On Using Eye Tracking in Empirical Assessment of Software Visualizations

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Use eye movement measurements in conducting empirical studies of software engineering tools, especially visualization techniques.

Eye tracking adds a new additional dimension to the assessment arsenal by allowing access to the gaze activity of human subjects.
Black Box Measures

- Traditional measures collected after the completion of a given task
  - Accuracy/level of the response
  - Time needed
  - Subject’s experience, comments, and preferences

- Potential risk of a disparity between the response and reality for a lengthy task
White Box Measures

- Implicitly collect a subject’s activity data in a non-obtrusive way while performing a given task
  - Eye gazes, i.e., movements, on a visual display
  - Audio and video recording of a session
Yesterday's Eye Tracking Equipment
State of the Art Eye Tracking Equipment

- Tobii 1750 eye-tracker
  - www.tobii.se
  - Non-intrusive (no head mount)
  - Two cameras built into a 17 in flat screen
  - Records audio and video of a session
  - Error rate < 0.5 degrees
  - Sampling rate of 50MHZ

- ClearView software
Name the entity class that is responsible for storing data?
A Subject’s Gaze Plot for a Task
Video of a Session

Name the class that controls the active window of an application.
Human subject given a number of specific tasks concerning UML class diagrams
Assess the effectiveness of different layouts (of UML Class diagrams)
See if labeling of classes with their stereotype/color information is helpful
Understand how we explore, examine, and navigate
Understand difference between novices and experts
New Measure for Effort

- **Number of fixation (effort)**
  - Classes and relationships are laid out in ways that can lead to inefficient visual exploration, explanation, and navigation
  - Spans the attention of the subject across a number of objects instead of narrowing down to a relevant area of interest

- Utilized for objective assessment of class diagram layout
May be a laundry list of what we can do with eye tracking? Which type of problem/tasks?
Final Thoughts

- The basic premise of eye tracking methods lays in the strong eye-mind hypothesis
  - Human gazes directly correspond to their thinking and cognitive process

- Use white box measures synergistically with traditional black box measures

- Recent advancements in eye-tracking technology provides a very effective tool in empirical research