Georgia State University

ScholarWorks @ Georgia State University

Psychology Faculty Publications   Department of Psychology

2013

Short Report: The Role of Emotion Perception in Adaptive Functioning of People with Autism Spectrum Disorders

Margaret B. Hudepohl

Diana L. Robins
Georgia State University, drobins@gsu.edu

Tricia Z. King
Georgia State University, tzking@gsu.edu

Christopher C. Henrich
Georgia State University, chenrich@gsu.edu

Follow this and additional works at: https://scholarworks.gsu.edu/psych_facpub

Part of the Psychology Commons

Recommended Citation

Short Report: The Role of Emotion Perception in Adaptive Functioning of People with Autism Spectrum Disorders

Margaret B. Hudepohl[a]
Diana L. Robins[a,b]
Tricia Z. King[a,b]
Christopher C. Henrich[a]

[a]Department of Psychology and [b]Neuroscience Institute
Georgia State University
Atlanta, GA 30302-5010

Address Correspondence to:

Diana L. Robins, Ph.D.
Department of Psychology
Georgia State University
Atlanta, GA 30302-5010

Tel:	**404-413-6293**
Fax:	**404-413-6207**
e-mail:	**drobins@gsu.edu**

Acknowledgements

Funding

SCIENTIFIC ABSTRACT

Cognitive functioning has historically been used to predict adaptive outcomes of people with autism spectrum disorders (ASDs); however, research shows that it is not a complete predictor. The current study explored whether emotion perception was a predictor of adaptive outcomes, and more specifically, hypothesized that emotion perception (DANVA-2 error scores) would mediate adaptive functioning of people with ASDs (Vineland-II). People with ASDs demonstrated significantly lower adaptive functioning and emotion perception skills compared to typically-developing individuals. Emotion perception acted as a significant mediator for socialization, but not communication or daily living skills, highlighting that in people with ASDs, lower socialization abilities is the result, in part, of emotion perception deficits. It was unexpected that emotion perception was not a mediator for communication skills. This may be related to sample restrictions, or the narrow focus on emotion perception. Future research should involve a larger, more inclusive ASD sample, broaden approaches to exploring relationships between social perception and adaptive outcomes, and relate findings to brain mechanisms underlying emotion perception.

Keywords: autism spectrum disorders, adaptive behavior, emotion perception, socialization skills

Introduction

Autism spectrum disorders (ASDs) are characterized by deficits in socialization, particularly social and emotional interaction, and communication, with restricted interests and/or perseverative behaviors. Much research, therefore, has focused on the nature, outcome, and prediction of these behaviors, and possible interventions. An area of considerable focus within this research investigates *adaptive functioning*, which refers to the effectiveness with which one can perform daily activities and meet every day environmental demands required for personal and social sufficiency. Previous research shows that people with ASDs exhibit a unique pattern of adaptive behaviors, including overall low levels of adaptive behavior and, within that, significant socialization deficits, mild-moderate communication impairments, with daily living skills being a relative strength (e.g., Carpentieri & Morgan, 1996).

People with ASDs tend to demonstrate adaptive impairments beyond what would typically be expected from their cognitive functioning. For example, Liss and colleagues (2001) revealed that people with High-Functioning Autism (HFA) emerged as more impaired in socialization and daily living skills than people with Low-Functioning Autism, when each was compared to their nonverbal IQ-matched group. This finding emphasizes that, even as the cognitive potential of these individuals' increases, adaptive functioning does not correspondingly develop. There is evidence that intellectual functioning does not sufficiently predict how people with ASD meet day-to-day life demands. Measures of cognitive and language functioning are often used together to predict outcomes. For example, joint attention, childhood language abilities, and IQ together predicted later social and adaptive functioning (Gillespie-Lynch et al., 2012), and age of first word was shown to predict later childhood adaptive skills (Mayo et al., 2013). These recent findings along with previous conclusions that intellectual functioning does

not fully predict adaptive abilities highlights the continued need to determine what factors, above and beyond cognitive functioning, contribute to adaptive outcomes in people with ASDs.

Emotion perception is an individual's ability to interpret emotional cues. To effectively communicate and interact socially, one must be able to successfully process emotional cues received from others. Beginning with the earliest description of autism, many studies have documented the impairments that these individuals exhibit in recognizing and understanding emotion. Deficits specifically in the perceptual ability to recognize, match, and label emotions in faces, but not other perceptual tasks (e.g., Boucher and Lewis, 1992), affective prosody, and other emotion-related skills such as understanding and attributing emotions to others are well-documented (e.g., Klin et al., 2007). Furthermore, emotion perception abilities, such as the face perception task utilized in the current study, are a critical component of social perception, and may be the most studied aspect of social cognition (Schultz, 2005).

Although there are separate literatures investigating emotion perception and adaptive functioning, to date, it remains unclear exactly how these two constructs are related. Most research has focused on relating intelligence and adaptive functioning. For example, Klin et al. (2007) reported inconsistent findings regarding the relationship between verbal IQ and adaptive outcomes; specifically, using different IQ tests, one site found significant correlations whereas the other did not. A strength of Klin et al. (2007) is that they explored the potential role of diagnostic symptoms (ADOS) and adaptive functioning, finding a weak relationship. There has been little exploration of other variables that may be related to adaptive outcomes. The relationship between the constructs of emotion perception and adaptive functioning is intuitive when one considers that successful adaptive skills appear to depend on proficient emotion perception abilities. That is, social interactive, communicative, and daily living skills may be

contingent, in varying ways and degrees, on an individual's emotion perception abilities (e.g., processing emotional cues during conversation; expressing feeling to another). Thus, emotion perception abilities may play an important role in the development of skills implicated in real-life situations, such as school or work, having meaningful relationships, and developing the skills necessary to live an independent life.

The current study aimed to investigate the relationship between emotion perception and adaptive outcomes in people with ASDs. It was hypothesized that emotion perception ability mediates the relationship between diagnostic group and adaptive functioning (Figure 1). That is, people with ASDs have lower adaptive functioning at least in part because of deficits in emotion perception ability. This mediation model was investigated for each of the three Vineland-II adaptive functioning domains: Socialization, Communication, and Daily Living Skills. It was expected that Socialization and Communication would partially mediate this relationship, given that social interactive and communicative skills may be contingent on an individual's emotion perception abilities differentially.

Method

Participants: Participants were part of a larger, ongoing emotion perception study. They were recruited from local autism societies, support groups, clinic referrals, university undergraduate research pool, and community advertisements. Inclusion in the study was contingent on ASD diagnosis and intellectual functioning (IQ>75; 1 ASD excluded). ASD diagnoses were confirmed with the Autism Diagnostic Interview, Revised (LeCouteur et al., 2003) and Autism Diagnostic Observation Schedule (Lord et al., 1999). Typically developing (TD) individuals demonstrated a lack of ASD symptomatology, measured by the Social Communication Questionnaire (Rutter et

al., 2003; *M*=2.6; *SD*=2.96; *Range*: 0-11), and emotion perception skills within normal limits (3

TD excluded, performed < 2 SD below mean).

The final sample consisted of forty individuals, 18 with ASDs (9 Autistic Disorder; 9

other-ASD; Age: *M*=13.08; *SD*=3.92; *Range*: 7.38-21.2) and 22 age- and IQ-matched TDs (Age:

M=13.9; *SD*=3.31; *Range*: 9.14-19.2) with 5 females per group ($\chi^2(1)$=.14, *p*=.71). See Table 1

for additional descriptive statistics.

Measures: In addition to diagnostic measures, participants were administered the 4-

subtest Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) to estimate

cognitive abilities. Groups did not significantly differ in cognitive functioning (Full Scale IQ;

t(38)=1.04, *p*=.31; combined group *M*=105.95; *SD*=15.73). Cognitive ability was not used as a

covariate as described in Dennis and colleagues (2009) regarding studies of neurodevelopmental

disorders.

Parents were interviewed about participants' current adaptive skills in the areas of

communication, socialization, and daily living skills using the Vineland Adaptive Behavior

Scales, Second Edition (Vineland-II; Sparrow et al., 2005). Participants completed the

Diagnostic Analysis of Nonverbal Accuracy, Second Edition (DANVA-2; Nowicki, 2004) to

assess emotion perception, with adult and child facial expression and paralanguage subtests.

Participants identified the emotion perceived in a forced choice format (i.e., happy, sad, angry,

fearful) in 1) facial expressions in photographs, and 2) audio-tracks of one neutral-content

sentence stated in the four emotions. Emotion perception errors on each subtest were totaled and

standardized using normative data. Subtest *z*-scores were summed to create composite error *z*-

scores (Table 1).

Procedures: All participants provided written informed consent and/or assent following procedures approved by the Georgia State University Institutional Review Board. Trained research assistants administered measures as part of a larger battery in a counterbalanced order. Participants were debriefed and compensated.

Results

Independent samples t-tests compared the two groups on all test measures. As expected, people with ASDs made significantly more errors in emotion perception on the DANVA-2 compared to TD (Table 1) and demonstrated lower adaptive skills (Socialization ($t(38)= 5.58$, $p<.001$), Communication, ($t(38)= 3.67$, $p=.001$), and Daily Living skills ($t(38)= 3.59$, $p=.001$)). Significant correlations between adaptive measures and emotion perception supported pursuing the meditational analysis (See Table 2).

To evaluate the mediational hypothesis, bootstrapping in conjunction with OLS regression was utilized (Preacher & Hayes, 2004). Bootstrapping is a nonparametric statistical technique that does not utilize normal distribution assumptions and thus accounts for the non-normality of sampling distributions of the mediated effects, given that indirect effects are typically not normally distributed. In this way, it increases the power of the mediational analysis and is believed to provide the most accurate confidence intervals for indirect effects (see Preacher & Hayes, 2004). Estimates of indirect effects were obtained with bias-corrected bootstrap confidence intervals using 5,000 bootstrap samples. Results for each path of the model are reported in Figure 1. Path results and bootstrap Bias Corrected and Accelerated (BCa) 95% confidence intervals revealed partial mediation of the relationship between diagnostic group and adaptive functioning by emotion perception ability for the Socialization skills outcome (i.e., significant *a* and *b* paths; confidence interval of a*b does not overlap with zero; *c'* path remains

significant). Emotion perception ability did not mediate the relationship between diagnostic group and Communication skills or Daily Living Skills.

Discussion

The purpose of this study was to examine the role of emotion perception as related to adaptive functioning of people with ASDs. Consistent with previous findings, people with high-functioning ASDs, on average, demonstrated more impaired adaptive functioning (e.g., Carpentieri & Morgan, 1996), and a greater number of emotion perception errors relative to the TD group (e.g., Haviland et al., 1996). Emotion perception ability partially mediated the relationship between diagnostic group and adaptive functioning for Socialization skills but not Communication or Daily Living skills.

Klin and colleagues (2007) recommend that factors other than cognitive functioning be investigated to determine additional influences on adaptive outcomes of people with ASDs. The current study was undertaken on that basis, given the important role of emotion perception abilities in day-to-day activities and real-life situations, such as interpersonal success at school and work. Given that our hypothesized mechanism of change (i.e., that aspects of adaptive functioning change as a function of emotion perception ability) falls within a gap in the literature, it appears that the current findings provide initial evidence for a novel factor that may influence select adaptive outcomes of people with ASDs. Although these mediation results do not establish causation, this link between emotion perception and socialization skills may be of particular significance for future studies assessing treatments to enhance aspects of adaptive functioning. Furthermore, the multi-method approach of parent-informant report of the participants' everyday functioning and the participants' emotion perception performance are strengths of the study, as it avoids shared method variance.

It was surprising to see that emotion perception ability did not mediate communication skills. The adaptive functioning profile was somewhat similar to Liss and colleagues' (2001), in that individuals with HFA demonstrated greatest impairment in socialization. However, it should be noted that communication and daily living skills were equally impaired in this sample. It is possible that including more individuals across the autism spectrum may reveal additional variance in communication skills, which may have implications for its relationship with emotion perception.

The absence of a significant relationship between emotion perception and communication skills may also reflect the current focus on emotion perception. In some literature, there are three processes thought to be part of social perception: *input/perception* (receptive tasks), *integration* of input from different modalities, and *output*, or behavioral responses on expressive tasks (Feldman et al., 1982). When an individual perceives incoming cues, integrates them within their context, and provides output via an appropriate behavioral response, successful social perception results. Thus, when considering the processes that contribute to social perception, the emotion perception task in the current study, the DANVA-2, assesses the input/perception process, but does not require integration or significant output (i.e., forced-choice responses, not generation of emotion words). It seems that communication skills may be more highly related to the integration (e.g., dynamic audio-visual stimuli) and output stages of social perception, not measured in the current study. Therefore, it may be that the greatest mechanism of change in adaptive functioning skills is related to the larger construct of social perception and that emotion perception is too restrictive to fully explain adaptive outcomes across domains. If the broader construct of social perception is, in fact, related to adaptive outcomes, future research should fully assess all processes of social perception, and explore if there are developmental aspects of

these relationships. The age range of participants was broad (i.e., ages 7 to 21); although

adaptive functioning measures used standard scores that take age into account, the expected

complexity of adaptive skills does increase with age. Therefore, future research should examine

the relationship between variables in our model to see if the model changes as a function of age.

Other areas for future research include increasing sample size with individuals across the

autism spectrum, and exploring brain mechanisms that underlie the relationship between these

skills using diffusion tensor imaging or BOLD activation using fMRI during a dynamic emotion

perception task.

References

Carpentieri, S.C. & Morgan, S.B. (1996). Adaptive and intellectual functioning in autistic and

    nonautistic retarded children. *Journal of Autism and Developmental Disorders, 26*(6),

    611-620.

Dennis, M., Francis, D.J., Cirino, P.T., Schachar, R., Barnes, M.A., & Fletcher, J.M. (2009).

    Why IQ is not a covariate in cognitive studies of neurodevelopmental disorders. *Journal*

    of the International Neuropsychological Society, 15(3), 331-343.

Feldman, R. S., White, J., & Lobato, D. (1982). Development of social skills in nonverbal

    behavior. In R. S. Feldman (Ed.), *Development of Nonverbal Behavior in Children*. New

    York: Springer-Verlag.

Gillespie-Lynch, K., Sepeta, L., Wang, Y., Marshall, S., Gomez, L., Sigman, M., Hutman, T.

    (2012). Early childhood predictors of the social competence of adults with autism.

    Journal of Autism and Developmental Disorders, 42(2), 161-174.

Haviland, J.M., Walker-Andrews, A.S., Huffman, L.R., Toci, L. & Alton, K. (1996). Intermodal

    perception of emotional expressions by children with autism. *Journal of Developmental*

    and Physical Disabilities, 8(1), 77-89.

Klin, A., Saulnier, C.A., Sparrow, S.S., Cicchetti, D.V., Volkmar, F.R. & Lord, C. (2007). Social

    and communication abilities and disabilities in higher functioning individuals with autism

    spectrum disorders: The Vineland and the ADOS. *Journal of Autism and Developmental*

    Disorders, 37(4), 748-759.

Le Couteur, A., Lord, C. & Rutter, M. (2003). *Autism Diagnostic Interview-Revised-Interview*

    Protocol. Los Angeles: Western Psychological Services.

Liss, M., Harel, B., Fein, D., Allen, D., Dunn, M., Feinstein, C., Morris, R., Waterhouse, L., & Rapin, I. (2001). Predictors and Correlates of Adaptive Functioning in Children with Developmental Disorders. *Journal of Autism and Developmental Disorders, 31*(2), 219-230.

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

Mayo, J., Chlebowski, C., Fein, D.A., Eigsti, I. (2013). Age of first words predicts cognitive ability and adaptive skills in children with ASD. *Journal of Autism and Developmental Disorders, 43*, 253-264.

Nowicki, S. (2004). Instruction manual for the receptive tests of the Diagnostic Analysis of Nonverbal Accuracy 2. Unpublished manuscript, Emory University, Atlanta, GA.

Preacher, K. & Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods Instruments & Computer, 36*(4), 717-731.

Rutter, M., Bailey, A., Berument, S.B., Lord, C., & Pickles, A. (2003). Social Communication Questionnaire (SCQ). Los Angeles, CA: Western Psychological Services.

Schultz, R.T. (2005). Developmental deficits in social perception in autism: the role of the amygdala and fusiform face area. *International Journal of Developmental Neuroscience, 23*, 125-141.

Sparrow, S., Cicchetti, D.V., Balla, D.A. (2005). *Vineland Adaptive Behavior Scales, Second Edition*. Circle Pines, MN: American Guidance Service, Inc.

Wechsler, D. (1999). *Wechsler Abbreviated Scale of Intelligence (WASI)*. San Antonio, TX: Harcourt Assessment, Inc.

1   Table 1

2   *Descriptive Statistics for TD (n=22) and ASD (n=18) groups*

	TD M (SD)	ASD M (SD)
WASI FSIQ	108.4 (12.3)	102.9 (19.1)
	Range: 79-126	Range: 74-132
WASI VIQ	108.6 (14.7)	102.9 (16.1)
	Range: 76-144	Range: 71-125
WASI PIQ	106.7 (13.1)	102.9 (23.1)
	Range: 84-128	Range: 64-135
Communication	97.8* (16.3)	78.1* (15.9)
	Range: 72-127	Range: 47-115
Socialization	101.4* (14.5)	72.7* (18.0)
	Range: 79-134	Range: 32-103
Daily Living Skills	95.9* (15.3)	78.1* (15.9)
	Range: 68-122	Range: 45-126
DANVA-2, error composite[‡]	-0.02* (0.3)	-0.3* (0.8)
	Range: -0.61-0.43	Range: -1.1-1.75

3   *Note*. WASI FSIQ = Wechsler Abbreviated Scale of Intelligence, Full Scale IQ, standard scores; Socialization, Communication, Daily Living

4   Skills = Vineland-II adaptive functioning domains, standard scores; DANVA-2 = Diagnostic Assessment of Nonverbal Accuracy, Second

5   Edition, [‡]Composite error *z*-scores, where average is 0 and one standard deviation is 1. **Negative scores on the Danva-2 Error Composite**

6   **indicate fewer errors than the normative sample.**

7   **t*-test revealed significant group differences.

8   [+] Correlations were significant at *p* < .05.

9   [++] Correlations significant at *p* <.01

10   Table 2

11   *Correlations for the Entire Sample*

	1.	2.	3.	4.	5.	6.	7.	8.
1. Diagnosis group	----	-.17	-.19	-.11	-.47++	-.64++	-.46++	.48++
2. WASI FSIQ		----	.82++	.85++	.22	.27	.19	-.42++
3. WASI VIQ			----	.39+	.18	.30	.13	-.23
4. WASI PIQ				----	.18	.15	.18	-.44++
5. Communication					----	.84++	.87++	-.29
6. Socialization						----	.87++	-.42++
7. Daily Living Skills							----	-.35+
8. DANVA-2, error composite‡								----

12   *Note*. WASI FSIQ = Wechsler Abbreviated Scale of Intelligence, Full Scale IQ, standard scores; Socialization, Communication, Daily Living

13   Skills = Vineland-II adaptive functioning domains, standard scores; DANVA-2 = Diagnostic Assessment of Nonverbal Accuracy, Second

14   Edition, ‡Composite error *z*-scores, where average is 0 and one standard deviation is 1. **Negative scores on the Danva-2 Error Composite**

15   **indicate fewer errors than the normative sample.**

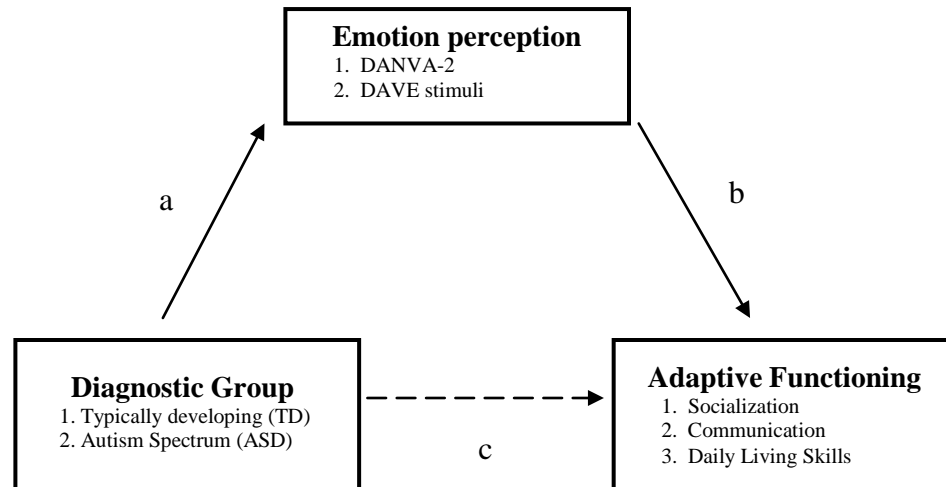16   **t*-test revealed significant group differences.

17   + Correlations were significant at $p < .05$.

18   ++ Correlations significant at $p < .01$

19   Figure Caption

20   *Figure 1*. Mediational model of emotion perception as mediator of the relationship between

21   diagnostic group and three adaptive functioning outcomes.

Summary of Mediation Models Testing whether Emotion Perception Mediates the Relationship between Diagnostic Group and Adaptive Functioning Domain

Vineland-II Domain (DV)	Effect of IV on *M* (*a*)	95% CI (*a*)		Effect of *M* on DV (*b*)	95 % CI (*b*)		Direct effects (*c'*)	95% CI (*c'*)		Indirect effect (SE) (a*b)	BCa 95% CI (*a*b*)	
		(L)	(U)		(L)	(U)		(L)	(U)		(L)	(U)
Socialization	0.48*	0.10	0.87	-0.65*	-18.2	-1.3	-1.60**	-39.2	-18.3	-0.32	-0.95	-0.02
Communication	0.48*	0.10	0.87	-0.45	-15.4	1.93	-1.03**	-26.5	-4.5	-0.23	-0.70	0.01
Daily Living	0.48*	0.1	0.8	-0.51	-16.0	0.5	-0.94*	-24.5	-3.6	-0.25	-0.73	0.00

Skills	0	7	9

Note. Unstandardized coeffcients. BCa – bias-corrected and accelerated bootstrapping; 95% CI = confidence intervals, (L) = lower bound, (U) = upper bound; 5,000 bootstrap samples. Socialization shows significant *a* and *b* path and the indirect path CI does not overlap with zero; significant *c'* path reflects partial mediation between diagnostic group and Socialization skills.

*p < .05; **p < .01