How Autism Spectrum Disorder Affects Action Preparation in Children

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I. Introduction

The time between an action being executed and the initial thought to perform that action is known as action preparation, or more commonly, reaction time (RT). Increases in RT may arise from increased task complexity. Impairments in motor control, such as those seen in children with Autism Spectrum Disorder (ASD), may also manifest as increases in RT.

II. Methods

Five children with ASD and five Typically Developing (TD) children were asked by a tester to, “Help me put it away.” Or “Help me hammer.” Using the provided stick or hammer (figure 1).

Subjects were instructed to keep their hands flat on the sticky notes, placed just in front of them until they heard the “put” or “hammer” command. RT was measured from the beginning of the command to the moment that the subjects index, middle and ringer finger of either hand lifted or slid off the sticky note. This was scored using ELAN Language Archive software.

Table 1- Reaction times: Actions vs. objects.

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Hammer</th>
<th>Stick</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASD</td>
<td>0.59</td>
<td>0.70</td>
<td>0.65</td>
</tr>
<tr>
<td>“Hammer”</td>
<td>0.59</td>
<td>0.70</td>
<td>0.65</td>
</tr>
<tr>
<td>“Put it away”</td>
<td>0.24</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td>Control Subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Hammer”</td>
<td>0.43</td>
<td>0.60</td>
<td>0.52</td>
</tr>
<tr>
<td>“Put it away”</td>
<td>0.26</td>
<td>0.28</td>
<td>0.27</td>
</tr>
<tr>
<td>Average</td>
<td>0.38</td>
<td>0.45</td>
<td></td>
</tr>
</tbody>
</table>

Each subject was presented with 32 tasks per day that were arranged in a randomized order to avoid any predictability or pattern formations that may have affected the RTs. The ASD subjects completed a minimum of 12 trials each. While the control subjects only completed three trials each due to time constraints. Each trial lasted no more than 10 minutes and took place on a different day in order to avoid a loss of attention during the testing periods.

Color variations with the stick and hammer (figure 1) were being used in a study conducted in parallel showing grasp variations. As well as yet another form variability aimed to keep familiarity low and the task more engaging.

III. Results (Table 1)

- Overall reaction times of the ASD children were typically increased from those of TD children.
- Reaction times increased for both groups when the stick was the object used and decreased when the hammer was the object used. The difference was less with the ASD.
- Tasks in which subjects helped vs. when they did not help showed no significant differences between the ASD group while the controls exhibited an increase in RT when helping the tester (Figure 2).
- Tasks which required manipulation showed no significant differences in either group.

IV. Conclusions

A lack of Theory of Mind (ToM), being able to see from another’s perspective, could account for the ASD group having little to no difference between the trials where they helped the researcher and those where they did not.

However ToM appears to be present when comparing the two tasks. Overall subjects had an increased RT for the “hammer” task. Implying that they may have understood that this task required them to orient the object in a way that facilitated the tester.

Likewise the significant decrease in RT with the “put” task hints that each group understood that they did not have to facilitate the tester as much during this task.

Another possibility for the significant reduction in RT for the “put” task may arise form the lingual characteristics of the command word. “Put” has a sharp and pronounced signature at the start with the letter “P”. Whereas “hammer” has a soft pronunciation throughout the whole word.

Decreases in the RT for the hammer may arise form its inherent action properties when compared to the stick. It is easier to grasp and has a more inherent function.

V. Acknowledgement

Study conducted with funding from a USU Research Catalyst Grant and lab assistance from the USU SMB Lab.