Performance-Monitoring and Evaluative Control in High Functioning Autism

Erin Krauskopf
eekrauskopf@gmail.com
A. Clawson
O. Johnston
M. J. Crowley

Follow this and additional works at: https://scholarsarchive.byu.edu/fhssconference_studentpub
Part of the Psychology Commons

The Annual Mary Lou Fulton Mentored Research Conference showcases some of the best student research from the College of Family, Home, and Social Sciences. The mentored learning program encourages undergraduate students to participate in hands-on and practical research under the direction of a faculty member. Students create these posters as an aide in presenting the results of their research to the public, faculty, and their peers.

BYU ScholarsArchive Citation
https://scholarsarchive.byu.edu/fhssconference_studentpub/204

This is brought to you for free and open access by the Family, Home, and Social Sciences at BYU ScholarsArchive. It has been accepted for inclusion in FHSS Mentored Research Conference by an authorized administrator of BYU ScholarsArchive. For more information, please contact scholarsarchive@byu.edu, ellen_amatangelo@byu.edu.
Performance Monitoring and Evaluative Control in High Functioning Autism

E. Krauskopf, A. Clawson, O. Johnston, M. J. Crowley, M.J. Larson, and M. South

(1) BYU Department of Psychology, (2) BYU College of Life Sciences (3) Yale Child Study Center

Key Terms:
ASD = Autism Spectrum Disorder
ERP = Event-Related Potential
ERN = Error Related Negativity
Pe = Post-Error Positivity

AIMS
1. Understanding the neurobiology of how children with ASD make mistakes has implications for understanding biological causes and informing intervention strategies.
2. This study aimed to determine how response monitoring (i.e., learning from mistakes) differs between those with ASD and controls.

BACKGROUND
• ASD is a neurodevelopmental disorder characterized by qualitative impairments in social interaction and communication skills, and a variety of behavioral deficits.
• Decision making difficulties in ASD may arise in part from impaired awareness of feedback, including negative feedback.
• The error-related negativity (ERN) and post-error positivity (Pe) are brain wave components related to the response to mistakes, measured by EEG for evoked-response potential (ERP) tasks.
• Current theories suggest the ERN reflects automatic performance- and error-monitoring while the Pe reflects error-processing and awareness.
• As reflections of the response monitoring system, these components have direct behavioral implications in self-monitoring and decision-making in social-emotional processes (Crowley et al., 2009).
• Findings from such paradigms may be especially helpful for elucidating individual differences across the autism spectrum (Henderson et al., 2006).

METHODS
• ASD was characterized using both the ADOS-G (total social communication score >7) and the SCQ (total score >15).
• High-density ERPs were acquired while 25 ASD participants and 25 matched controls performed a modified version of the Eriksen Flanker task over 400 trials.
• Flanker task requires the subject to decide if an arrow presented in the center of the screen with 4 flanking arrows is pointing left or right. Thus, the subject is forced to choose very quickly (rate of 1 sec) if the arrow is pointing in a direction congruent (i.e., “<<<<”) or incongruent (i.e., “<><<>”) with the flanking arrows.
• Response-locked ERPs were separately averaged for correct and error trials.

BEHAVIORAL RESULTS

One-way ANOVA Analyses of ERN and Pe

<table>
<thead>
<tr>
<th>Effect</th>
<th>F (1,45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERN</td>
<td>37.54***</td>
</tr>
<tr>
<td>Accuracy</td>
<td></td>
</tr>
<tr>
<td>Accuracy * Group</td>
<td>3.97*</td>
</tr>
<tr>
<td>Pe</td>
<td>38.37***</td>
</tr>
<tr>
<td>Accuracy</td>
<td></td>
</tr>
<tr>
<td>Accuracy * Group</td>
<td>0.71</td>
</tr>
</tbody>
</table>

• We found a significant difference in accuracy between the two groups for the ERN, but not for the Pe.
• We did not find an association between Verbal IQ and the ERN in ASD, but this association was significant for the control group.
• Behavioral inhibition was significantly associated with the difference score between correct and incorrect trials in the Pe, driven by a significant positive correlation between the Pe and behavioral inhibition.

CONCLUSIONS
• The ERN offers the potential for rich insight into response monitoring in ASD, but task-specific and sample-specific differences across studies have thus far preclude a clear understanding of the phenomenon.
• We encourage further studies that give explicit attention to important factors of diagnostic severity, cognitive function, anxiety and personality to help identify possible subtypes of autism that could be characterized by reliable physiological measures such as the ERN.

Participants

<table>
<thead>
<tr>
<th>n</th>
<th>Age</th>
<th>Full Scale IQ</th>
<th>SCARED Total***</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASD</td>
<td>24</td>
<td>13.48 (2.03)</td>
<td>109.00 (13.55)</td>
</tr>
<tr>
<td>TDC</td>
<td>23</td>
<td>14.24 (2.72)</td>
<td>111.17 (14.18)</td>
</tr>
</tbody>
</table>

Errors (ERN) Correct Responses

• The ASD group demonstrated little difference in their response to errors and correct trials.
• The control group demonstrated larger differences in their response to errors and correct trials than the ASD group.

Our ERP recordings use the 128-channel EGI Geodesics system

Correspondence address: southlab@byu.edu

Many thanks to our study participants and their families.

This work was supported by a Mentored Environment Grant, a Family Studies Center Research Grant, and a College of Family, Home and Social Sciences Research Award from Brigham Young University.