

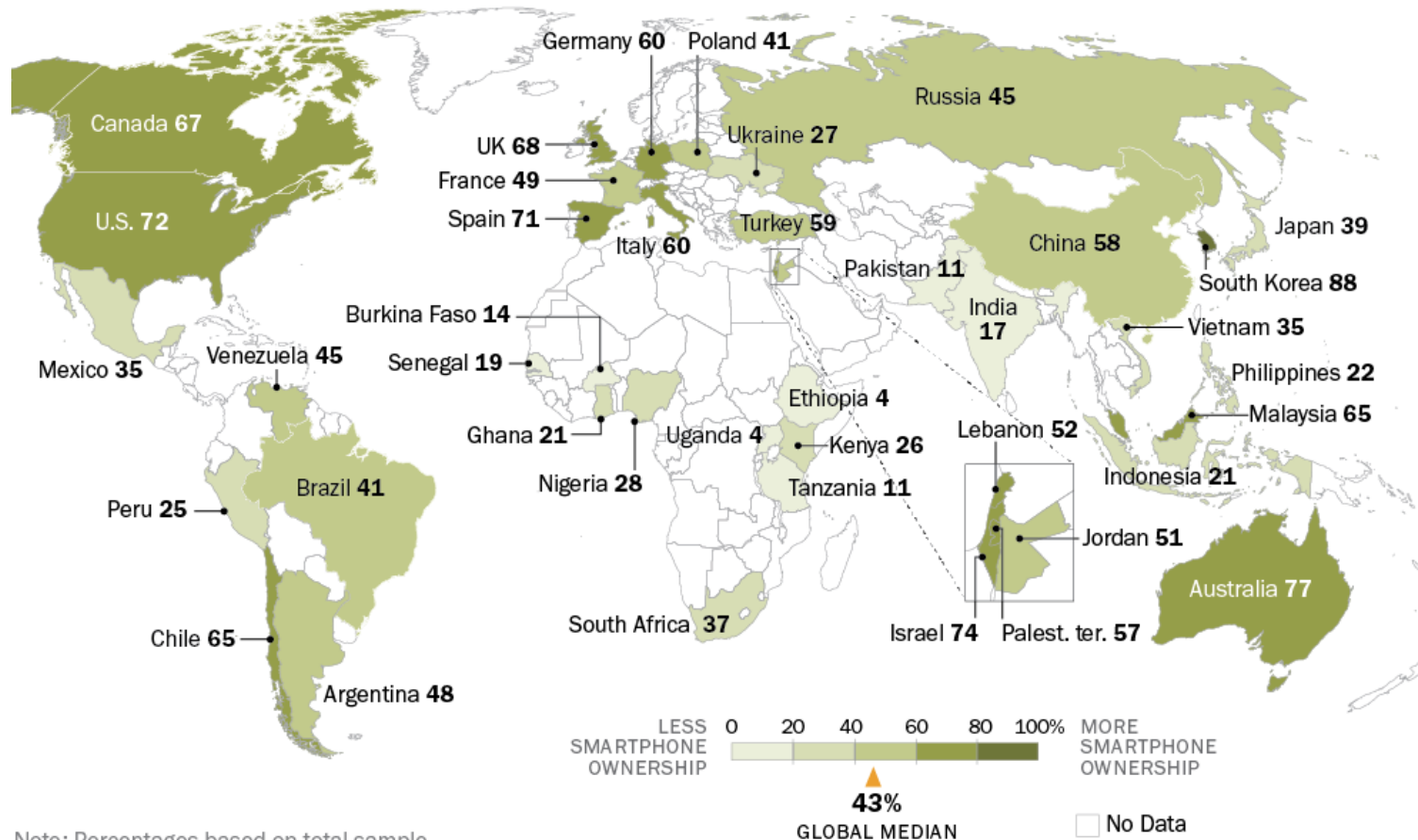
WPI

Effective Use of User Interface and User Experience in an mHealth Application

Wonchan Choi & Bengisu Tulu
Robert A. Foisie School of Business
Worcester Polytechnic Institute
Worcester, MA

Increasing Smartphone Ownership

Percent of adults who report owning a smartphone

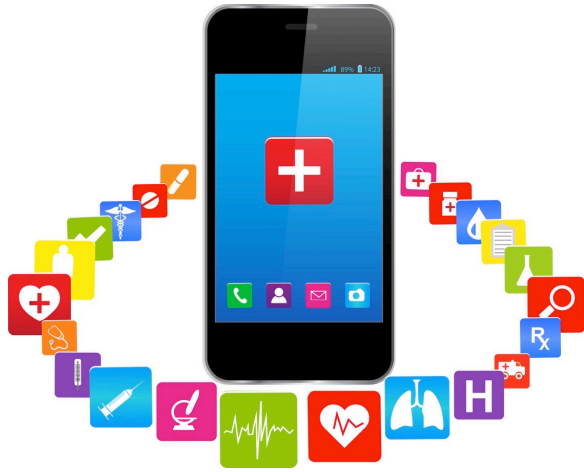


Note: Percentages based on total sample.

Source: Spring 2015 Global Attitudes survey. Q71 & Q72.

PEW RESEARCH CENTER

Mobile Health Technology



- 62% of smartphone owners used their phones to access health-related information in 2015 (Smith, et al., 2015).
- 58% of smartphone users downloaded a health-related mobile app in 2015 (Krebs & Duncan, 2015).
 - Weight loss & calorie tracking
 - Nutrition
 - Physical activity
 - Medical monitoring

Importance of UI Design in User–App Interaction

- User interface (UI) directly affects the user–app interaction (Rosson & Carroll, 2002).
- Especially for mHealth apps that require users to input data “frequently and repeatedly,” UI is a crucial component that:
 - affects users’ **engagement** with the app;
 - determines the concrete **user experience (UX)** with the app.

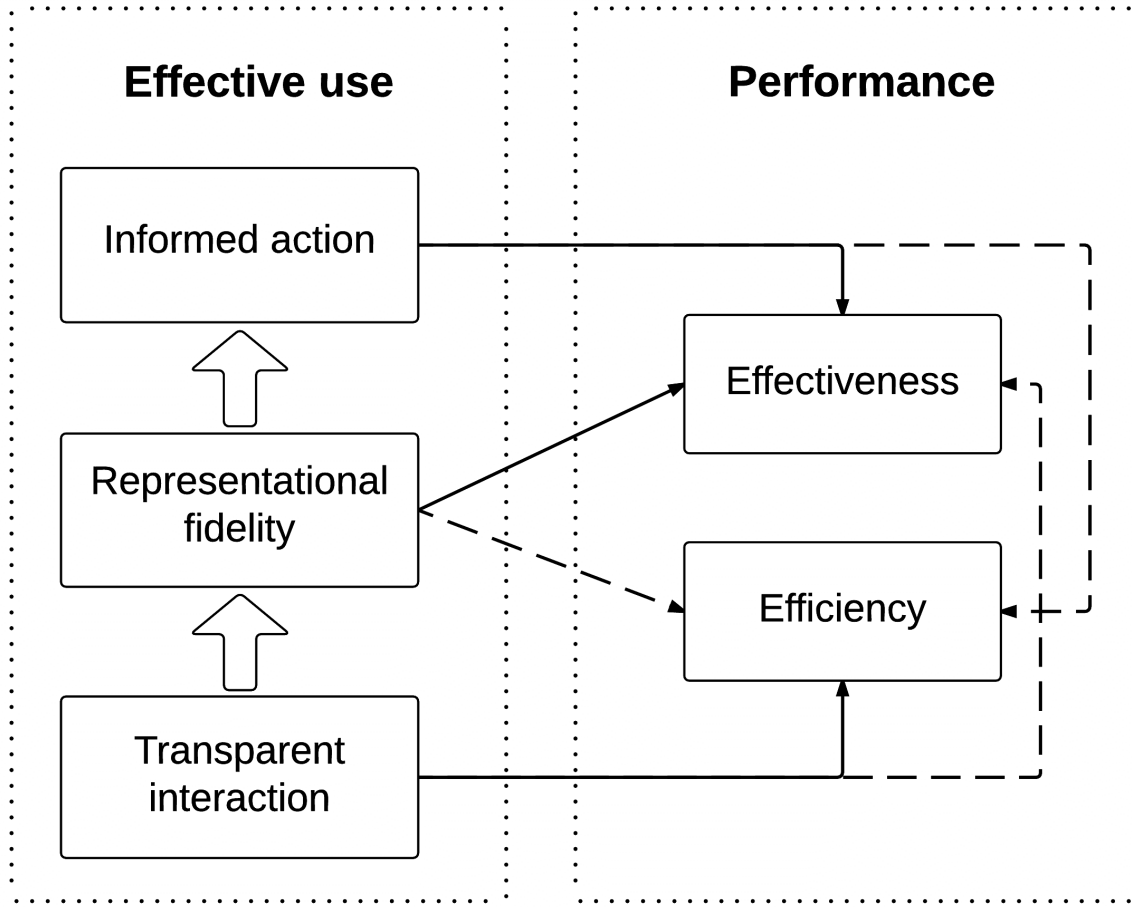
Purpose of the Study

- To examine the effects of data entry UI types on UX within the context of a mobile app designed for Android smartphones.

Effective Use Theory (Burton-Jones & Grange, 2013)

Effective use

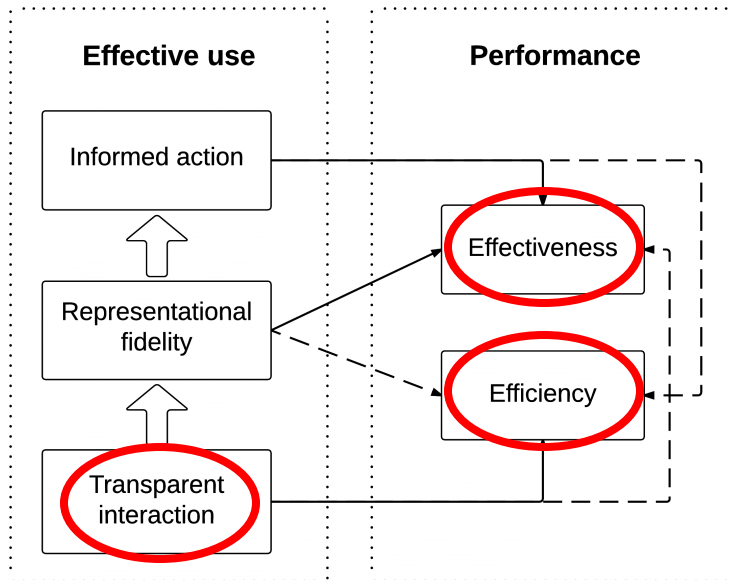
“using a system in a way that helps attain the goals for using the system.”



Performance

“the extent to which a user has attained the goals of the task for which the system was used.”

Effective Use Theory (Contd.)

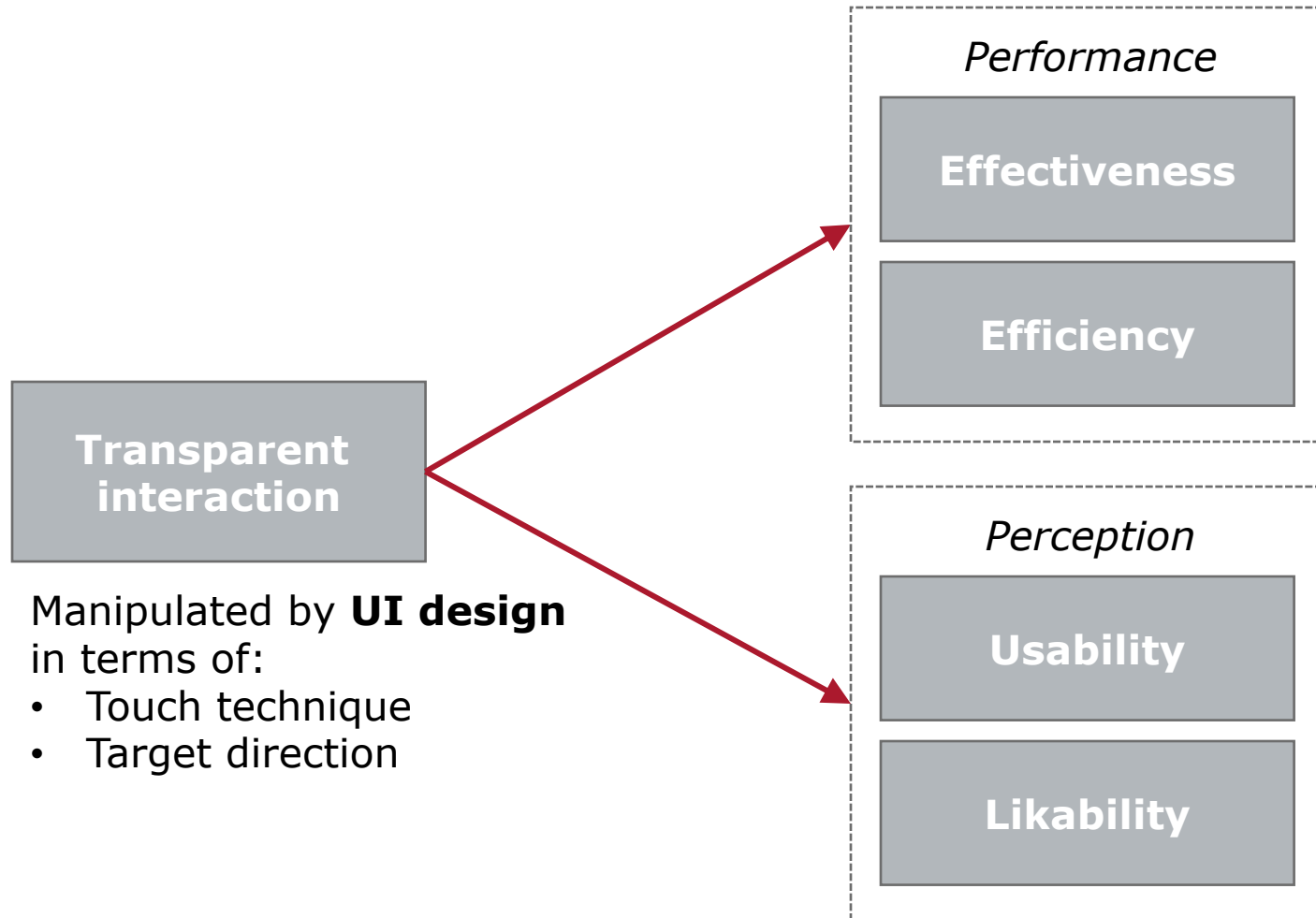


- **Transparent interaction:** “the extent to which a user is accessing the system’s representations unimpeded by its surface and physical structures.”
 - When a system’s transparent interaction increases, it ***improves its user’s performance.***

Effectiveness: “the extent to which a user has attained the goals of the task for which the system was used.”

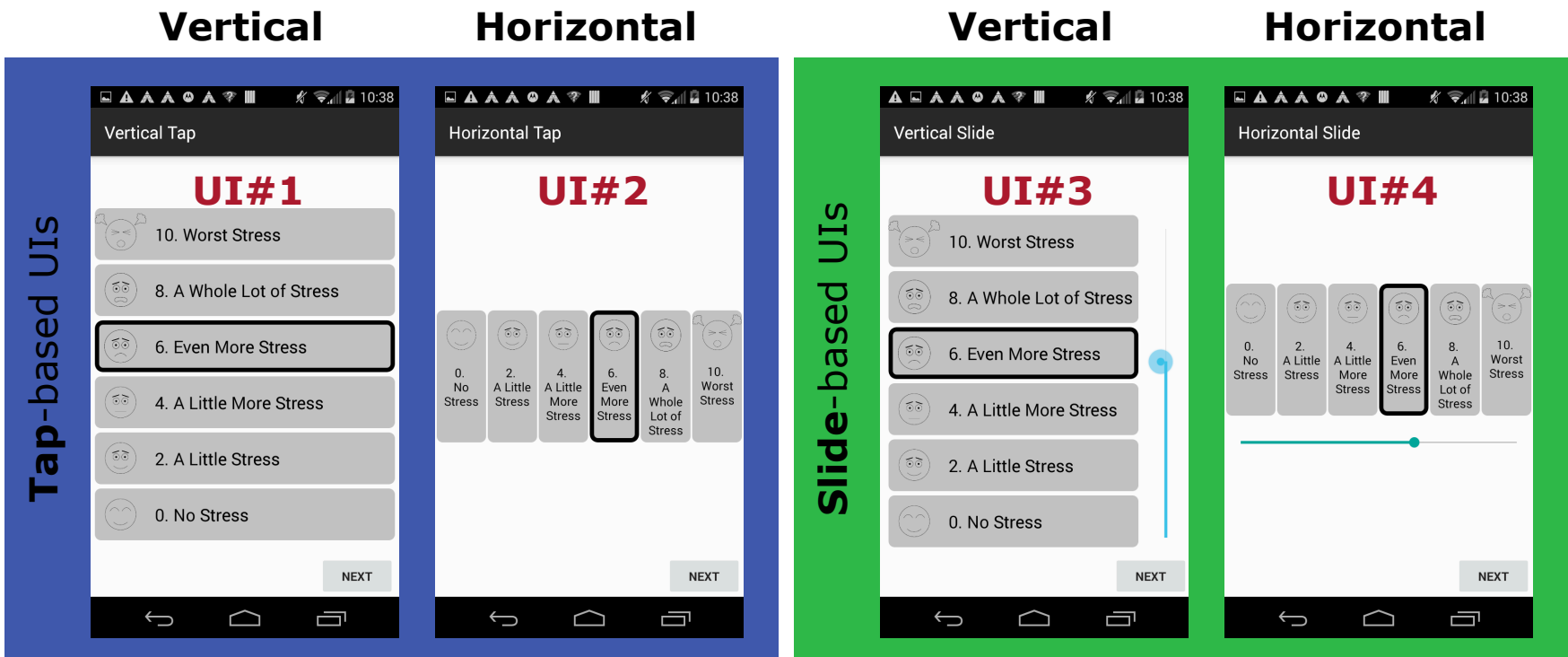
Efficiency: “the extent of goal attainment for a given level of input, such as effort or time.”

Study Model



Experimental App Design

- Task: Entering a specified stress level using the given **smartphone app UI** (manipulated variable)



Study Participants

- 2 (tap vs. slide) X 2 (vertical vs. horizontal) within-subjects design
- Sample: 50 college students
 - 41 (82%) master and 9 (18%) undergraduate students
 - 31 (62%) females and 19 (38%) males
 - 38 (76%) Asians, 8 (16%) White, 4 (8%) multi-racial
- Recruitment sites:
 - Social science participant system (Sona)
 - A face-to-face class at WPI
- Data collection: March and April in 2016

Data Collection Procedures

- Mixed methods consisting of a controlled experiment & a follow-up survey
 - **Experiment:** using a study smartphone, each participant input a specified level of data across the four UIs, as quickly and as accurately as possible.
 - **Follow-up survey:** each participant filled out a survey questionnaire asking about their perceptions of usability and likability of the UIs.

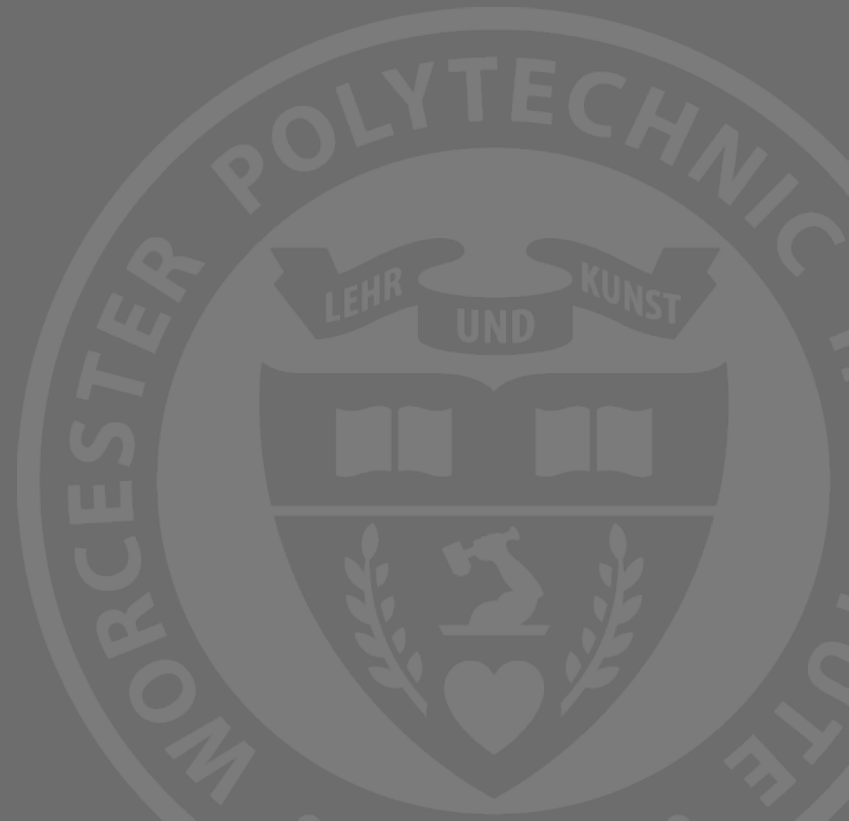
Survey questions

	Criteria	Item wording
Roudaunt et al. (2008)	Fun	"The interface is fun to use."
	Learnability	"The interface is easy to learn."
	Pleasantness	"The interface is pleasant."
	Simplicity	"The interface is simple."
	Accuracy	"I can input data accurately using the interface."
	Speed	"I can input data quickly using the interface."
Stoyanov et al. (2015)	Ease of use	"The interface is easy to use."
	Visual appeal	"The interface is visually appealing."

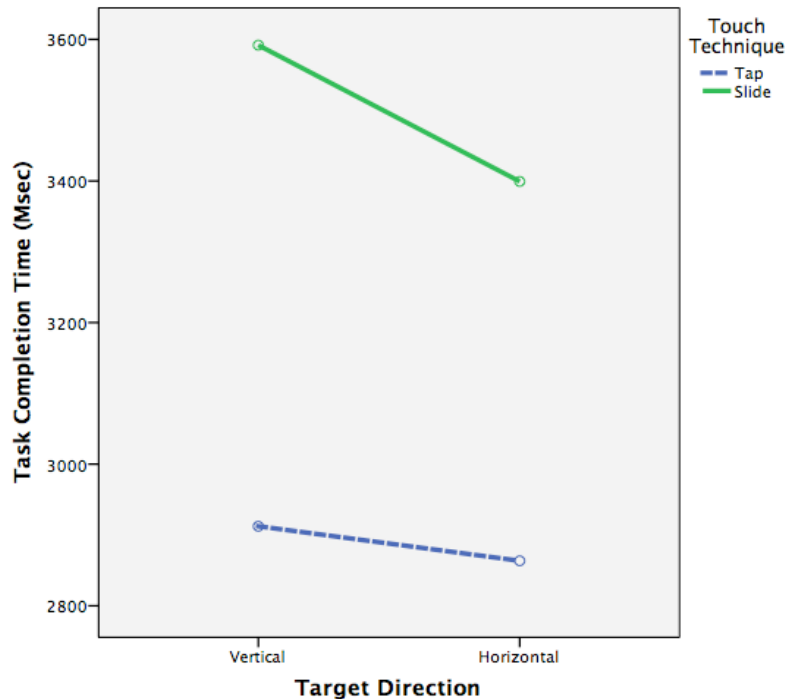
Measures

- Performance
 - **Efficiency:** Task completion time in milliseconds
 - **Effectiveness:** Error rate—cases where users failed to input the specified level of data (i.e., “6-Even More Stress”).
- Perceptions
 - **Perceived usability:** 5-point Likert type scale-based items on (1) learnability, (2) simplicity, (3) accuracy, (4) speed, and (5) ease of use
 - **Perceived likability:** 5-point Likert type scale-based items on (6) fun, (7) pleasantness, and (8) visual appeal

Results



Performance: Task Completion Time

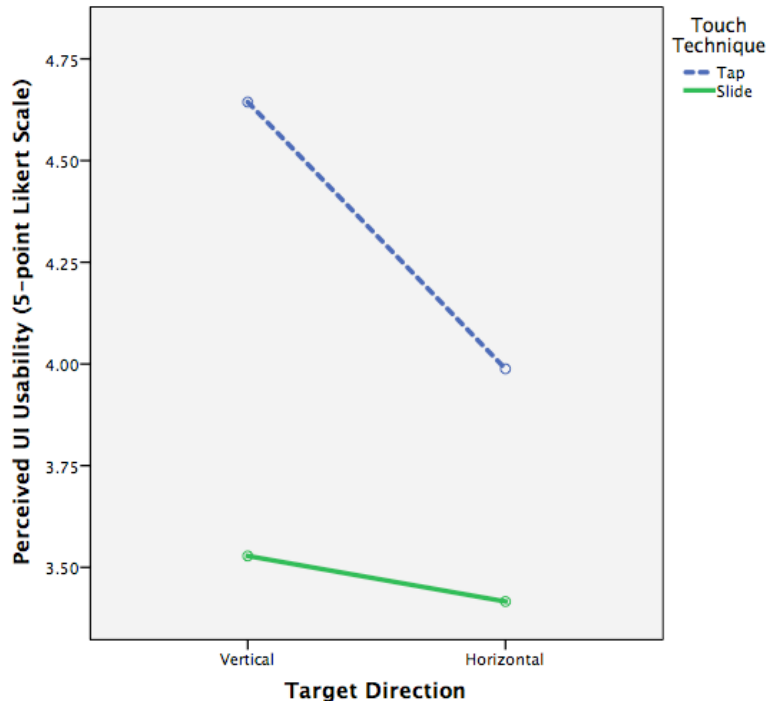


- Significant *touch technique* effect ($p < .001$):
 - Users were **significantly more efficient** in using **Tap-based UIs** (UI#1 & UI#2) to enter data compared to slide-based UIs (UI#3 & UI#4).
- Non-significant *target direction* effect ($p = .212$)
- Non-significant interaction effect ($p = .592$)

Performance: Error Rate

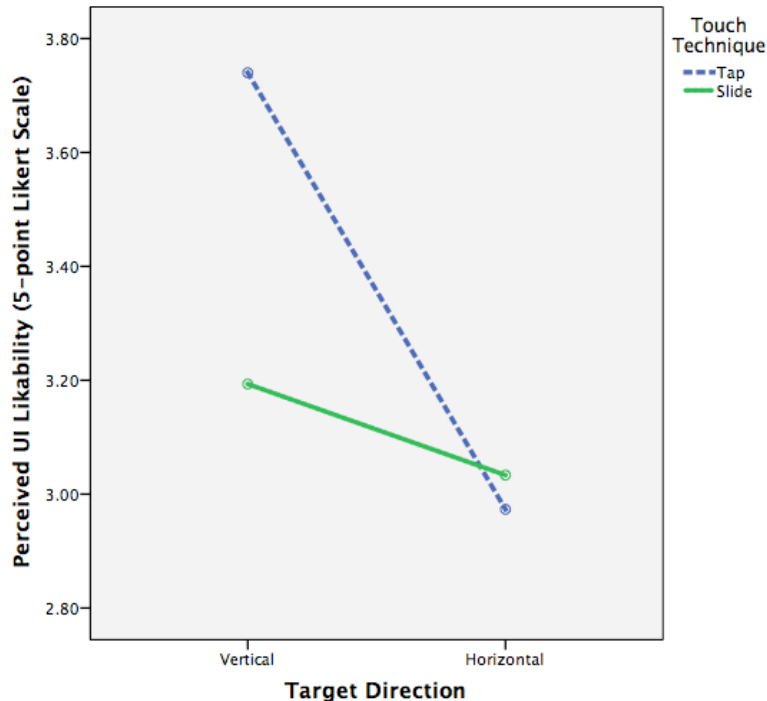
- Of the 200 data entries by 50 participants, **no errors** were made.
 - UI type did not affect user performance in terms of error rate.

Perception: Usability



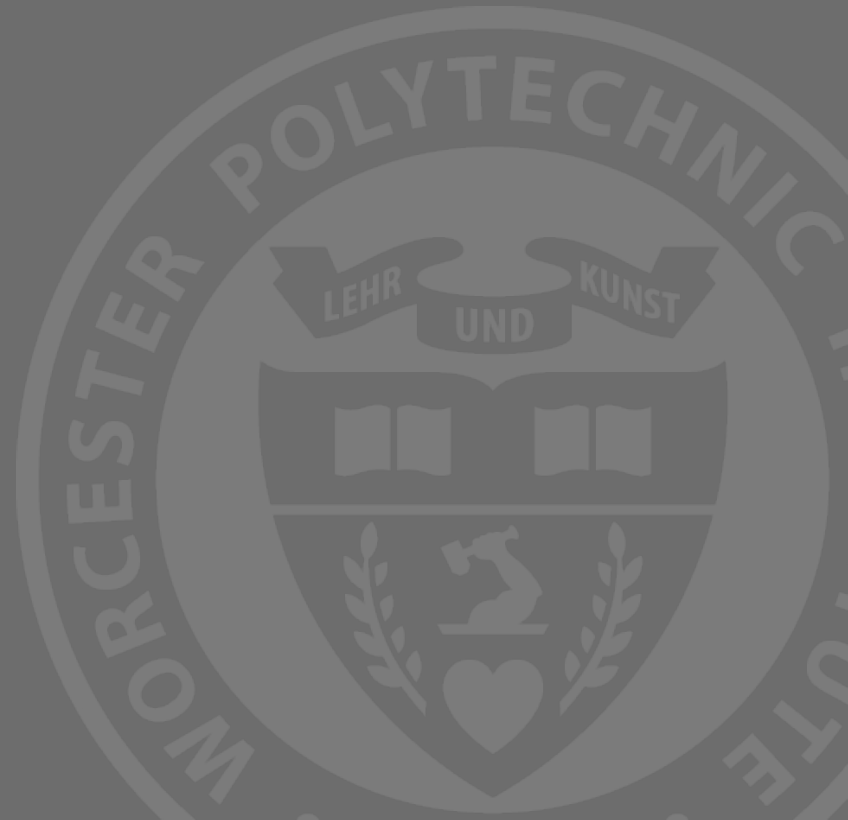
- Significant main effects (*touch technique & target direction*, $p < .001$) and significant *interaction* effect ($p < .001$).
 - **Tap-based UIs** were perceived as **more usable** than the slide-based UIs, regardless of target direction.
 - **Vertical display** was perceived as **more usable** than horizontal display **only in the tap-based UIs**.

Perception: Likability

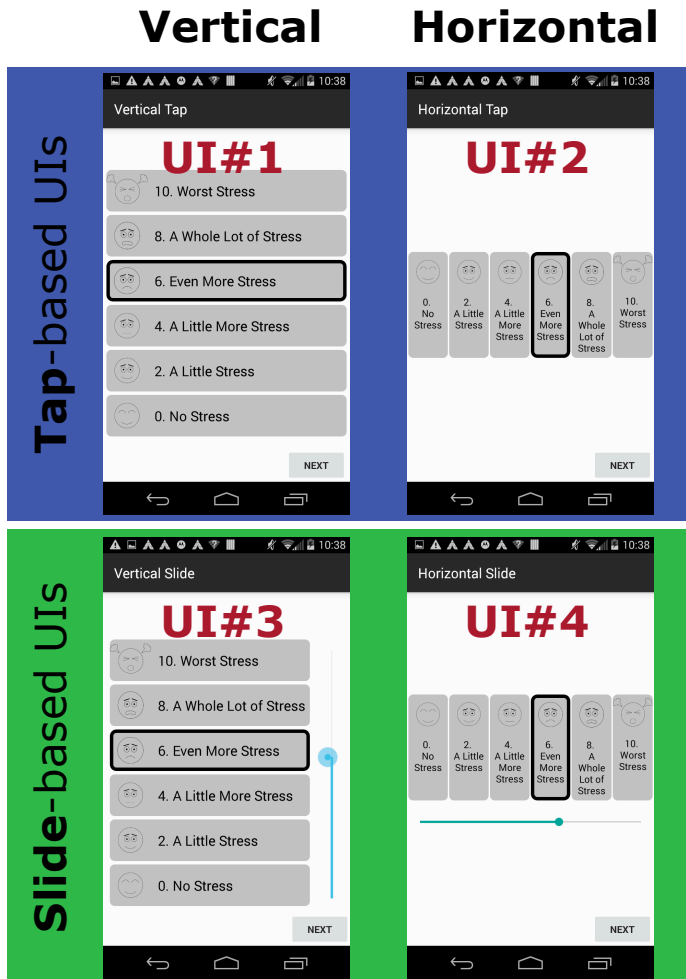


- Significant main effects (*touch technique & target direction*, $p < .001$) and significant *interaction* effect ($p < .001$).
 - **Tap-Vertical (UI#1)** was perceived as **more likable** than any other UIs (UI#2, UI#3, & UI#4) in the study.
 - There was no statistical difference among the the other thee UIs.

Discussions & Future Research Directions

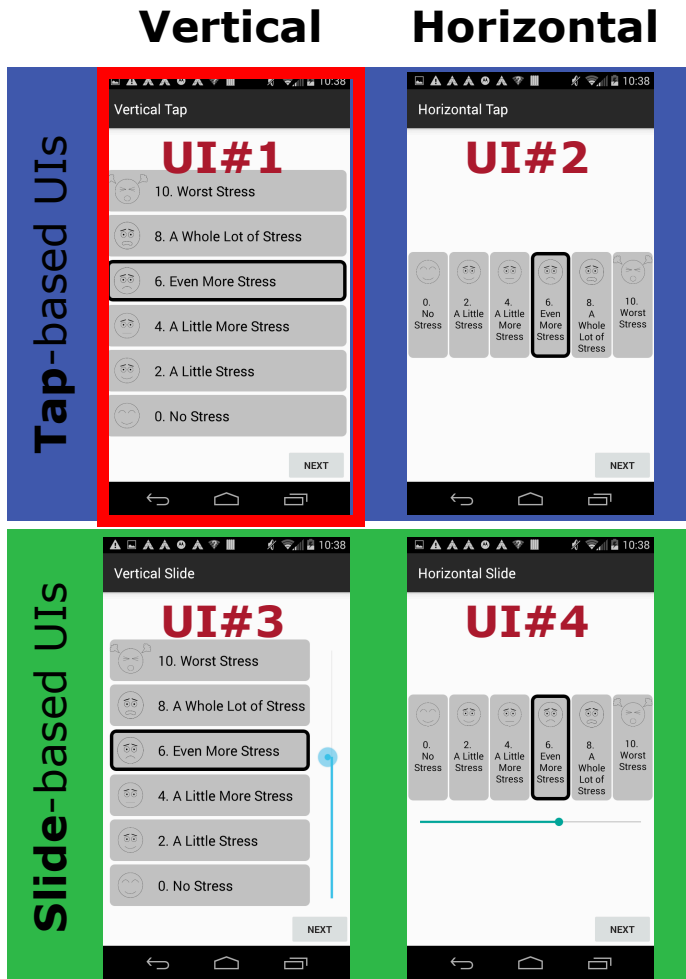


Effect of UI Design on Efficiency



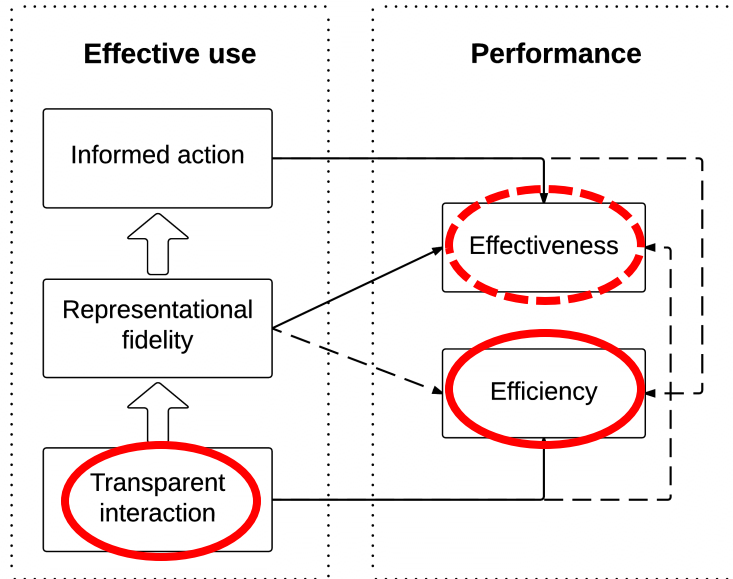
- Tap-based UIs (UI#1 & UI#2) had higher “efficiency” in frequent data input tasks.
 - Tapping was more “transparent” than sliding when users interact with a mobile app.
- Target direction did not affect “efficiency.”

Effect of UI Design on Perception



- Tap-based UIs (UI#1 & UI#2) were perceived as more usable than slide-based UIs.
- Tap-Vertical UI (UI#1) was perceived as more likable than other UIs.

Effect of UI Design on Effectiveness



- UI design did not affect “effectiveness.”
 - A system’s transparent interaction was mainly concerned with efficiency (i.e., task completion time), rather than effectiveness (i.e., error rate).

Future Research Directions

1. Increase (manipulate) the level of task complexity to examine the potential effect of UI design on effectiveness.
2. Examine the effects of the other two dimensions of effective use, “*representational fidelity*” and “*informed action*.”
3. Examine how effective use and performance influence users’ perceptions and their behaviors regarding retention (continued use) of the app.

Thank you!

Bengisu Tulu, PhD

bengisu@wpi.edu

Associate Professor of MIS

Robert A. Foisie School of Business

Worcester Polytechnic Institute

