FEATURE SELECTION PROPOSAL

OVERVIEW

<table>
<thead>
<tr>
<th>Feature</th>
<th>Function description</th>
<th>Trigger event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap force</td>
<td>Attraction forces with correct oriented block approaching to the target cell</td>
<td>&gt; The center of a block with correct face and orientation is within 25 pixels inches of the target cell position</td>
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<tr>
<td>Rejection force</td>
<td>A virtual block (1/5 of the block size) will be placed between the block and the target cell. Rejection force will be triggered when users place a block with incorrect face or orientation into the target cell.</td>
<td>&gt; Users attempt to place a block into an incorrect target cell position</td>
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<tr>
<td>Highlighted grid</td>
<td>An overlaid grids will be displayed to help users parse the pattern into elements</td>
<td>&gt; Users touch the pattern with a stylus</td>
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<tr>
<td>Highlighted Matching</td>
<td>Highlights appear in an element within the pattern, available matching among the scattered blocks, and its matching destination position.</td>
<td>&gt; The highlighted grid will be faded when a block has been placed into the target cell</td>
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<tr>
<td>Visual proactive assistant</td>
<td></td>
<td>&gt; Users touch a specific element within the pattern with a stylus</td>
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<tr>
<td></td>
<td></td>
<td>&gt; This function can be triggered only when the highlighted grids function is active</td>
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<tr>
<td></td>
<td></td>
<td>&gt; Faded when a block has been placed into the target cell area</td>
</tr>
</tbody>
</table>

DETAILS

- Motor cues will assist users without any voluntary control of the haptic device.
  - “Snap force” is a “record and play back” feature, which is expected to assist users in approaching the target position with proper motion. It will also reduce the need to mentally validate a correct placement.
  - Rejection force is a “virtual fixture” feature, which is expected to correct an error in placement when users are uncertain about the placement. We plan to test the average approaching speed when users are confident in their decisions (for making a correct placement) with pilot’s data. After that, the criterion for slowing approaching due to uncertainty will be established. Such feature will also reduce users’ needs in the validation process.
• Visual cues will require users to make their intention explicit.
  o Highlighted grid is a proactive technique to provide assistive cues for pattern recognition. Users need to make explicit requirement for potential augmented cues. This feature will help users elicit individual elements within a pattern, but it will also cost additional task time. As a consequence, users may be encouraged to read the pattern in the very first few trials. It is also expected that as the capability to parse the pattern increases, there will also be a decrease in activation of this function. This constitutes another evidence of learning.
  o Highlighted matching is a proactive technique which highlights an element in the pattern, its matching block face and its corresponding position in the working space. These assistive cues will be triggered when users touch a specific element within a pattern. Similar to highlighted grids, this feature also requires users to make their intention explicit. Once the highlight is activated, it will stay active until a block placement is accomplished. It helps users to search for a solution at individual element level.

• Audio assistant: Confirming sound when a correct placement has been made. This feature will help users in the validation stage.

COGNITIVE WALKTHROUGH OF BLOCK DESIGN

J.E. Hoffman et al. “Spatial breakdown in spatial construction: Evidence from eye fixations, in children with Williams syndrome”
Cognitive steps for a block puzzle problem,

(a) Look at the model to gain information about its spatial organization,

(b) Search in the parts space for a block that matches one component of that organization,

(c) Reexamine the model area to see where to place the block,

(d) Check the model to verify that the copy matches it; if a discrepancy is detected, they might decide to

(e) Correct the copy by removing incorrect blocks, and then begin the entire sequence again.

The flowcharts below are cognitive flows if an assistive technique is available.
Motor assistant flow chart

1. Look at the pattern to gain spatial organization info
2. Find matching choices among scattered blocks
3. Can one decide whether a match exists?
   - Yes: Does a match exist?
     - Yes: Reexamine the model area to see where to place the block
     - No: Adjust the block to matching one element
   - No: Reject from the area to be placed
4. Place the block in the destination
5. Is the placement correct?
   - No: Reject from the area to be placed
   - Yes: Hear "Ding" Snap to the destination
6. Have all blocks been placed?
7. Confirm the completion

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Visual & Motor assistant cognitive flow chart

1. Look at the pattern to gain spatial organization info.
2. Can a user parse the spatial organization of the pattern?
   - Yes: Find matching choices among scattered blocks.
   - No: Click on pattern for additional cues: grids appear within the pattern area.
3. Can one decide whether a matching exists?
   - Yes: Does a match exist?
     - Yes: Reexamine the mood area to see where to place the block.
     - No: Adjust the block to matching one element.
4. Does a match exist?
   - Yes: Pick up the block which has available solutions.
   - No: Highlight available choice.
5. Is the placement correct?
   - Yes: Hear “Ding” Snap to the destination.
   - No: Reject from the area to be placed.
6. Have all blocks been placed?
   - Yes: Confirm the completion.
   - No: Remove the incorrect block.