



Assessing the Usability of Gaze-Adapted Interface against Conventional Eye-based Input Emulation

Chandan Kumar, Raphael Menges and Steffen Staab



Motivation

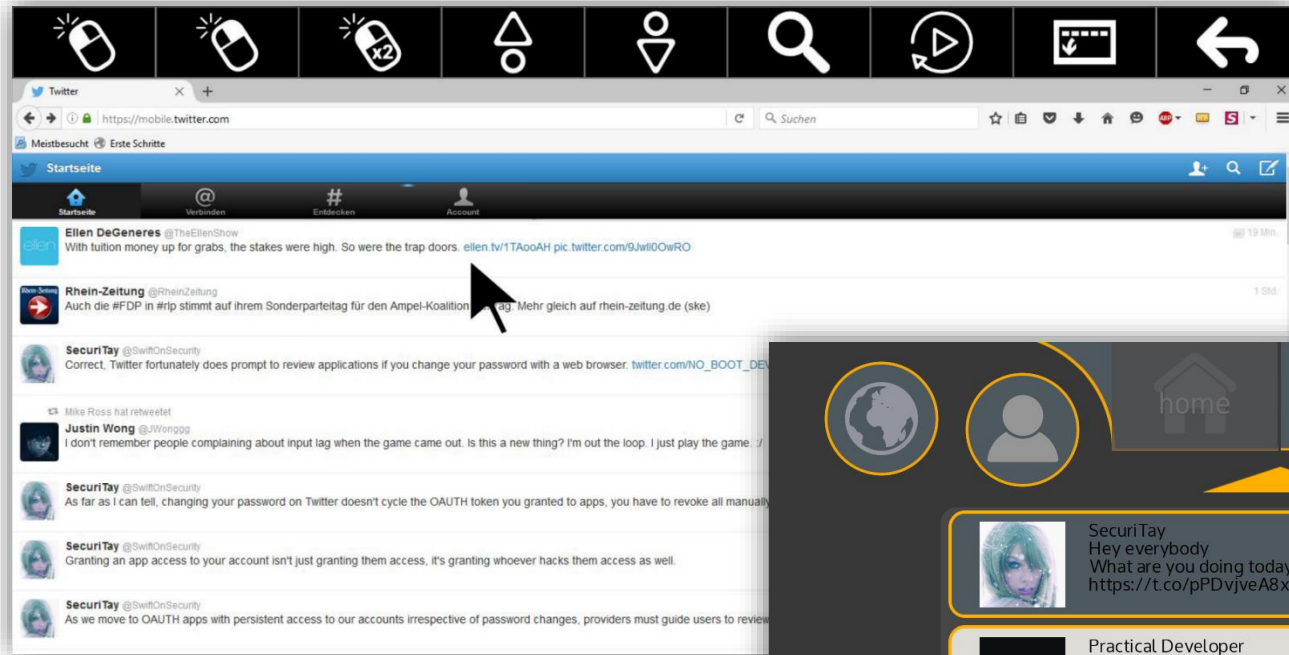
- **Social platforms** are an **opportunity** for **physically impaired** people to connect with others



- **Eye gaze** tracking is an emerging **input device**
- Two interface approaches to include eye gaze
 - **Emulation** of traditional input devices
 - **Gaze-adapted** interface

Research Question: What is the impact on Usability and Task Load for the user?

Assessment of Usability



Emulation¹

¹OptiKey Software and Firefox, showing mobile Twitter page

Gaze-Adapted Twitter



Eye Tracking

There are two major challenges¹ for eye tracking

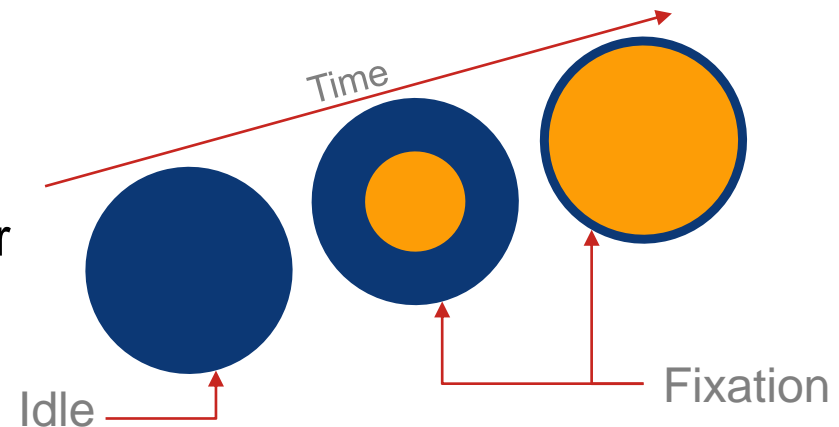
- **Limited Accuracy**

- Maximal accuracy is one degree due eye geometry
- Calibration drift through head movements

→ Size and position of interface elements

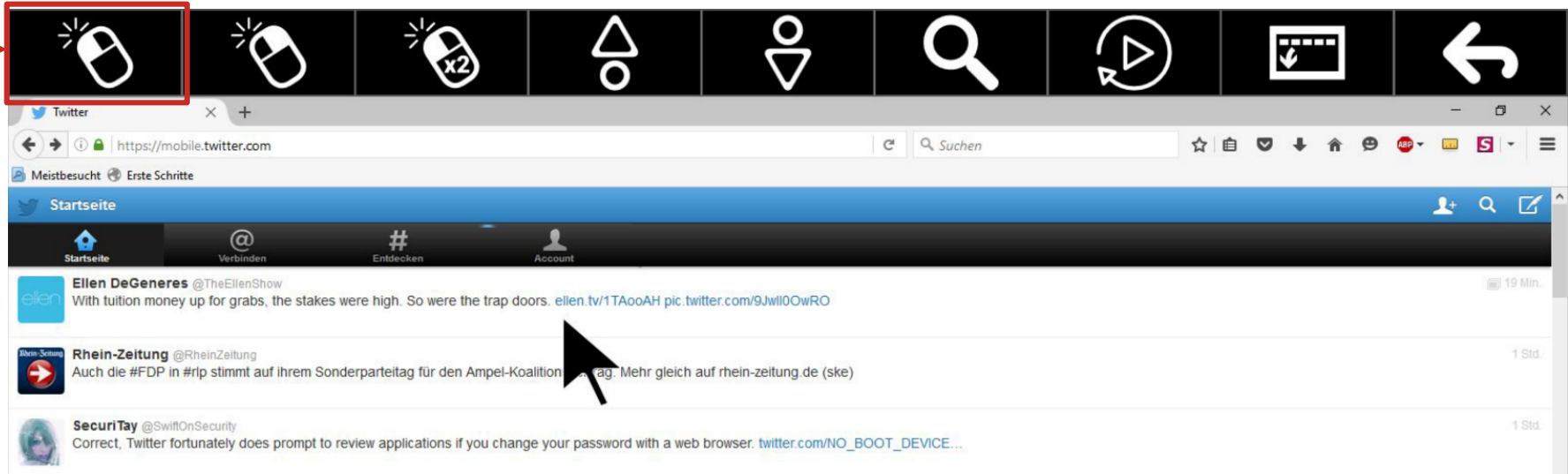
- **Midas Touch**

- Eye is both sensor and controller
- Dwell time based interaction



¹Kumar, C., Menges, R., & Staab, S. (2016). Eye-Controlled Interfaces for Multimedia Interaction. IEEE Multimedia, 23(4), 6-13.

Emulation of traditional input devices



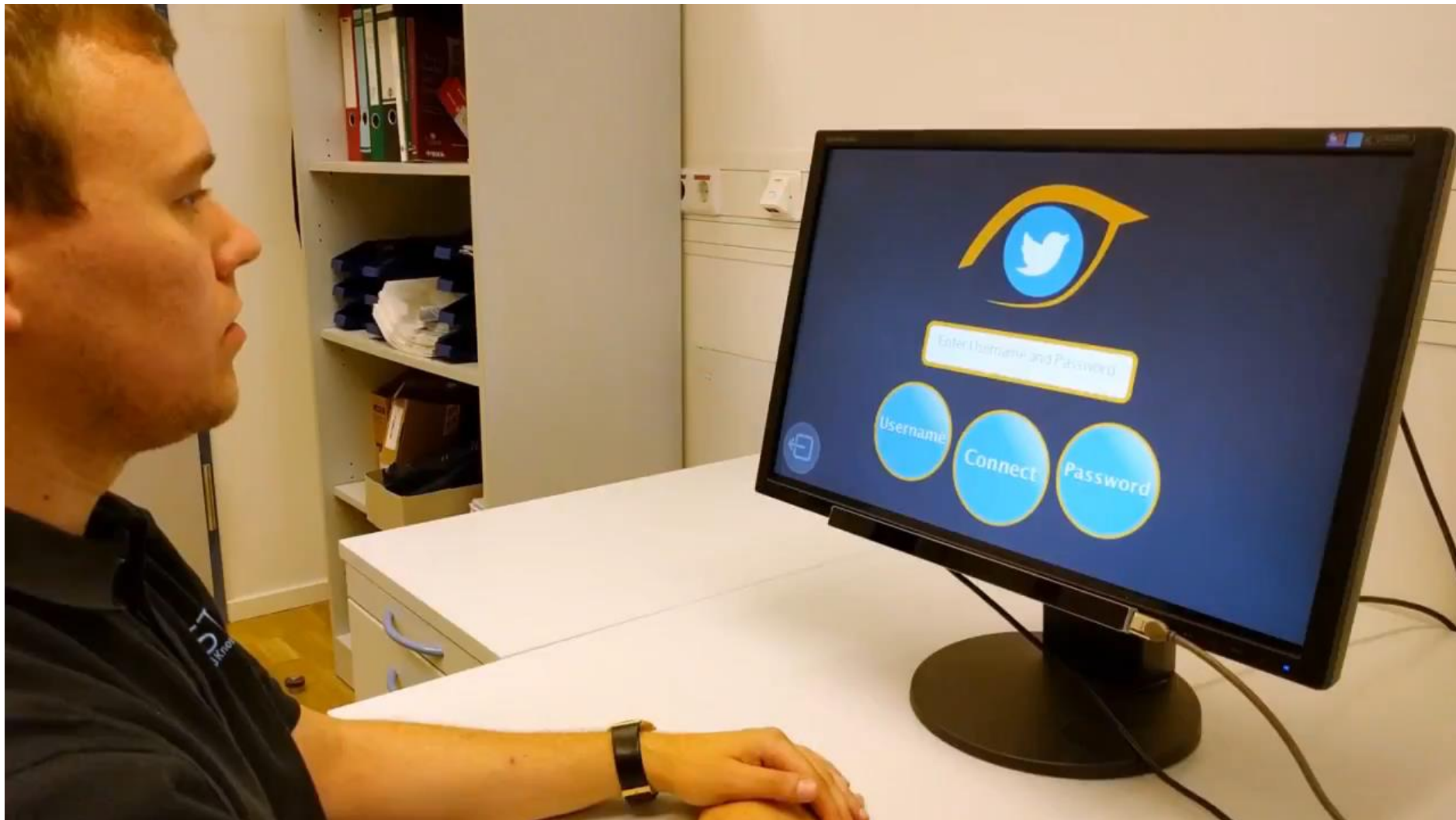
- **Emulation of mouse and keyboard** using gaze
 - **Dwell time** based button interaction
 - Example of left mouse button click
- Dwell on left mouse click button → Dwell on click area → Magnification of area and another dwell on exact position

Gaze-adapted Twitter



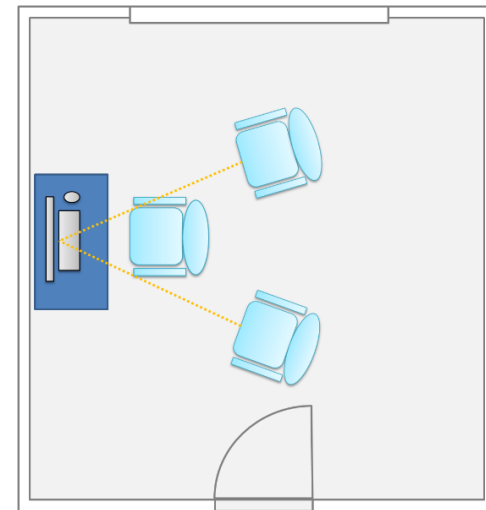
- **Content Area** displays recent tweets and provides no interaction
- **Action Bar** provides contextual actions by dwell time buttons

Gaze-adapted Twitter: Demo

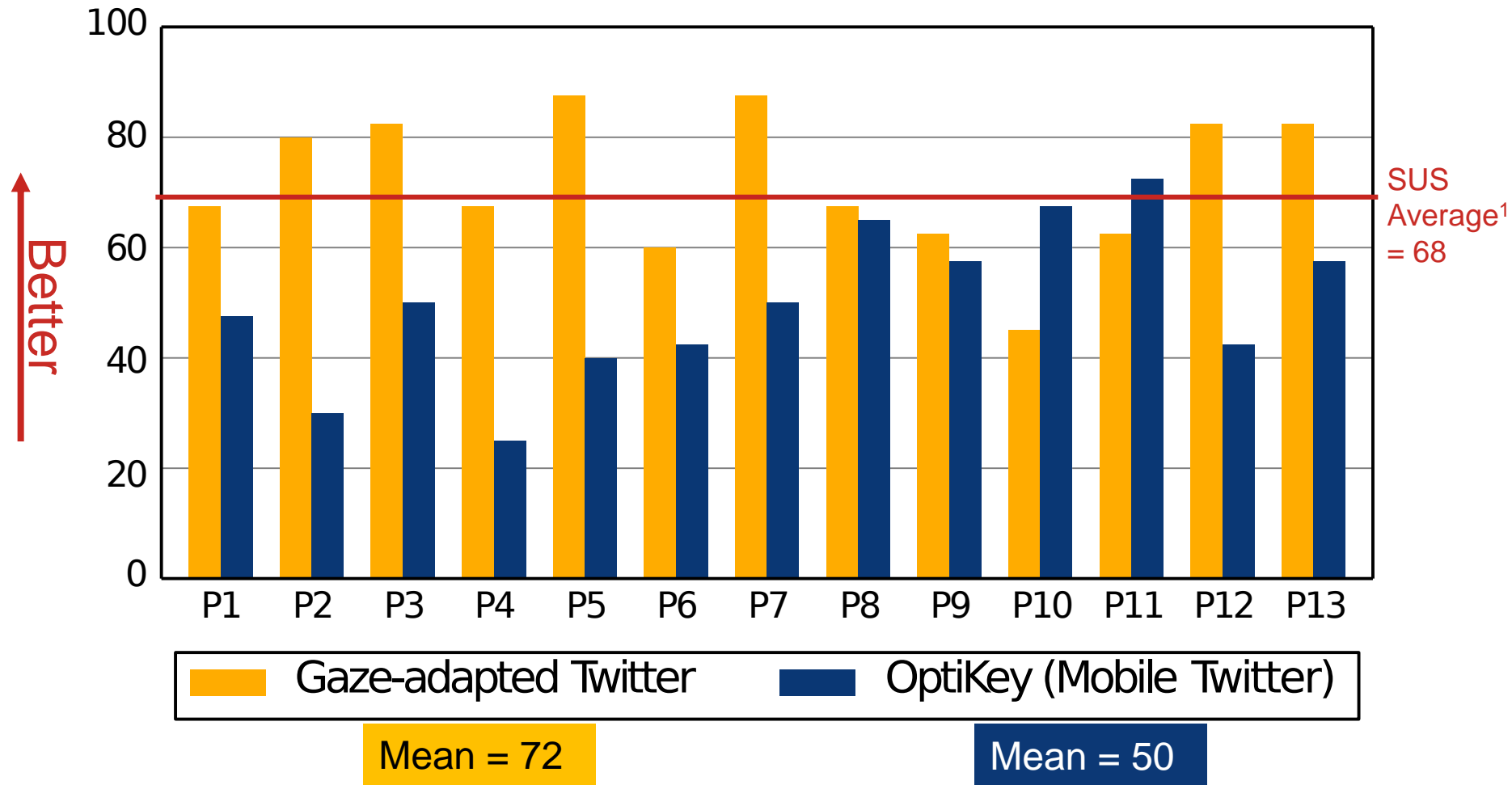


Experimental Setup

- Hardware
 - Tobii EyeX consumer eye tracking device
- Software
 - Our gaze-adapted Twitter application
 - OptiKey operating Firefox with mobile Twitter page
- Study
 - Learning: Eye tracking tutorial provided by Tobii executed
 - Think-aloud study, including **SUS** and **NASA-TLX** survey
 - Counter-balancing between the two softwares performed
- Task
 - Write a tweet and publish it, find a particular user and follow her, find and like a certain tweet. Explore the application (5-10 min)
- Participants
 - 13 students (10M, 3F), aged between 20 and 39



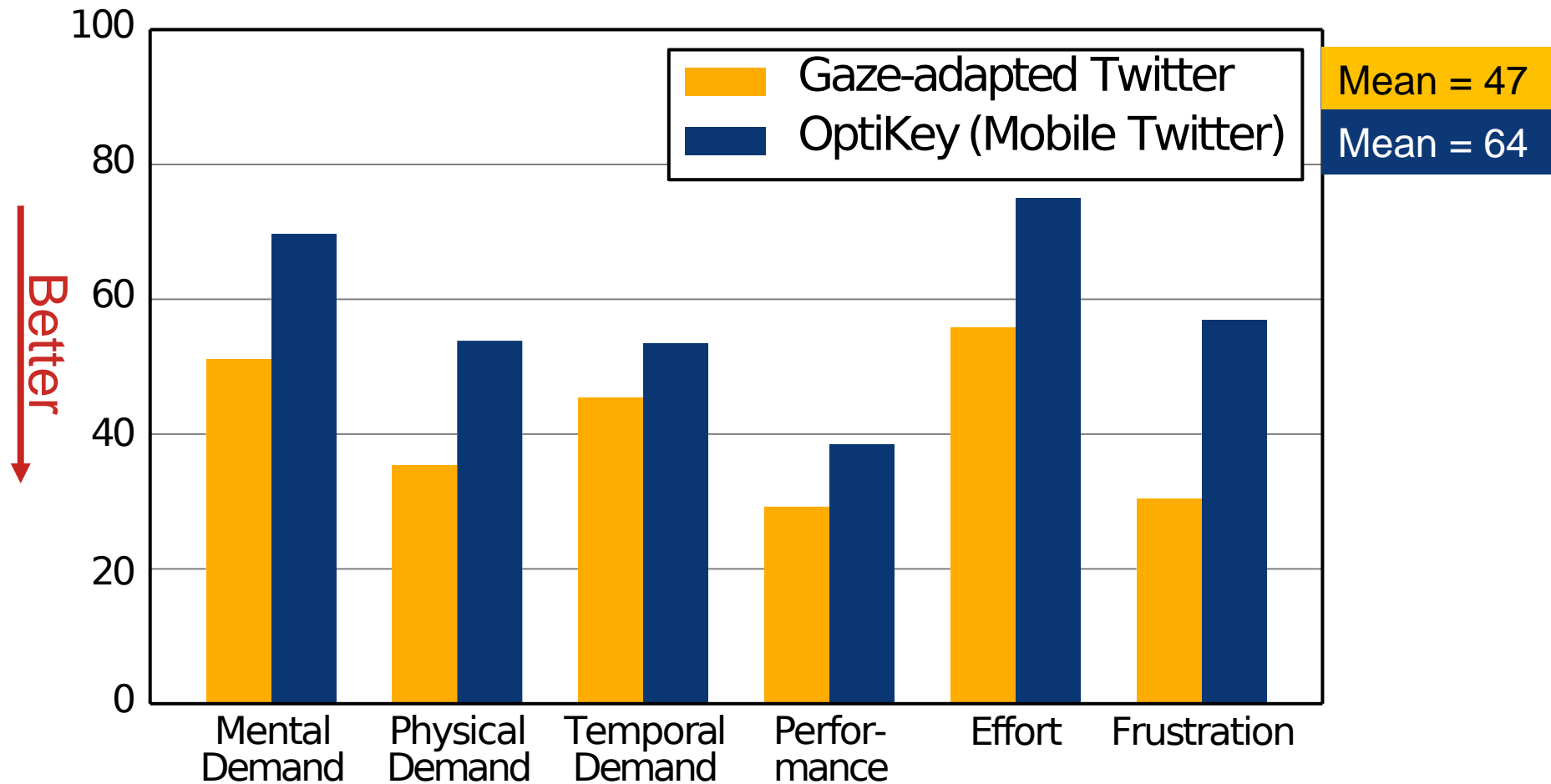
Results: System Usability Score



$p = .0044 < 5\%$

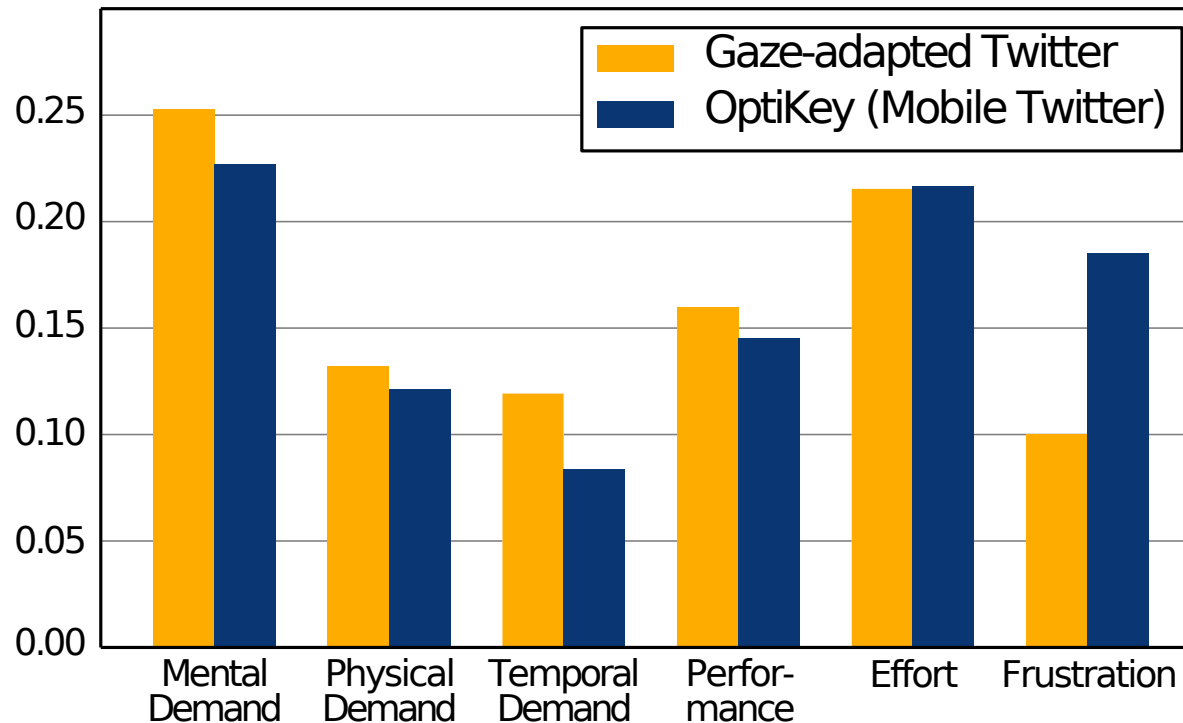
¹<https://measuringu.com/sus>

Results: Task Load Average **Raw Score**



$p = .0238 < 5\%$

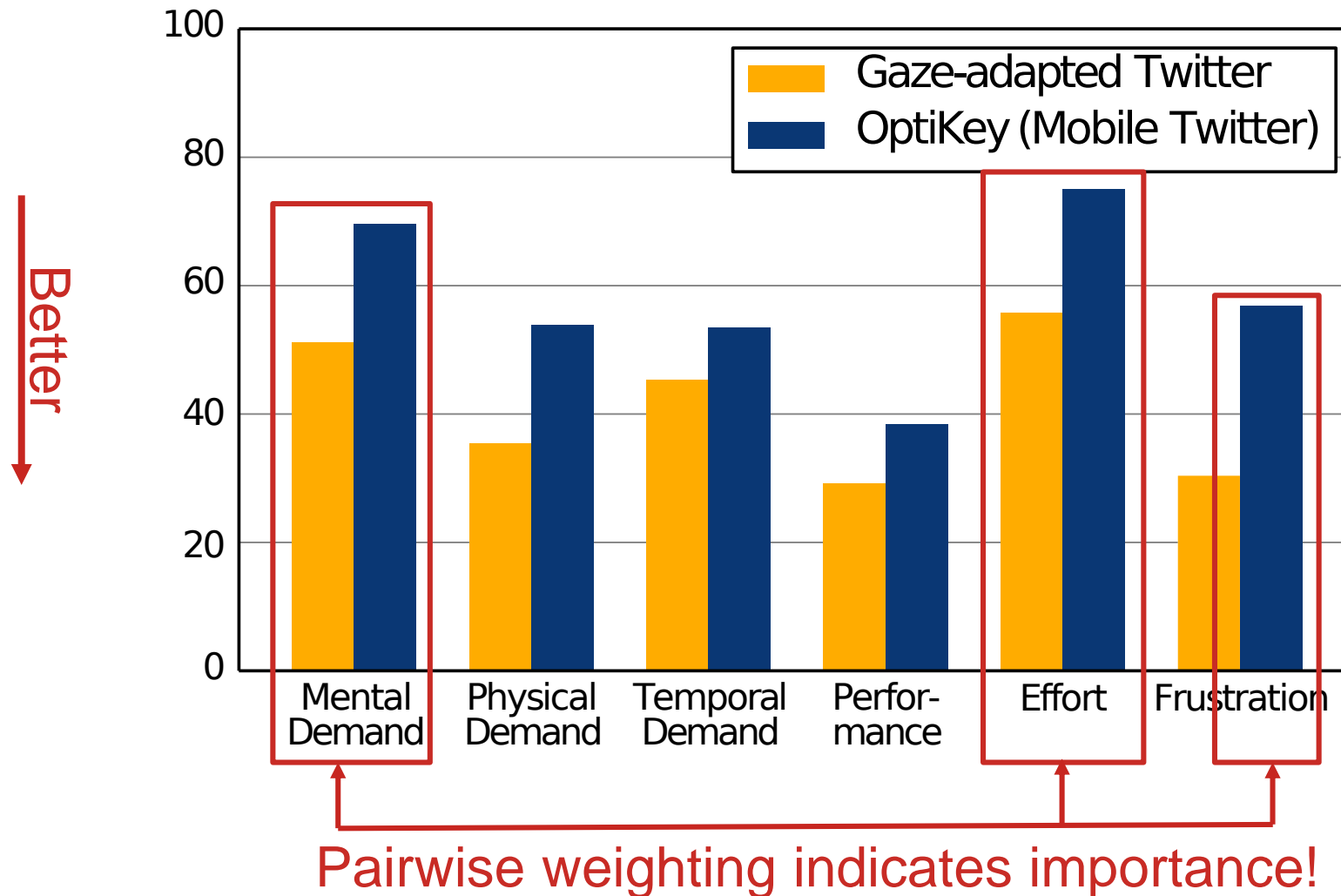
Results: Task Load Average Weightings



Providing the importance of the values

- **Frustration weighting** being **two times higher** for the emulation
- **Mental demand, effort and frustration** were judged as the **most relevant** scales by the participants

Results: Task Load Average **Raw Score**



Pairwise weighting indicates importance!

Observations

- Participants **felt stressed** when the interface **reacted constantly** to their gaze
- Users are very **focused on the visual search task** and overlook system's help (e.g., auto text suggestions while typing)
- Participants **prefer** the option **to personalize** the interaction with respect to their experience



Conclusion

- **Gaze-adapted** interface for **Twitter** was presented
- Evaluation showed an **advantage** in both **usability** and **mental demand** for gaze-adapted interface over emulation approach
- Future Work: We implement and evaluate **Web browsing with eyes and mind**, for gaze-adaption of various service interfaces

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Thank you for your Attention!



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