Project 07:
A Cognitive Training Quiz Application
Midpoint Presentation

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Project Description

• Create a web-based visuospatial cognitive training program
  • Has 5 modules and progressively trains participants
• Custom-designed graphics and animations supplied by the Arts as Applied to Medicine Department
• Employ user experience design and gamification to enhance the test
Dependencies

• Software dependency management: npm, bower, mvn – Done
• Test question illustrations – Arts as Applied to Medicine Department
• Stash (Git) access – Done
• Jira access – Done
• Possible deployment environment – Done
UI Sketches

Log In Screen

Patient Dashboard

Modules

- Module 1
- Module 2
- Module 3
- Module 4
- Module 5
UI Sketches

Physician Dashboard

Patient In-Depth

- Patrick Mercer
- Sara Collahan
- John Doe
- Olivia Perez
- Joe Park
- Allie Winters
- Martin McCormick
- Andrew Jackson

<table>
<thead>
<tr>
<th>Name</th>
<th>User ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patrick Mercer</td>
<td>1</td>
</tr>
<tr>
<td>Sara Collahan</td>
<td>2</td>
</tr>
<tr>
<td>John Doe</td>
<td>3</td>
</tr>
<tr>
<td>Olivia Perez</td>
<td>4</td>
</tr>
<tr>
<td>Joe Park</td>
<td>5</td>
</tr>
<tr>
<td>Allie Winters</td>
<td>6</td>
</tr>
<tr>
<td>Martin McCormick</td>
<td>7</td>
</tr>
<tr>
<td>Andrew Jackson</td>
<td>8</td>
</tr>
</tbody>
</table>
UI Sketches

Quiz – Single Select

Quiz – Multi-Select
Deliverables

• **Minimum:**
  - Design documents & UI mockup ✔
  - HIPAA-Compliant, Encrypted Database ✔
  - Serve the quiz (3 out of 5 modules)
  - Working barebone interface

• **Expected:**
  - Serve all 5 modules of the quiz
  - Store results, allow patients to view own results, allow physicians to view their patient’s results
  - Polished UI
  - Plot performance history over time

• **Maximum:**
  - Data analytics on stored data
  - Allow for advanced queries on data
  - Conduct usability studies/pilot studies with actual patients
Demonstration
Technical/Design Challenge: Data Serialization

Spatial Ability

In this training program we will practice improving our spatial ability. Spatial ability is a very important skill in our daily lives. We use our spatial ability in activities, such as “reading” a road map, in giving directions to others, and in moving about in our home or in a shopping mall. Spatial ability is also necessary for tasks, such as rearranging the furniture, assembling parts in a kit in e.g. putting together (reassembled) equipment, furniture, and in playing certain games (chess, checkers). Spatial ability is necessary in certain jobs, such as airline pilots, dentists, and artists. In what activities do you use spatial ability?

One very important aspect of spatial ability is being able to visualize mentally spatial movements. For example, you can visualize mentally yourself moving from the kitchen to the bedroom in your home. You have a mental map of the spatial location of rooms in your home. You also can visualize yourself going from your house to the grocery store—you have a mental map. These mental maps have developed through much practice. They may be so overlearned that we are not always aware of them.

We can also develop mental images for familiar people and objects. A mental image enables us to visualize a familiar object in different spatial orientations. Look at the pictures of the hands below. In each picture the back of the hand is shown, not the palm.

The hands are shown at different angles. Now can we determine which pictures show the back of the right hand and which pictures show the back of the left hand? We can mentally visualize the hand being rotated to a more familiar position. Which pictures show the back of the right hand? Which pictures show the back of the left hand?
Data Serialization

• Need to transmit the data from server to client in a format that is easily consumable (REST APIs consume JSON)
• Want to serve it piecewise (no long loading delays)
• Also need to serve resources (images, etc)
• Need to devise a scheme for submission of results also
Current Solution

• Quizzes already broken up into 5 modules
• Subdivide further into training & testing
  • Components within training & testing
  • Each component is a JSON object, with a “type” field that indicates which view should be rendered: single-select, multi-select, instructions, etc.
  • Type flag indicates what other fields can be expected within the JSON object
    • Links to prompt images, additional resources, etc.
Current Solution (cont’d)

**FORMING MENTAL IMAGES**

There are several stages involved in solving spatial problems. The first step is to form a mental image of an object or drawing. A second step involves mentally rotating or turning this mental image.

In this exercise, we will practice the first step—forming mental images. Look at EXAMPLE A. Look at the picture on the left. What picture on the right bears the same spatial relationship as the picture on the left? Yes, it is Answer C. In order to solve this type of problem, you must remember how a mental image of the drawing on the left. Then you must decide which drawing on the right is like this mental image. Now, circle the answer to EXAMPLE A.

**EXAMPLE A**

A  B  C  D

The answer to EXAMPLE A is D.

Note: work the problems on the next 3 pages. The trainer will give you 8 minutes. Do not be concerned if you cannot answer all the problems. You may answer all the problems in 8 minutes, but you need to know how many problems you can answer in one minute. Work as quickly and as accurately as you can.

**EXAMPLE B**

A  B  C  D

**EXAMPLE C**

A  B  C  D

**A MENTAL EXERCISE - 2**

Mentally rotating drawings in different spatial positions involves memory ability. You must be able to remember the drawing. You must be able to have in memory what the drawing looks like at different spatial positions. You will be remembering numbers, rather than drawings in this exercise.

The trainer will call out several numbers. You are to repeat the numbers in exactly backwards order in the order in which they were called out. For example, the trainer calls out 1, 2, 3. You respond 3, 2, 1.

Let’s practice on 2 problems.

(Trainer takes booklet)

**EXAMPLE A**

<table>
<thead>
<tr>
<th>Trainer</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXAMPLE B**

<table>
<thead>
<tr>
<th>Trainer</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Do you have any questions about what you are to do?
Current Solution (cont’d)

• Data for modules stored in .json file
  • Human-readable, easy to edit (while we’re in the process of transcribing the quizzes)
  • Resources, including question HTML hosted from separate webserver for front-end
  • Back-end server only hosts the REST API

• ModuleProvider class parses this file on server startup, is injected as a dependency into controllers that serve module data on back-end

• Answers stored in localstorage (with cookie fallback) in browser, pushed on completion via REST API call
Possible Improvements/Considerations

• Migrate module data to the back-end database
  • Allows for modification without restarting the server

• Separation of resources and data somewhat problematic
  • Have to alter both the data on the back-end server and the resources on the front-end server to add/alter modules
  • Better if they were consolidated in one place
Minimum Deliverables

- Develop Project Plan Presentation: 2/17/2016 - 2/22/2016
- Write static UI mockups in HTML/CSS: 2/25/2016 - 3/10/2016
- Expected Deliverables
  - Polish UI: 3/10/2016 - 4/15/2016
  - Plot performance history for both patients and clinicians: 3/11/2016 - 4/15/2016
  - Implement data analytics on quiz data: 3/11/2016 - 4/15/2016
- Maximum Deliverables
Questions?