Using oculometrics for cognitive task analysis

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BACKGROUND

One element of a legally defensible job analysis is the inclusion of a thorough task analysis, or the examination of discrete tasks required of the job (Ferris, 1996). However, in today’s knowledge economy, how a job analyst gains access to tasks carried out by knowledge workers (e.g., accountants, computer programmers, etc.) is obfuscated by the constraint that an individual interacting with a computer presents. In traditional, manual labor jobs, ensuring tasks carried out allows for recording of observable, discrete units of work such as chopping and lifting. The interface with a worker and his/her computer prohibits a job analyst to get a clear picture of the work for at least three reasons: (1) the speed of the work, (2) integrated systems, (3) undeliberate analytical processes. Thus, the goal of the present effort is to evaluate how the use of eye-tracking and screen capture technologies impact observation and analysis of the cognitive tasks conducted by knowledge workers.

RESEARCH QUESTION

How can eye-tracking and screen capture (i.e., oculometrics) technologies impact observation and analysis of the cognitive tasks conducted by knowledge workers?

METHODOLOGY

Phase 1: Survey

**Purposes:**
- Acquire verbal confirmation of the conclusions drawn from eye-tracking and screen capture recordings
- Increase researcher understanding of work being completed

**Phase 2: Scenario Eye-Tracking**

**Purposes:**
- Sample a wide array of potential work processes
- Identify specific pieces of information required to solve problems
- Controlled environment removed typical work and technological distractions

Phase 3: VPN Eye-Tracking

**Purposes:**
- Acquire verbal confirmation of the conclusions drawn from eye-tracking and screen capture recordings
- Increase researcher understanding of work being completed

Phase 4: Eye-Tracking Interview

Please refer to the computer screen next to this poster for visualization of the data collected.

DATA AND RESULTS

### Chronological Order Participant Visited Each Task System in Scenario 1

<table>
<thead>
<tr>
<th>System</th>
<th>Chronological Order</th>
<th>Participant Visited</th>
<th>Total Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASP</td>
<td>115</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>EMN</td>
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<td>1</td>
<td>1</td>
</tr>
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<td>Java</td>
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<td>1</td>
</tr>
<tr>
<td>닷컴</td>
<td>102</td>
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<td>2</td>
</tr>
<tr>
<td>MUI</td>
<td>104</td>
<td>2</td>
<td>2</td>
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<tr>
<td>DOT</td>
<td>105</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MUX</td>
<td>106</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**ICP Model Significance:**
- Information Interface
- Learning
- Information Handling
- Attention
- Mental Plan and Schedule
- Memory
- Mental Execution
- Motivation
- Monitor
- Environment
- Communication

**CONCLUSIONS**

- Based on our findings, eye-tracking and screen capture technologies can be utilized in this four-phase methodology to accurately extract the knowledge, skills, and abilities required to complete knowledge work. This methodology also goes further to identify specific information needed to complete the work.

**RECOMMENDATIONS**

- Modify the methodology to the cognitive task being performed
- Begin each eye-tracking cognitive task analysis with a traditional job analytic survey
- Utilize eye-tracking technologies in two stages to capture both controlled and uncontrolled responses

**KEY REFERENCES**


- Special thank you to Union Pacific Railroad for their participation with the study and their agreement to release heatmap images. This project would not have been possible without their support and willingness to participate.
- Thank you to UNO’s College of Business Administration for their support of my Graduate Assistantship and facilitation of the relationship between UNO and UP.
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