature of the data that can be collected using EMA methodology, it will now be important to examine more closely the correlates of affective reports. Previous work in typically developing populations has indicated that valence and intensity of affect varies with the social context (i.e., alone, with friends, with parents) (Larson & Richards, 1991) and the environmental contexts (i.e., school, home, other) (Schneiders, et al., 2007). Understanding how context influences the reports of individuals with autism will further enhance our

understanding of their affective experiences and will also provide valuable information for conceptualizing treatment plans.

4.8 CONCLUSIONS

Almost sixty years after Kanner first characterized autism, clinicians and researchers are still trying to understand the "disturbance of affective contact" that so clearly captures the social nature of these individuals, yet is so difficult to operationalize and quantify. The current study indicates that even by adolescence, the ways in which individuals with autism understand, experience, and report on their emotions differs from their typically developing peers. Results suggest they have less-well-defined emotion concepts, particularly for self-conscious emotions. Additionally, when their affective experiences are sampled in an ecologically valid way, it appears that, in general, they experience more intense and labile negative affect than their typically developing peers, although the degree of this intensity and lability is still unclear. Many of the ways in which they differ from their typically developing peers are seemingly subtle, and even when using sensitive and ecologically valid methodology, the true the magnitude of these differences is difficult to capture. As such, it is likely that none of these impairments, in isolation, play a substantial role in impaired affective-social competence. However, as the effects of less-well-defined emotion concepts, lower attunement to the intensity of emotion, more labile affect, and less awareness of internal emotion signals converge, the daily impact on social-emotional reciprocity may become significant. Thus, while the current study is another step towards quantifying the "emotional deficit" in autism that was indentified over half

a decade ago, further work is urgently needed to help guide parents and professionals toward a better understanding of this component of the autistic experience.

APPENDIX A

EMOTION DEFINITIONS
from Losh & Capps, 2006

Happy: glad, cheery

Sad: unhappy

Angry: mad

Afraid: scared, frightened

Nervous: anxious, worried

Proud: pleased with yourself, happy about something you did well

Embarrassed: humiliated, self-conscious, making a mistake

Guilty: doing something wrong or bad

Tired: sleepy

Sick: ill, not healthy

Hungry: really want to eat food

APPENDIX B

CODING KEY FOR EMOTIONAL EXPERIENCES

1) Specific vs. Non-specific cause

0 = Don't know/no response

1 = Non-specific (no clear reference to a specific event)

Examples: "birthday parties make me happy"

"I'm was sad when people died"

2 = Specific (focus on a specific past event)

Examples: "I was sad when my dog died"

"I was mad when I got a bad grade"

2) Appropriateness of Causal Context

0 = Don't know/no response

1 = Incorrect/inappropriate context (actions and events that, without further explanation, would not typically elicit the emotion in question)

Examples: "I was sad one time when I got a birthday present"

"Hammers make me angry"

"I felt tired when my mom hugged me"

2 = Context with appropriate valance (episodes that would tend to elicit feelings of appropriate valance but do not contain sufficient details or explanation for distinguishing the specific emotion from similarly valenced feelings)

Examples: “I was proud when my mom gave me a present”

“I was guilty when my dog died”

“I was afraid when people made fun of me”

3 = Appropriate context (references describing unambiguously evocative contexts)

Examples: “I was happy when I went to the zoo with my friends yesterday”

“I was proud when I won the spelling bee”

“I was sick last year when I had the flu”

APPENDIX C

CHILD EMA SCRIPT

Adapted from Axelson, et al., 2003 & Silk, et al., 2007

Hi, NAME*, this is _____ from the University of Pittsburgh. Is this a good time to answer a few questions?*

If YES – begin; If NO – *ok, how long until I should call you back?*

Current Feelings
Ask on every call

1 = not at all
2 = a little
3 = moderately
4 = quite a bit
5 = extremely

I am going to ask you some questions about how you were feeling when the phone rang. Use the 1-5 scale and the thermometer on the back of your phone to tell me how you are feeling:

1. How **happy*** (good, satisfied) are you? 1 2 3 4 5
2. How **sad*** (unhappy) are you? 1 2 3 4 5
3. How **nervous*** (worried, anxious) are you? 1 2 3 4 5
4. How **upset** (agitated, distressed) are you? 1 2 3 4 5
5. How **angry*** (mad) are you? 1 2 3 4 5
6. How **lonely** (feeling sad/bad because you're alone) are you? 1 2 3 4 5
7. How **proud*** (pleased and happy with yourself or someone else because you/they did something good) are you? 1 2 3 4 5
8. How **scared*** (frightened, afraid) are you? 1 2 3 4 5
9. How **guilty*** (feeling bad because you did something you shouldn't have) are you? 1 2 3 4 5
10. How **embarrassed*** (self-conscious) are you? 1 2 3 4 5

***Probe:**

If they rate happy, sad, nervous, angry, scared, proud, embarrassed, or guilty *a **4 or 5**:*

11. A. You said you were feeling {quite a bit/extremely} _____. What made you feel that way?

B. You said you were feeling {quite a bit/extremely} _____. What made you feel that way?

C. You said you were feeling {quite a bit/extremely} _____. What made you feel that way?

D. You said you were feeling {quite a bit/extremely} _____. What made you feel that way?

Current Activity

12. At the moment the phone rang, what were you doing?

13. A. Where were you {current activity}?

B. How long have you been {current activity}?

14. Were you interacting with anyone when the phone rang? **YES NO**

Who?

In what way were you interacting (in person, on telephone, on computer)?

A. If they were interacting with someone on #14:

Were you {current activity} together when the phone rang? **YES NO**

Most Negative and Positive – Past Hour
Ask on every call

15. **Try to remember your feelings and thoughts over the past hour (so, between XX and now). Think about the time when you felt the worst, or the most negative (e.g., mad, upset, nervous, disappointed, sad, worried). What happened?**

16. When was it?

___right before I was called = 1
___about 15 minutes ago = 2
___about 30 minutes ago = 3
___about 45 minutes ago = 4
___about 1 hour ago = 5

A. At the worst point, how **angry** did you feel? 1 2 3 4 5
B. At the worst point, how **nervous** did you feel? 1 2 3 4 5
C. At the worst point, how **sad** did you feel? 1 2 3 4 5
D. At the worst point, how **upset** did you feel? 1 2 3 4 5

1 = not at all
2 = a little
3 = moderately
4 = quite a bit
5 = extremely

17. Now think about the best or happiest time in the past hour.
(e.g., happy, excited, relaxed). What happened?

18. When was it?

___right before I was called = 1
___about 15 minutes ago = 2
___about 30 minutes ago = 3
___about 45 minutes ago = 4
___about 1 hour ago = 5

1 = not at all
2 = a little
3 = moderately
4 = quite a bit
5 = extremely

19.

A. At the best point, how **happy** did you feel? 1 2 3 4 5

Worry
Ask on every call

20. A. Were you were worrying about anything before the phone rang. *If nothing, see question 21*.

W1

Is there anything else you were worrying about?
W2

Is there anything else you were worrying about?
W3

Is there anything else you were worrying about?
W4

B. How worried were you about {worry}?

W1
W2
W3
W4

1 = not at all
2 = a little
3 = moderately
4 = quite a bit
5 = extremely

21. (*Ask only if nothing for question 20)* What have you been thinking about?

Ask only on the last call of every day

Enjoyable Experiences

22. A. What was the best thing that happened to you today?

B. At the best moment, how enjoyable was {enjoyable event} for you? (Circle Answer)

Enjoyable 1

1 = not at all
2 = a little
3 = moderately
4 = quite a bit
5 = extremely

23. Did you go to school today?

1 = yes	5 = sick
2 = weekend	6 = just not going
3 = school holiday	7 = home schooled
4 = doctors/dentist appointment	8 = summer vacation

24. Will you go to school tomorrow?

1 = yes	5 = sick
2 = weekend	6 = just not going
3 = school holiday	7 = home schooled
4 = doctors/dentist appointment	8 = summer vacation

25. Any after school or extracurricular activities:

1 = sporting activity	4 = detention
2 = academic	5 = other extracurricular activity
3 = social (football game/dance/etc)	6 = none

APPENDIX D

PARENT EMA QUESTIONNIARE

Please think back on your child's emotional experiences between the hours of ____ and ____.

On a scale of 1 to 5, where 1 is "not at all," 2 is "a little," 3 is "moderately," 4 is "quite a bit," and 5 is "extremely," did your child experience any of the following emotions at a **level of 4 or 5**?

1. **Happy**? NO YES If YES, was it at LEVEL 4 LEVEL 5

What happened to cause this?_____

Around what time today did this happen?_____

Was "Name" with anyone when he was feeling this way? NO YES

If YES, who was "Name" with?_____

Repeat for:

2. **Sad**
3. **Angry**
4. **Nervous**
5. **Upset**
6. **Scared**
7. **Proud**
8. **Embarrassed**
9. **Guilty**

APPENDIX E

SCREEN FOR CHILD ANXIETY RELATED EMOTIONAL DISORDERS

(SCARED) SCALE

Birmaher, et al., 1997

Please read the following statements and circle that response that best describes you:

	Not True (0)	Sometimes True (1)	Often True (2)
1. When I feel frightened, it is hard for me to breathe	**0**	**1**	**2**
2. I get headaches when I am at school	**0**	**1**	**2**
3. I do not like to be with people I do not know well	**0**	**1**	**2**
4. I get scared if I sleep away from home	**0**	**1**	**2**
5. I worry about other people liking me	**0**	**1**	**2**
6. When I get frightened, I feel like passing out	**0**	**1**	**2**
7. I am nervous	**0**	**1**	**2**
8. I follow my mother or father wherever they go	**0**	**1**	**2**
9. People tell me I look nervous	**0**	**1**	**2**
10. I feel nervous with people I don't know well	**0**	**1**	**2**
11. I get stomachaches at school	**0**	**1**	**2**
12. When I get frightened, I feel like I am going crazy	**0**	**1**	**2**
13. I worry about sleeping alone	**0**	**1**	**2**

	Not True (0)	Sometimes True (1)	Often True (2)
14. I worry about being as good as other kids	**0**	**1**	**2**
15. When I get frightened, I feel like things are not real	**0**	**1**	**2**
16. I have nightmares about something bad happening to my parents	**0**	**1**	**2**
17. I worry about going to school	**0**	**1**	**2**
18. When I get frightened, my heart beats fast	**0**	**1**	**2**
19. I get shaky	**0**	**1**	**2**
20. I have nightmares about something bad happing to me	**0**	**1**	**2**
21. I worry about things working out for me	**0**	**1**	**2**
22. When I get anxious, I sweat a lot	**0**	**1**	**2**
23. I am a worrier	**0**	**1**	**2**
24. I get really frightened for no reason at all	**0**	**1**	**2**
25. I am afraid to be alone in the house	**0**	**1**	**2**
26. It is hard for me to talk to people I don’t know well	**0**	**1**	**2**
27. When I get frightened, I feel like I am choking	**0**	**1**	**2**
28. People tell I that I worry too much	**0**	**1**	**2**
29. I do not like to be away from my family	**0**	**1**	**2**
30. I am afraid of having anxiety (or panic) attacks	**0**	**1**	**2**
31. I worry that something bad might happen to my parents	**0**	**1**	**2**
32. I feel shy with people I don’t know well	**0**	**1**	**2**
33. I worry about what is going to happen in the future	**0**	**1**	**2**
34. When I get frightened, I feel like throwing up	**0**	**1**	**2**
35. I worry about how well I do things	**0**	**1**	**2**

	Not True (0)	Sometimes True (1)	Often True (2)
36. I get scared to go to school	**0**	**1**	**2**
37. I worry about things that have already happened	**0**	**1**	**2**
38. When I get frightened, I feel dizzy	**0**	**1**	**2**
39. I feel nervous when I am with other children and I have to do something while they watch me (for example: read aloud, speak, play a game, play a sport)	**0**	**1**	**2**
40. I feel nervous about going to parties, dances, or any place where there will be people that I don't know well	**0**	**1**	**2**
41. I am shy	**0**	**1**	**2**

APPENDIX F

SCREEN FOR CHILD ANXIETY RELATED EMOTIONAL DISORDERS

(SCARED) SCALE -- PARENT

Birmaher, et al., 1997

Please read the following statements and circle that response that best describes your child:

	Not True (1)	Sometimes True (1)	Often True (2)
8. When my child feels frightened, it is hard for him/her to breathe	**0**	**1**	**2**
9. My child gets headaches when he/she is at school	**0**	**1**	**2**
10. My child does not like to be with people he/she does not know well	**0**	**1**	**2**
11. My child gets scared if he/she sleeps away from home	**0**	**1**	**2**
12. My child worries about other people liking him/her	**0**	**1**	**2**
13. When my child gets frightened, he/she feels like passing out	**0**	**1**	**2**
14. My child is nervous	**0**	**1**	**2**
8. My child follows us wherever we go	**0**	**1**	**2**
9. People tell my child he/she looks nervous	**0**	**1**	**2**
10. My child feels nervous when with people he/she does not know well	**0**	**1**	**2**
11. My child gets stomachaches at school	**0**	**1**	**2**
12. When my child gets frightened, he/she feels like he/she is going crazy	**0**	**1**	**2**

	Not True (0)	Sometimes True (1)	Often True (2)
13. My child worries about sleeping alone	**0**	**1**	**2**
14. My child worries about being as good as other kids	**0**	**1**	**2**
15. When my child gets frightened, he/she feels like things are not real	**0**	**1**	**2**
16. My child has nightmares about something bad happening to us	**0**	**1**	**2**
17. My child worries about going to school	**0**	**1**	**2**
18. When my child gets frightened, his/her heart beats fast	**0**	**1**	**2**
19. My child gets shaky	**0**	**1**	**2**
20. My child has nightmares about something bad happing to him/her	**0**	**1**	**2**
21. My child worries about things working out for him/her	**0**	**1**	**2**
22. When my child gets anxious, he/she sweats a lot	**0**	**1**	**2**
23. My child is a worrier	**0**	**1**	**2**
24. My child gets really frightened for no reason at all	**0**	**1**	**2**
25. My child is afraid to be alone in the house	**0**	**1**	**2**
26. It is hard for my child to talk to people he/she doesn't know well	**0**	**1**	**2**
27. When my child gets frightened, he/she feels like he/she is choking	**0**	**1**	**2**
28. People tell my child that he/she worries too much	**0**	**1**	**2**
29. My child does not like to be away from his/her family	**0**	**1**	**2**
30. My child is afraid of having anxiety (or panic) attacks	**0**	**1**	**2**
31. My child worries that something bad might happen to us	**0**	**1**	**2**
32. My child feels shy with people he/she doesn't know well	**0**	**1**	**2**
33. My child worries about what is going to happen in the future	**0**	**1**	**2**
34. When my child gets frightened, he/she feels like throwing up	**0**	**1**	**2**

	Not True (0)	Sometimes True (1)	Often True (2)
35. My child worries about how well he/she does things	**0**	**1**	**2**
36. My child gets scared to go to school	**0**	**1**	**2**
37. My child worries about things that have already happened	**0**	**1**	**2**
38. When my child gets frightened, he/she feels dizzy	**0**	**1**	**2**
39. My child feels nervous when he/she is with other children and he/she has to do something while they watch him/her (for example: read aloud, speak, play a game, play a sport)	**0**	**1**	**2**
40. My child feels nervous about going to parties, dances, or any place where there will be people the he/she doesn't know well	**0**	**1**	**2**
41. My child is shy	**0**	**1**	**2**

APPENDIX G

THE TORONTO ALEXITHYMIA SCALE – 20 FOR CHILDREN

Rieffe, Oosterveld, & Meerum Terwogt, 2006

Please read the following statements and circle that response that best describes you:

1.	I am often confused about the way I feel inside	**Not True A Bit True True**
2.	I find it difficult to say how I feel inside	**Not True A Bit True True**
3.	I feel things in my body that even doctors don't understand	**Not True A Bit True True**
4.	I can easily say how I feel inside	**Not True A Bit True True**
5.	When I have a problem, I want to know where is comes from and not just talk about it	**Not True A Bit True True**
6.	When I am upset, I don't know if I'm sad, scared, or angry	**Not True A Bit True True**
7.	I am often puzzled by things I feel in my body	**Not True A Bit True True**
8.	I'd rather wait and see what happens, instead of thinking about why things happen	**Not True A Bit True True**
9.	Sometimes I can't find the words to say how I feel inside	**Not True A Bit True True**
10.	It is important to understand how you feel inside	**Not True A Bit True True**
11.	I find it hard to say how I feel about other people	**Not True A Bit True True**

12. Other people tell me I should talk more about how I feel inside	**Not True**	**A Bit True**	**True**
13. I don't know what's going on inside me	**Not True**	**A Bit True**	**True**
14. I often don't know why I am angry	**Not True**	**A Bit True**	**True**
15. I prefer talking to people about everyday things, rather than about how they feel	**Not True**	**A Bit True**	**True**
16. I prefer watching funny television shows, rather than shows that tell a story about other people's problems	**Not True**	**A Bit True**	**True**
17. It is difficult for me to say how I really feel inside, even to my best friend	**Not True**	**A Bit True**	**True**
18. I can feel close to someone, even when we are sitting still and not saying anything	**Not True**	**A Bit True**	**True**
19. Thinking about how I feel helps me when I want to do something about my problems	**Not True**	**A Bit True**	**True**
20. When I have to concentrate on a movie to understand the story, I enjoy the movie much less.	**Not True**	**A Bit True**	**True**

APPENDIX H

SAMPLE OF PARTICIPANT REPSONSES FROM THE EMOTIONAL EXPERIENCES TASK

Appropriateness of Context:

2 Point Descriptions:

BASIC

- "I felt sad the first few days of 4th grade when I had to meet new people" (sad; autism group; 15 years old)
- "The other day I made a substance called Gobbledy Goo and the composite just didn't come out right" (sad; autism group; 16 years old)
- "When this kid at school starts to talk about porn and stuff" (angry, autism group; 15 years old)
- "When I first met my grandparents" (afraid; control group; 15 years old)

SELF-CONSCIOUS

- "I'm proud when I clean the house" (proud; autism group; 13 years old)
- "I'm proud at my family" (proud; autism group; 17 years old)

- "I was embarrassed when I accidentally broke something special" (embarrassed; autism group; 13 years old)
- "I was embarrassed when I accidentally came home late" (embarrassed; autism group; 12 years old)
- "I felt guilty when I hanged [sic] out with the wrong types of friends" (guilty; autism group; 17 years old)
- "I feel guilty when I'm clumsy" (guilty; autism group; 14 years old)
- "When my brother accidentally got a nail in his foot and I didn't know what to do" (guilty; control group; 14 years old)

<u>3 Point Descriptions:</u>

BASIC

- "I was sad when we had to put my dog down" (sad; autism group; 16 years old)
- "I am angry at my mom or dad at a time we are disagreeing about something" (angry; autism group; 15 years old)
- "I was afraid when we were on an airplane and it got bumpy" (afraid; autism group; 16 years old)
- "I was nervous when I went to camp for the first time" (nervous; autism group; 15 years old)
- "I was afraid when I first rode a rollercoaster" (afraid; control group; 17 years old)
- "When I had to play in a band concert and I was in front of the whole school" (nervous; control group; 12 years old)

SELF-CONSCIOUS

- “I was proud when I was able to finish very difficult questions very quickly before everyone else” (proud; autism group; 16 years old)
- “When I was young, every time I got scared I had this girly scream, and everyone would laugh at me” (embarrassed; autism group; 16 years old)
- “When I made a speech in class that wasn’t really put in my own words” (guilty; autism group; 15 years old)
- “Mostly when someone points out that my pants are sagging a little lower than I’d like” (embarrassed; autism group; 17 years old)
- “When I took my grandma’s car and I let someone else drive it, and I shouldn’t have” (guilty; control group; 16 years old)
- “When I had to take my younger brother out with me and my friends and he acted rudely” (embarrassed; control group; 15 years old)

Specific, Personalized Causes:

Non-Specific Descriptions:

- “I’m sad when someone hurts my feelings” (sad; autism group; 16 years old)
- “I’m nervous during tests” (nervous; autism group; 12 years old)
- “When I slip and fall in public” (embarrassed, autism group; 17 years old)
- “When I’ve done good on an assignment” (proud; autism group; 15 years old)
- “I’m afraid of heights sometimes” (afraid; control group; 14 years old)
- “Sometimes in school, if you do something bad, you really don't want people to see what happened” (embarrassed; control group; 15 years old)

Specific Descriptions:

- “When the Steelers won the Super Bowl” (happy; autism group; 13 years old)
- “Recently when I found out one of my mentors, my camp director, had passed away. He had leukemia” (sad; autism group; 15 years old)
- “I got proud that I was able to write a script without copying someone else's lines” (proud; autism group; 15 years old)
- “When I broke that orb a few years ago in my front yard” (guilty; autism group; 12 years old)
- “My brother broke my sunglasses and I was angry at him” (angry; control group; 14 years old)
- “When my parents are in a store and I do something wrong and they tell me to stop. That's embarrassing!” (embarrassed; control group; 16 years old)

BIBLIOGRAPHY

Achenbach, T.M., McConaughy, S.H., Howell, C.T. (1987). Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychological Bulletin, 101,* 213-232.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (*4th ed*.). Washington, DC: Author.

Attwood, T. (1998). *Asperger's syndrome: A guide for parents and professionals.* London: Jessica Kingsley.

Attwood, T. (2008, July). The complete guide to Asperger's syndrome: "Making friends and managing feelings." Paper presented at the Autism and Asperger Syndrome Conference, Dixon, IL.

Axelson, D. A., Bertocci, M. A., Lewin, D. S., Trubnick, L. S., Birmaher, B., Williamson, D. E., et al. (2003). Measuring mood and complex behavior in natural environments: Use of ecological momentary assessment in pediatric affective disorders. *Journal of Child and Adolescent Psychopharmacology, 13*, 253-266.

Bagby, R.M., Parker, J. D., & Taylor, G.J. (1994). The twenty-item Toronto Alexithymia Scale-I. Item selection and cross-validation of the factor structure. *Journal of Psychosomatic Research, 38,* 23-32.

Baron-Cohen, S. (1991). Do people with autism understand what causes emotion? *Child Development, 62*, 385-395.

Bauminger, N. (2002). The facilitation of social-emotional understanding and social interaction in high-functioning children with autism: Intervention outcomes. *Journal of Autism and Developmental Disorders, 32*, 283-298.

Bauminger, N. (2004). The expression and understanding of jealousy in children with autism. *Development and Psychopathology, 16*, 157-177.

Bauminger, N., & Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development, 71*, 447-456.

Begeer, S., Koot, H. M., Rieffe, C., Meerum Terwogt, M., & Stegge, H. (2008). Emotional competence in children with autism: Diagnostic criteria and empirical evidence. *Developmental Review, 28*, 342-369.

Berthoz, S., & Hill, E. L. (2005). The validity of using self-reports to assess emotion regulation abilities in adults with autism spectrum disorder. *European Psychiatry, 20,* 291-298.

Beversdorf, D.Q., Anderson, J.M., Manning, S.E., Anderson, S.L., Dordgrenm R.E., Felopulos, G.J., et al. (1998). The effect of semantic and emotional context on written recall for verbal language in high-functioning adults with autism spectrum disorder. *Journal of Neurology, Neurosurgery, and Psychiatry, 65,* 685-692.

Birmaher, B., Brent, D.A., Chiappetta, L., Bridge, J., Monga, S., and Baugher, M. (1999). Psychometric properties of the screen for child anxiety related emotional disorders (SCARED): A replication study. *Journal of the American Academy of Child and Adolescent Psychiatry, 38,* 1230-1236.

Birmaher, B., Khetarpal, S., Brent, D., Cully, M., Balach, L., Kaufman, J., and Neer, S. (1997). The screen for child anxiety related emotional disorders (SCARED): Scale construction and psychometric characteristics. *Journal of the American Academy of Child and Adolescent Psychiatry, 36,* 545-553.

Bolte, S., Feineis-Matthews, S., & Poustka, F. (2008). Brief report: Emotional processing in high-functioning autism -- Physiological reactivity and affective report. *Journal of Autism and Developmental Disorders, 38,* 776-781.

Brooks, S.J., & Kutcher, S. (2001). Diagnosis and measurement of adolescent depression: A review of commonly used instruments. *Journal of Child and Adolescent Psychopharmacology, 11,* 341-376.

Bruck, M., London, K., Landa, R., & Goodman, J. (2007). Autobiographical memory and suggestibility in children with autism spectrum disorder. *Development and Psychopathology, 1, 73-95.*

Capps, L., Kasari, C., Yirmiya, N., & Sigman, M. (1993). Parental perception of emotional expressiveness in children with autism. *Journal of Consulting and Clinical Psychology, 61,* 475-484.

Capps, L., Yirmiya, N., & Sigman, M. (1992). Understanding of simple and complex emotions in non-retarded children with autism. *Journal of Child Psychology and Psychiatry, 33,* 1169-1182.

Cassidy, J., Parke, R.D., Butkovsky, L., & Braungart, J.M. (1992). Family-peer connections: The roles of emotional expressiveness within the family and children's understanding of emotions. *Child Development,* 603-618.

Centers for Disease Control and Prevention. (2009). Prevalence of Autism Spectrum Disorders. [Morbidity and Mortality Weekly Report]. *Surveillance Summaries, February. MMWR 2007, 58*(SS-10), 1-20.

Church, C., Alisanski, S., & Amanullah, S. (2000). The social, behavioral, and academic experiences of children with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities, 15,* 12-20.

Cole, D. A., & Martin, N. C. (2005). The longitudinal structure of the Children's Depression Inventory: Testing a latent trait-state model. *Psychological Assessment, 17,* 144-155.

Cole, D. A., Truglio, R., & Peeke, L. (1997). Relation between symptoms of anxiety and depression in children: A multitrait-multimethod-multigroup assessment. *Journal of Consulting and Clinical Psychology, 65,* 110-119.

Cook, E.T., Greenberg, M.T., & Kusche, C.A. (1994). The relations between emotional understanding, intellectual functioning, and disruptive behavior problems in elementary-school-aged children. *Journal of Abnormal Child Psychology, 22,* 205-219.

Constantino, J. N. & Todd, R. D. (2003). Autistic traits in the general population: A twin study. *Archives of General Psychiatry*, 60, 524 -530.

Costello, E.J., Benjamin, R., Angold, A., & Silver, S. (1991). Mood variability in adolescents: A study of depressed, nondepressed and comorbid patients. *Journal of Affective Disorders, 23,* 199-212.

Crane, L., & Goddard, L. (2008). Episodic and semantic autobiographical memory in adults with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 38,* 498-506.

Custrini, R. J., & Feldman, R. S. (1989). Children's social competence and nonverbal encoding and decoding of emotions. *Journal of Clinical Child Psychology, 18,* 336-342.

Davidson, D. (2006). The role of basic, self-conscious and self-conscious evaluative emotions in children's memory and understanding of emotion. *Motivation and Emotion, 30,* 237-247.

Dawson, G., Webb, S., & McPartland, J. (2005). Understanding the nature of face processing impairment in autism: Insights from behavioral and electrophysiological studies. *Developmental Neuropsychology, 27*(3) 403-424.

Denham, S. (1986). Social cognition, prosocial behavior, and emotion in preschoolers: Contextual validation. *Child Development, 57,* 194-201.

Dennis, M., Lockyer, L., & Lazenby, A. L. (2000). How high-functioning children with autism understand real and deceptive emotion. *Autism, 4,* 370-381.

Devilly, G.J. (2005). ClinTools Software for Windows: Version 4 (computer programme). www.clintools.com, Psytek Ltd.

Downs, A., & Smith, T. (2004). Emotional understanding, cooperation, and social behavior in high-functioning children with autism. *Journal of Autism and Developmental Disorders, 34*, 625-635.

Eisenberg, N., Fabes, R. A., Shepard, S. A., Murphy, B. C., Guthrie, I. K., Jones, S., et al. (1997a). Contemporaneous and longitudinal prediction of children's social functioning from regulation and emotionality. *Child Development, 68*, 642-664.

Eisenberg, N., Guthrie, I. K., Fabes, R. A., Reiser, M., Murphy, B. C., Holgren, R., et al. (1997b). The relations of regulation and emotionality to resiliency and competent social functioning in elementary school children. *Child Development, 68*, 295-311.

Ekman, P. (2003). *Emotions Revealed*. New York: Owl Books.

Farrugia, S., Hudson, J. (2006). Anxiety in adolescents with Asperger syndrome: Negative thoughts, behavioral problems, and life interference. *Focus on Autism and Other Developmental Disabilities, 21*, 25-35.

Fivush, R., Berlin, L.J., Sales, J.M., Mennuti-Washburn, J., & Cassidy, J. (2003). Functions of parent-child reminiscing about emotionally negative events. *Memory, 11*, 179-192.

Gaigg, S.B., & Bowler, D.M. (2008). Free recall and forgetting of emotionally arousing words in autism spectrum disorder. *Neuropsychologia, 46*, 2336-2343.

Garcia-Villamisar, D., Rojahn, J., Zaja, R.H., Jodra, M. (2010). Facial emotion processing and social adaptation in adults with and without autism spectrum disorder. *Research in Autism Spectrum Disorders, 4*, 755-762.

Gastgeb, H., Rump, K. M., Best, C. A., & Strauss, M. S. (2009). Prototype formation in autism: Can individuals with autism abstract facial prototypes? *Autism Research, 2*, 279-284.

Gresham, F. M., & Elliott, S. N. (1990). Social Skills Rating System. Minneapolis: NCS Pearson, Inc.

Hadwin, J.A., & Perner, J. (1991). Pleased and surprised: Children's cognitive theory of emotion. *British Journal of Developmental Psychology, 9*, 215-234.

Halberstadt, A. G., Denham, S. A., & Dunsmore, J. C. (2001). Affective social competence. *Social Development, 10*, 79-119.

Happe, F. G. E. (1995). The role of age and verbal ability in the theory of mind performance of subjects with autism. *Child Development, 66*, 843-855.

Harris, P.L., Johnson, C., Hutton, D., Andrews, G., & Cooke, T. (1989). Young children's theory of mind and emotion. *Cognition and Emotion, 3*, 379-400.

Harris, P. L., & Olthof, T. (1982). The child's concept of emotion. In G. Butterworth & P. Light (Eds.), *Social Cognition*. Chicago: University of Chicago Press.

Haviland-Jones, J., Gebelt, J.L., & Stapley, J.C. (1997). The questions of development in emotion. In *Emotional development and emotional intelligence: Educational implications* (pp. 35-69). New York, NY: Basic Books.

Heerey, E. A., Keltner, D., & Capps, L. M. (2003). Making sense of self-conscious emotion: Linking theory of mind and emotion in children with autism. *Emotion, 3*, 394-400.

Hertzig, M. E., Snow, M. E., & Sherman, M. (1989). Affect and cognition in autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 28*(2), 195-199.

Hill, E., Berthoz, S., & Frith, U. (2004). Brief report: Cognitive processing of own emotions in individuals with autistic spectrum disorder and in their relatives. *Journal of Autism and Developmental Disorders, 34*, 229-235.

Hillier, A., & Allinson, L. (2002). Understanding embarrassment among those with autism: Breaking down the complex emotion of embarrassment among those with autism. *Journal of Autism and Developmental Disorders, 32*, 583-592.

Hobson, R. (1986a). The autistic child's appraisal of expressions of emotion. *Journal of Child Psychology and Psychiatry, 27*, 321-342.

Hobson, R. P. (1990). On the origins of self and the case of autism. *Development and Psychopathology, 2*, 163-181.

Hobson, P. (2004). *The Cradle of Thought*. Oxford: Oxford University Press.

Hobson, R. P. (2005). Autism and Emotion. In F. R. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.), *Handbook of Autism and Pervasive Developmental Disorders* (3 ed., Vol. 1, pp. 406-422): Wiley.

Hobson, P., Chidambi, G., Lee, A., & Meyer, J. (2006). Foundations for self-awareness: An explanation through autism. *Monographs of the Society for Research in Child Development, 71*, 1 - 166.

Jaedicke, S., Storoschuk, S., & Lord, C. (1994). Subjective experience and causes of affect in high-functioning children and adolescents with autism. *Development and Psychopathology, 6*, 273-284.

Jansen, L. M., Gispen-de Wied, C. C., van der Gaag, R. J., & Van Engeland, H. (2003). Differentiation between autism and multiple complex developmental disorder in response to psychosocial stress. *Neuropsychopharacology, 28*, 582-590.

Jansen, L. M., Gispen-de Wied, C. C., Wiegant, V. M., Westenberg, H. G., Lahuis, B. E., & van Engeland, H. (2006). Autonomic and neuroendocrine responses to a psychosocial stressor in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 36,* 891-899.

Jensen, P.S., Rubio-Stipec, M., Canino, G., Bird, H.R., Dulcan, M.K., Schwab-Stone, M.E., et al. (1999). Parent and child contributions to diagnosis of mental disorder: Are both informants always necessary? *Journal of the American Academy of Child and Adolescent Psychiatry, 38,* 1569-1579.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217-250.

Kasari, C., Sigman, M., Baumgartner, P., & Stipek, D. J. (1993). Pride and mastery in children with autism. *Journal of Child Psychology and Psychiatry, 34,* 353-362.

Klin, A., Jones, W., Schultz, R.T., & Volkmar, F.R. (2003). The enactive mind, or from actions to cognition: Lessons from autism. *Philosophical Transactions of the Royal Society of London, 358,* 345-360.

Klin, A., Jones, W., Schultz, R.T., & Volkmar, F.R. (2005). The enactive mind – From actions to cognition: Lessons from autism. In F. R. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.), *Handbook of Autism and Pervasive Developmental Disorders* (3 ed., Vol. 1, pp. 682-703): Wiley.

Klinger, L., & Dawson, G. (2001). Prototype formation in children with autism and Down syndrome. *Development and Psychopathology, 13*, 111-124.

Kovacs, M. (1992). *Children's Depression Inventory.* New York: Multi-Health Systems.

Lagutta, K.H., & Wellman, H.M. (2002). Difference in early parent-child conversations about negative versus positive emotions: Implications for the development of psychological understanding. *Developmental Psychology, 38,* 564-580

Larson, R. (1989). Beeping children and adolescents: A method for studying time use and daily experience. *Journal of Youth and Adolescence, 18,* 511-530.

Larson, R., Csikszentmihalyi, M., & Graef, R. (1980). Mood variability and the psychosocial adjustment of adolescents. *Journal of Youth and Adolescence 9,* 469-490.

Larson, R., & Lampman-Petraitis, C. (1989). Daily emotional states as reported by children and adolescents. *Child Development, 60,* 1250-1260.

Larson, R. W., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development, 73*, 1151-1165.

Larson, R. W., Raffaelli, M., Richards, M. H., Ham, M., & Jewell, L. (1990). Ecology of depression in late childhood and early adolescence: A profile of daily states and activities. *Journal of Abnormal Psychology, 99*, 92-102.

Larson, R., & Richards, M. (1991). Daily companionship in late childhood and early adolescence: Changing developmental contexts. *Child Development, 62,* 284-300.

Laurent, J., Catanzaro, S. J., Joiner, T. E., Rudolph, K. D., Potter, K. I., Lambert, S., et al. (1999). A measure of positive and negative affect for children: Scale development and preliminary validation. *Psychological Assessment, 11*, 326-338.

Lewis, M., Sullivan, M.W., Stanger, C., & Weiss, M. (1989). Self development and self conscious emotions. *Child Development, 60,* 146-156.

Leyfer, O. T., Folstein, S. E., Bacalman, S., Davis, N. O., Dinh, E., Morgan, J., Tager-Flusberg, H., & Lainhart, J. E. (2006). Comorbid psychiatric disorders in children with autism: Interview development and rates of disorders. *Journal of Autism Developmental Disorders, 36,* 849-861.

Lopata, C., Toomey, J.A., Fox, J.D., Volker, M.A., Chow, S.Y., Thomeer, M.L., et al. (2010). Anxiety and depression in children with HFASDs: Symptom levels and source differences. *Journal of Abnormal Child Psychology, 38*, 765-776.

Lord, C., Risi, S., Lambrecht, L., Cook, J. E., Leventhal, B. L., DiLavore, P. C., et al. (2000). The Autism Diagnostic Observation Schedule – Generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders, 24,* 659-685.

Lord, C., Rutter, M., DiLavore, P.C., & Risi, S. (1999). *Autism Diagnostic Observation Schedule*. Los Angeles, CA: Western Psychological Services.

Lord, C., Rutter, M., & Le Couteur, A. (1994). Autism Diagnostic Interview-Revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders,* 24, 659-695.

Losh, M., & Capps, L. (2006). Understanding of emotional experience in autism: Insights from the personal accounts of high-functioning children with autism. *Developmental Psychology, 42,* 809-818.

Mazefsky, C. A., Kao, J., & Oswald, D.P. (2011). Preliminary evidence suggesting caution in the use of psychiatrtic self-report measures with adolescents with high-functioning autism spectrum disorders. *Research in Autism Spectrum Disorders, 5,* 164-174.

Mazefsky, C. A., Oswald, D.P. & Lainhart, J. E. (May, 2008). *Assessment of psychiatric comorbidity in ASD: Assessment of the recently developed Autism Comorbidity Interview*

and issues of self report. Poster presented at the International Meeting for Autism Research, London, England.

Millward, C., Powell, S., Messer, D., & Jordan, R. (2000). Recall for self and other in autism: Children's memory for events experienced by themselves and their peers. *Journal of Autism and Developmental Disorders, 30,* 15-28.

Moskowitz, D. S., & Young, S. N. (2006). Ecological momentary assessment: What it is and why it is a method of the future in clinical psychopharmacology. *Journal of Psychiatry and Neuroscience, 31,* 13-20.

Muller, E., & Schuler, A. (2006). Verbal marking of affect by children with Asperger Syndrome and high functioning autism during spontaneous interactions with family members. *Journal of Autism and Developmental Disorders, 36,* 1089-1100.

Murphy, B.C., Shapard, S.A., Eisenberg, N., & Fabes, R. A., (2004). Concurrent and across time prediction of young adolescents' social functioning: The role of emotionality and regulation. *Social Development, 13,* 56-86.

Newell, L. C., Best, C. A., Gastgeb, H., Rump, K. M., & Strauss, M. S. (2010). The development categorization and facial knowledge: Implications for the study of autism. In L. M. Oakes, C. H. Cashon, M. Casasola, & D. H. Rakison (Eds.) *Infant Perception and Cognition: Recent Advances, Emerging Theories, and Future Directions,* New York: Oxford Press.

Nicpon, M.F., Doobay, A.F., Assouline, S.G. (2010). Parent, teacher, and self perceptions of psychosocial functioning in intellectually gifted children and adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 40,* 1028-1038.

Prior, M., Dahlstrom, B., & Squires, T.L. (1990). Autistic children's knowledge of thinking and feeling states in other people. *Journal of Child Psychology and Psychiatry, 31,* 587-601.

Reaven, J.A., Blakeley-Smith, A., Nichols, S., Dasari, M., Flanigan, E., Hepburn, S. (2009). Cognitive-behavioral group treatment for anxiety symptoms in children with high-functioning autism spectrum disorders: A pilot study. *Focus on Autism and Other Developmental Disabilities, 24,* 27-37.

Ricks, D. M., & Wing, L. (1975). Language, communication, and the use of symbols in normal and autistic children. *Journal of Autism and Childhood Schizophrenia, 5,* 191-221.

Rieffe, C., Oosterveld, P., & Meerum Terwogt, M. (2006). An alexithymia questionnaire for children: Factorial and concurrent validation results. *Personality and Individual Differences, 40,* 123-133.

Rieffe, C., Meerum Terwogt, M., & Cowan, R. (2005). Children's understanding of mental states as causes of emotions. *Infant and Child Development, 14,* 259-272.

Rieffe, C., Meerum Terwogt, M., & Kotronopoulou, K. (2007). Awareness of single and multiple emotions in high-functioning children with autism. *Journal of Autism and Developmental Disorders, 37*, 455-465.

Rump, K. M., Giovannelli, J. L., Minshew, N. J., & Strauss, M. S. (2009). The development of emotion recognition in individuals with autism. *Child Development, 80,* 1434-1447.

Russell, E., Sofronoff, K. (2005). Anxiety and social worries in children with Asperger syndrome. *Australian and New Zealand Journal of Psychiatry, 39*, 633-638.

Saarni, C. (2007). The development of emotional competence: Pathways for helping children to become emotionally intelligent. In *Educating people to be emotionally intelligent* (pp. 15-35). Westport, CT: Praeger Publishers/Greenwood Publishing Group.

Schneiders, J., Nicolson, N. A., Berkhof, J., Feron, F. J., Devries, M. W., & van Os, J. (2007). Mood in daily contexts: Relationship with risk in early adolescence. *Journal of Research on Adolescence, 17*, 697-722.

Schneiders, J., Nicolson, N. A., Berkhof, J., Feron, F. J., Van Os, J., & Devries, M. W. (2006). Mood reactivity to daily negative events in early adolescence: Relationship to risk for psychopathology. *Developmental Psychology, 42*, 543-554.

Shalom, D., Mostofsky, S., Hazlett, R., Goldberg, M., Landa, R., Faran, Y., et al. (2006). Normal physiological emotions but differences in expression of conscious feelings in children with high-functioning autism. *Journal of Autism and Developmental Disorders, 36*, 395-400.

Silk, J. S., Dahl, R. E., Ryan, N. D., Forbes, E. E., Axelson, D. A., Birmaher, B., et al. (2007). Pupillary and reactivity to emotional information in child adolescent depression: Links to clinical and ecological measures. *American Journal of Psychiatry, 164*(12), 1873-1880.

Silk, J., Steinberg, L., & Sheffield Morris, A. (2003). Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. *Child Development, 74*, 1869-1880.

Stewart, M. E., Barnard, L., Pearson, J., Hasan, R., & O'Brien, G. (2006). Presentation of depression in autism and Asperger syndrome: A review. *Autism, 10*, 103-116.

Stichter, J.P., Herzog, M.J., Visovsky, K., Schmidt, C., Randolph, J., Schultz, T., et al. (2010). Social competence intervention for youth with Asperger syndrome and high-functioning autism: An initial investigation. *Journal of Autism and Developmental Disorders, 40*, 1067-1079.

Stone, A.A. & Shiffman, S. (1994). Ecological momentary assessment (EMA) in behavioral medicine. Annals of Behavioral Medicine, 16, 199-202.

Toichi, M., & Kamio, Y. (2002). Long-term memory and levels-of-processing in autism. *Neuropsychologia, 40*, 964-969.

Tracy, J. L., & Robins, R. W. (2004). Putting the self into self-conscious emotions: A theoretical model. *Psychological Inquiry, 15*, 103-125.

Trentacosta, C.J., Fine, S.E. (2009). Emotion knowledge, social competence, and behavior problems in childhood and adolescence: A meta-analytic review. *Social Development, 19*, 1-29.

Vickerstaff, S., Heriot, S., Wong, M., Lopes, A., & Dossetor, D. (2007). Intellectual ability, self-perceived social competence, and depressive symptomatology in children with high functioning autistic spectrum disorders. *Journal of Autism and Developmental Disorders, 37*, 1647-1664.

Wechsler, D. (1999). *Wechsler Abbreviated Intelligence Scale*. San Antonio: The Psychological Corporation.

Weisbrot, D.M., Gadow, K.D., DeVincent, C.J., & Pomeroy, J. (2005). The presentation of anxiety in children with pervasive developmental disorders. *Journal of Child and Adolescent Psychopharmacology, 15*, 477-496.

Wellman, H.M., & Lagattuta, K. H. (2000). Developing understandings of mind. In S. Baron-Cohen, H. Tager-Flusberg, & D. Cohen (Eds.), *Understanding other minds: Perspectives from developmental cognitive neuroscience, second edition*. Oxford, UK: Oxford University Press.

Whalen, C.K., Henker, B., Ishikawa, S.S., Jamner, L.D., Floro, J.N., Johnston, J.A., & Swindle, R. (2006). An electronic diary study of contextual triggers and ADHD: Get read, get set, get mad. *Journal of the American Academy of Child and Adolescent Psychiatry, 45*, 166-174.

Whalen, C.K., Jamner, L.D., Henker, B., & Delfino, R.J. (2001). Smoking and moods in adolescents with depressive and aggressive dispositions: Evidence from surveys and electronic diaries. *Health Psychology, 20*, 99-111.

White, S.W., Oswald, D., Ollendick, T., & Scahill, L. (2009). Anxiety in children and adolescents with autism spectrum disorders. *Clinical Psychology Review, 29*, 216-229.

Widen, S.C., & Russell, J.A. (2003). A closer look at preschoolers' freely produced labels for facial expressions. *Developmental Psychology, 39*, 114-128.

Widen, S.C., & Russell, J.A. (2010a). Children's scripts for social emotions: Causes and consequences are more central than are facial expressions. *British Journal of Developmental Psychology, 28*, 565-581.

Widen, S.C., & Russell, J.A. (2010b). Differentiation in preschooler's categories of emotion. *Emotion, 10,* 651-661.

Wierzbicki, M (1987). A parent form of the Children's Depression Inventory: Reliability and validity in nonclinical populations. *Journal of Clinical Psychology, 43,* 390-397.

Williams, D., & Happe, F. (2010). Recognizing 'social' and 'non-social' emotions in self and others: A study of autism. *Autism, 14,* 285-304.