Follow up 12/2/2011 meeting

Attendees: Gil, Linus, Ma, Michael, Qin, Tupler, Zhu

Hello everyone,
As a follow-up to the meeting on 12/11/2011, below are the notes and the action items I recorded. Please advise if I have missed anything.

**Meeting Notes**

1. Current progress of experiment
   a. (Michael) Need to recruited 5 more subjects.

2. Preliminary data analysis
   a. (Caesar) Pre & Post ROCF analysis
      i. Subject 20 showed very poor post-score (28.5 → 21.5).
         1. Need to check whether it should be excluded.
      ii. Overall performance looks similar with the first experiment.
         1. Unit 2 showed the highest improvement while unit 16 showed negative improvement.
      2. Poor performance: Unit 1, (8), 11, 12
         a. Unit 1, 11, 12 consists of short line segments.
            i. The difficulty of eye-hand cooperation control with haptic
            ii. always finishes before the subject has time to make correction of either the direction or the linearity.
            iii. Subject needs more time to find out the exact location that the pen touches the drawing plate. Thus, the time is even tighter for them to pay enough attention during drawing the short line segments.
         b. Unit 1 has the weakest relation with the main frame, which determines the criterion of the placement.
         c. The visual coordinate of human eyes is horizontal and vertical. It’s relatively hard for human to control an object moving along an arbitrary angle repeatedly with parallel trajectory.
   d. **Please see attached for more information** *(Caesar_Summary of ROCF issues.docx/pdf)*

   i. Improvement across conditions
      1. A Haptic-aid showed the lowest improvement while the visual-aid showed the highest improvement.
         a. (Dr. Tupler) this result is consistent with the hypothesis that the Visual-aid condition may have more improvement than others.
      2. Excluding Subject 20 since it showed the highest negative improvement.
a. Haptic-aid showed the lowest improvement while Combination-aids showed the highest scores.
b. However, Combination-aids and a Visual-aid had little difference.
iv. Please see attached results spread sheet for more information (Caesar_Updated_ROCF_Performance_F11_R2.xlsx)
v. Possible clustering methods:
   1. Methods 1 (basic segments): Group 1 (horizontal and vertical line segments), Group 2 (diagonal line segments) and Group 3 (Circle segment).
      a. Group 1: unit 1, 2, 4, 5, 7, 8, 10, 15, 16, 17
      b. Group 2: unit 3, 6, 9, 12, 13, 14, 18
      c. Group 3: unit 11
   2. Methods 2 (unit level): Group 1 (basic units) and Group 2 (secondary units)
      a. Group 1: unit 2, 3
      b. Group 2: the rest
   3. Methods 3 (difficulty of drawing): Group 1 (Short line segments), Group 2 (long line segments), Group 3 (circle segment)
      a. Group 1: unit 1, 8, 12, (15)
      b. Group 2: unit 2, 3, 4, 5, 6, 7, 9, 10, 13, 14, (15), 16, 17, 18
      c. Group 3: unit 11

4. **Please see attached for more information** (Caesar_Summary of ROCF issues.docx/pdf)
vi. ROCF improvement compared with first experiment
   1. The percent improvement in S11 was 9.375% at the maximum in the Augmented VR condition.
   2. The Visual-aid condition showed 19.14% improvement at the maximum in F11.
   3. However, Combination showed the less improvement than VR conditions in S11.
4. **Please see attached for more information** (Caesar_Summary of ROCF issues.docx/pdf)

b. (Janet) Pre- & Post-tests: EFT & BD
   i. A Haptic-aid condition showed highest improvement in both tests.
   ii. There are individual differences in the scores:
      1. There are no rooms for improvement since some subjects already had highest scores.
   iii. Compare with native test in S11 with BD
      1. All conditions showed larger improvement.
      2. The Haptic-aid showed the largest difference.
4. **Please see attached for more information** (Janet_data analysis.xlsx)
c. (Biwen) Training session
i. Training BD score (learning rate curve)

![Learning Rate Curve]

1. The Combination condition showed least learning rate while the Haptic-aid showed fastest learning rate.
2. When comparing with Native task in S11, the Haptic-aid and Native conditions showed similar learning rate.

ii. Training Time

1. The haptic-aid showed steeper completion time rate.
   a. However, Combination condition showed similar pattern with Native task in S11.
   b. When comparing with VR conditions in S11, the Haptic-aid condition still showed steeper rate.
2. The Visual-aid took the longest time to complete tasks.
   a. When comparing with S11 results, the Visual-aid still showed the longest time to complete tasks.

iii. Please see attached for more information

   (Biwen_NSF.Haptic.Fall2011.xlsx)

   d. (Michael) BD strategy classification (brief summary: please see attached document for more detail information (Michael BD strategy classification.docx))

   i. Steps to collect segmentation, orientation and placement order:
      1. Track each block placement (even if the block is subsequently moved)
      2. Identify the location of each placement
      3. Determine which block placement is the “final” placement for each block.

   ii. Summary of the expected profiles for each strategy:

<table>
<thead>
<tr>
<th></th>
<th>Analytic</th>
<th>Synthetic</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Consults</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Placement Order</td>
<td>Row/Column</td>
<td>Gestalt</td>
<td>None</td>
</tr>
<tr>
<td>Segmentation</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Orientation</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
Based on prior research, a “high” value is around 1 and a “low” value is around 0.5.

iii. Strategy profile analysis
   1. Step 1: Reviewed the strategy profile calculations
   2. Step 2: Compared them to the data being recorded
      a. Data sets:
         i. Recorded data for placement order from the software:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>Unique subject ID. Can be used to identify the condition.</td>
</tr>
<tr>
<td>Trial</td>
<td>Trial number (1-8)</td>
</tr>
<tr>
<td>Design</td>
<td>Stimulus figure design</td>
</tr>
<tr>
<td>Time</td>
<td>Number of seconds that had elapsed when block was placed</td>
</tr>
<tr>
<td>right_wrong</td>
<td>R or W, depending on correct or incorrect placement</td>
</tr>
<tr>
<td>User</td>
<td>Orientation of the block being placed. User and Target values will match for correct placements and be different for incorrect placements.</td>
</tr>
<tr>
<td>Target</td>
<td>Correct placement of the block, according to stimulus figure. User and Target values will match for correct placements and be different for incorrect placements.</td>
</tr>
<tr>
<td>Row</td>
<td>Grid row of block placement (0-2)</td>
</tr>
<tr>
<td>Col</td>
<td>Grid column of block placement (0-2)</td>
</tr>
</tbody>
</table>

ii. Standard matrix form

\[
\begin{array}{ccc}
0,0 & 0,1 & 0,2 \\
1,0 & 1,1 & 1,2 \\
2,0 & 2,1 & 2,2 \\
\end{array}
\]

3. Step 3: Migrated the partial results into an Access 2010 data base
   a. To identify a method to analyze the placement order

4. Results:
   a. Used 10 subjects (approximately 400 data records) in Access
   b. The Haptic-aid condition only is more likely to use a regular placement.
   c. The results of Analytic strategy showed different patterns than regular patterns.
i. It seems reasonable that an analytic strategy may not necessarily manifest itself in the form of row/column placements.

5. Two possible directions:
   a. Develop our own placement order profile.
   b. Use a different profile for determining strategy (e.g., orientation index).

3. Next meeting: after holiday.

These are all the items that I noted or recalled from the meeting. If you have other points, please let me know.

Guk-Ho Gil