The Emotional Landscape of Toddlers with ASD

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Overview

Importance of emotions in ASD

Notions about emotional expressivity in autism

Intensity of emotional expression in toddlers with ASD

Experience of emotions at the physiological level
Why study emotion in autism?

Positive and negative emotions influence a broad range of cognitive processes (Ashby, Isen & Turken, 1999; Bell & Wolfe, 2004) as well as later emotional and physical health (Mäntymaa et al., 2003, 2015).

Children with ASD: comorbid affective problems begin during preschool years

Emotional expressivity in children with ASD?
Muted, less positive emotional expression?

Parent report
Capps et al., 1993; Zwaigenbaum et al., 2005; Garon et al., 2009; Clifford et al., 2013; Macari et al., 2017

Observations during adult-child interactions
Snow, Hertzig, & Shapiro, 1987; Yirmiya, Kasari, Sigman, & Mundy, 1989; Kasari, Sigman, Mundy, & Yirmiya, 1990; Joseph & Tager-Flusberg, 1997

Macari et al. JCPP 2017
Negative affectivity bias?

**Anecdotal report**
Kanner, 1943; Tinbergen & Tinbergen, 1977

**Parent report**
Zwaigenbaum et al., 2005; Adamek et al., 2011; Clifford et al., 2013; Macari et al., 2017

**Structured induction**
Jahromi, Meek, & Ober-Reynolds, 2012; Scherr et al., 2017

Macari et al. JCPP 2017
Limited, discrepant evidence

- Method type: Parent report, naturalistic observation or structured induction?
- If induction: social or nonsocial trigger stimuli?
- Measurement/metric (frequency, duration, intensity, etc.)
- Ages, comparison groups
Do toddlers with ASD differ in intensity of emotional expressivity compared to their peers?
Laboratory Temperament Assessment Battery
(Lab-TAB Locomotor; Goldsmith & Rothbart, 1999)

- **ANGER**
  - Car Seat
  - Arm Restraint
  - End of the Line

- **JOY**
  - Bubbles
  - Puppet Peek-a-Boo
  - Penguin Race

- **FEAR**
  - Spider
  - Scary Masks
  - Roaring Dinosaur
Anger
Expression of frustration (approach behaviors e.g., hitting, pushing) in response to restraint or goal blockage.

» Predicts later externalizing behavioral problems

Joy
Characterized by approach; manifests in smiling, laughter, and increased activity.

» Associated with later sociability, activity level, impulsivity, externalizing behavior

Fear
Withdrawal behaviors arising in response to stimuli that convey threat or uncertainty.

» Predicts behavioral inhibition, anxiety

Fear=Anger
Peak Emotional Intensity – Facial Joy
(adapted from Goldsmith & Rothbart, 1999; Izard & Weiss, 1979)

0 = No smiling at all

1 = Small smile, with lips slightly upturned, and no involvement of cheeks or eyes

2 = Medium smile, with lips upturned, perhaps mouth open, and/or slight bulging of cheeks, and/or some crinkling about the eyes (2 of these)

3 = Large smile, with lips stretched broadly AND upturned/mouth open, AND definite bulging of cheeks AND noticeable crinkling of eyes (all 3)
Deriving emotion intensity composites

TRIALS

Raw behavioral data:
*Spider* intensity of facial fear (scores 0-3)
*Spider* intensity of vocal distress (scores 0-5)

Response parameter level:
Mean of **facial** and **vocal** fear is computed

Episode level components:
Response parameters are averaged

Primary level emotion composite: Episode level components are averaged

Graphic adapted from Gagne et al., 2011
<table>
<thead>
<tr>
<th></th>
<th>ASD</th>
<th>DD</th>
<th>TD</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>43</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>% male</td>
<td>88*</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>Age in months</td>
<td>21.9 (3.0)</td>
<td>20.3 (3.6)</td>
<td>20.8 (3.9)</td>
</tr>
<tr>
<td>MSEL Visual Reception AE</td>
<td>17.7 (4.9)</td>
<td>19.6 (5.9)</td>
<td>23.2 (5.5)*</td>
</tr>
<tr>
<td>MSEL Fine Motor AE</td>
<td>18.3 (3.5)</td>
<td>19.3 (3.6)</td>
<td>22.1 (3.5)*</td>
</tr>
<tr>
<td>MSEL Receptive Language AE</td>
<td>11.8 (7.8)</td>
<td>15.3 (7.8)</td>
<td>23.6 (5.9)*</td>
</tr>
<tr>
<td>MSEL Expressive Language AE</td>
<td>11.3 (6.2)</td>
<td>11.7 (4.6)</td>
<td>21.9 (6.2)*</td>
</tr>
<tr>
<td>ADOS-2 Toddler SA</td>
<td>13.8 (4.6)*</td>
<td>7.0 (3.0)</td>
<td>---</td>
</tr>
<tr>
<td>ADOS-2 Toddler RRB</td>
<td>4.2 (1.8)*</td>
<td>1.2 (0.9)</td>
<td>---</td>
</tr>
</tbody>
</table>

Note: AE = Age Equivalent; MSEL = Mullen Scales of Early Learning (Mullen, 1992)
*p < .05
Do toddlers with ASD differ in intensity of emotional expressions compared to their peers?
Potential patterns of results

**muted affect**

**NA bias**
Intensity of emotion expression during Lab-TAB

Anger Condition
Joy Condition
Fear Condition

Mean Intensity of Emotion Expression

- \( d = .32 \) (ASD vs. TD)
- \( d = .58 \) (ASD vs. DD)
- \( d = .56 \) (ASD vs. TD)
- \( d = .54 \) (ASD vs. DD)

\( * p < .05 \)
\( ** p < .01 \)

\( \dagger p = .1 \)

ASD
DD
TD

Yale SCHOOL OF MEDICINE
Intensity of emotion expression during Lab-TAB

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CHILD & ADOLESCENT
PSYCHIATRY

NEW RESEARCH

Emotional Expressivity in Toddlers With Autism Spectrum Disorder

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Interim summary

Results inconsistent with accounts of muted affect or negative affectivity bias

**Anger:** ASD > DD, TD
Communication difficulties/emotion regulation problems

**Joy:** ASD = DD = TD
Passive receipt of enjoyable activities, no need to interact or seek out

**Fear:** ASD < DD, TD
Muted fear response warrants further investigation:
What’s going on “under the hood”?
Physiological reactivity to emotional challenges

Diminished expression of fear, enhanced expression of anger in response to real-world challenges (Macari et al., 2018)

Findings explained by differences in:

- behavioural display of emotions?
- physiological arousal levels?
  - EDA
Electrodermal activity (EDA)

Stressors → Sympathetic nervous system → Regulation of continuous sweating from eccrine glands → electrical changes at the surface of the skin (µS) = electrodermal activity
Method: LabTAB and EDA sensor

Laboratory Temperament Assessment Battery (LabTAB) adapted from Goldsmith & Rothbart, 1999

- EDA Sensor on child’s ankle
- EDA measured in μS
- Temperature & x,y,z axes

Affectiva Q sensor
Electrodermal reactivity during **Fear condition**

- ΔEDA different from zero?
  - TD: ↑ ΔEDA during Fear (t(26)=2.23, p=.035)
  - ASD: No change of EDA during Fear (t(26)=1.26, p<.219)
- Group difference? ASD < TD, p=.025
Physiological reactivity – atypical and modulated by context

**Figure 1.** ΔEDA in toddlers with ASD and TD under three emotion conditions.
Electrodermal reactivity vs intensity of expression of emotions?

Intensity of physiological response

Intensity of emotion expression

Macari et al. *in Press*
Is physiological response associated with intensity of behavioural emotional expression?

- ΔEDA response during Anger / intensity of anger expression
  - $r(56)=.40$, $p=.002$

- ΔEDA response during Fear / intensity of fear expression
  - $r(54)=.54$, $p<.001$

- No association of ΔEDA response during Joy with intensity of joy expression
  - $r(55)=-.04$, $p=.799$

Altered intensity of behavioural emotional expression in ASD driven by atypical emotional experience of the stimuli.
Summary & Implications

- Complex emotional landscape
- Broad construct of Negative Affect less useful in capturing emotional phenotypes
- Harness intact capacity for joy in toddlers with ASD for therapeutic purposes
- ΔEDA responses map onto intensity of behavioural expression in toddlers with ASD: What we see is how they feel
- How are early emotional profiles related to later psychopathology?
- Limited understanding of how affective comorbid symptoms emerge
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