Swiping Burger

Florian, Steffen, Felix, Lukas

June 13, 2016

Table of Contents

Expose

- Examination of a sequence of questions in an e-learning app often does not happen sequentially
- Swipe gestures are efficient when going through data sequentially, but how about other scenarios?
- Comparison of Hamburger menu navigation with swipe gestures for large jumps within sequence

Tasks

- Starting at page one, in each task, participant has to visit five pages in a predefined order (kind of a treasure hunt)
- The distances between two pages are once $d - 1$, three times d, and once $d + 1$: average distance is d
- After completion of a task, questionnaire has to be filled in (built into the application)

Tasks - Example

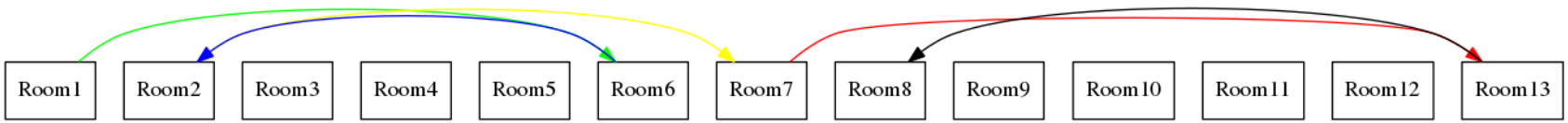

Figure: A task where $d = 5$

Sequence:
Room1 $\rightarrow$ Room6 $\rightarrow$ Room2 $\rightarrow$ Room7 $\rightarrow$ Room13 $\rightarrow$ Room8

Tasks

In total there are five tasks with different distances: 5, 10, 15, 20, 25

- Room1 → Room6 → Room2 → Room7 → Room13 → Room8
- Room1 → Room10 → Room20 → Room30 → Room19 → Room9
- Room1 → Room17 → Room32 → Room46 → Room31 → Room16
- Room1 → Room21 → Room41 → Room22 → Room43 → Room23
- Room1 → Room26 → Room52 → Room27 → Room3 → Room28

In order to reduce learning effect: no order of distances twice

Tasks - Realization

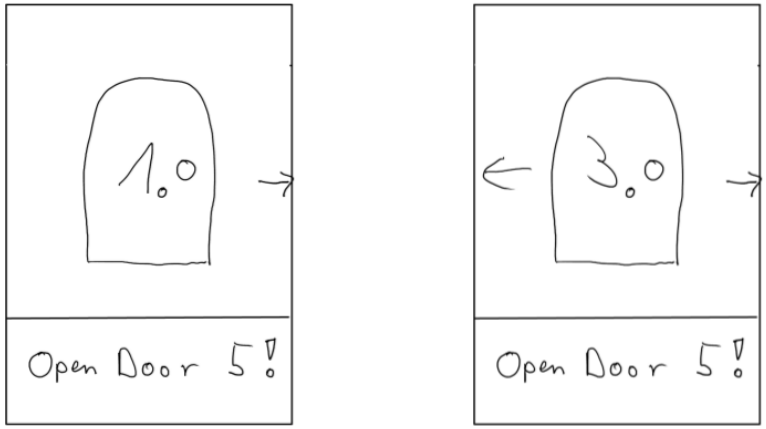

Figure: Navigation with swipe gestures

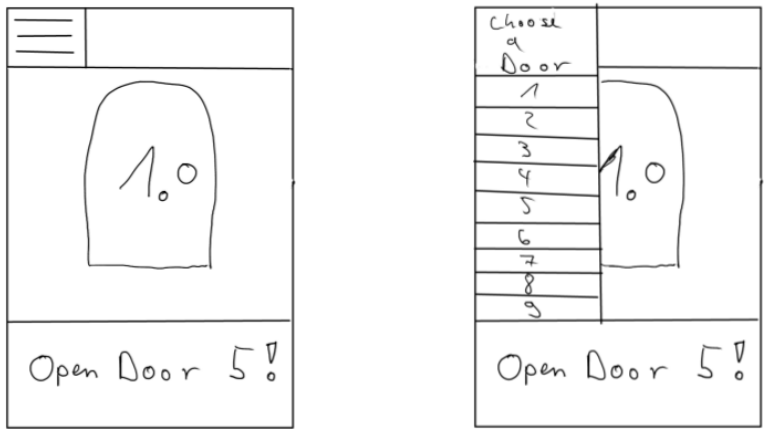

Figure: Navigation with Hamburger menu

Tasks - Realization cont'd

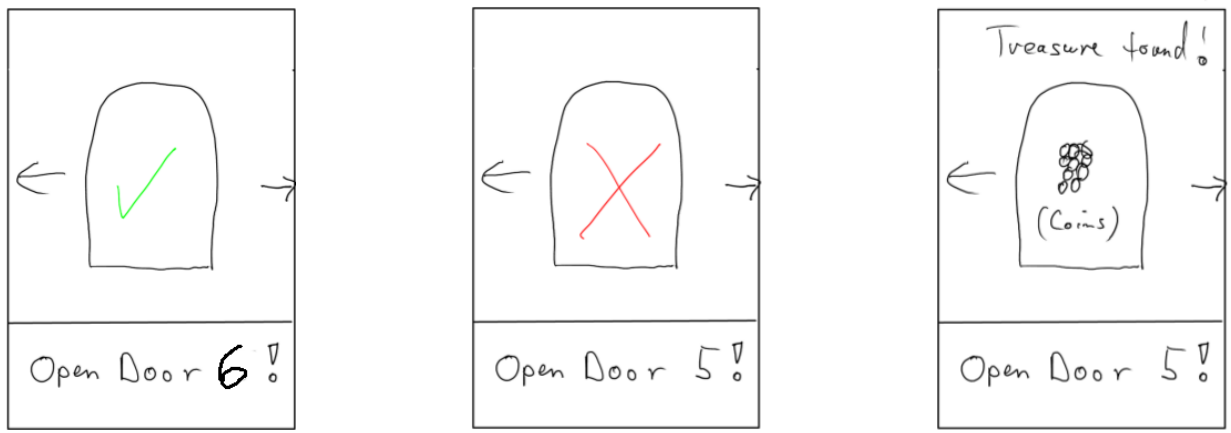

Figure: Opening the right door, a wrong door, and the last door

Hypotheses

- Usage of Hamburger Menu navigation requires constant time to travel a path.
- Usage of Swipe navigation results in growing time depending on the distance.
- There is some point of intersection, where the required navigation time of Swipe exceeds the required navigation time of Hamburger Menu.

Table of Contents

Within-, Between-group or Split-plot

- Between group treatment among navigation methods
- Within group design over the length of the navigation paths

$\rightarrow$ Split-plot design.

Independent / Dependent Variables

Independent Variables

- Navigation Method
- Navigation Distance

Dependent Variables

- Time
- User satisfaction (Questionnaires)

Participant Acquisition and where to investigate

Field study

Why? Participants should not get bored. Experiment is not too long.

Where? Mensa: because student's are used to smartphones.

When? Not during meal times to avoid distraction.

How Many? Mead's resource equation with $E = 20, B = 0, T = 2$:

$$\begin{aligned} E &= (N-1) - (B-1) - (T-1) \\ &= N - B - T + 1 \\ \Leftrightarrow N &= E + B + T - 1 \\ &= 20 + 0 + 2 - 1 = 21 \end{aligned}$$

Questionnaires

After each distance block

- “ Ich konnte die Aufgaben gut lösen. ”
- “ Die Erreichung des Ziels war mir zu umständlich.”

At the very end

- “Die Umgebung hat mich beim Bearbeiten der Aufgaben gestört”
- “Die Dauer des Experiments war mir zu hoch?”
- “Die Bedienung des mobilen Geräts war intuitiv”
- “Die Art der Navigation hat mir zugesagt”

Table of Contents

Main Idea

- **Given**: Required time, for each navigation method (swipe, burger) and for each distance $d \in D$.
- **Wanted**: Point of intersection, distance d^*, at which Swipe navigation becomes less efficient than Hamburger Menu navigation.
- **The Plan**:
  1. Compare the different distances *within* one navigation method to each other.
  2. Draw a comparison *between* the two navigation methods.

Hamburger Menu Navigation over distances D

- Consider normally distributed random variables X_d with means $\bar{x}_d$ and variance σ_x^2 being the time required for traveling d pages using Hamburger Menu navigation.
- We hypothesize that

$$H_0^{\text{burger}} : \bar{x}_{d_1} = \bar{x}_{d_2} = \cdots = \bar{x}_{d_{|D|}}$$

- Since we can assume equal variances, we evaluate the hypothesis using Repeated Measures ANOVA.
- In case we do not find significant differences, we can use the overall mean $\bar{x}$ for comparison with the Swipe navigation.

Swipe Menu Navigation over distances D

- Consider normally distributed random variables Y_d with means $\bar{y}_d$ and variances $\sigma^2_{y,d}$ being the time required for traveling d pages using Swipe navigation.
- Then we assert that the following hypothesis can be rejected:

$$H_0^{\text{swipe}} : \bar{y}_{d_1} = \bar{y}_{d_2} = \cdots = \bar{y}_{d_{|D|}}$$

Since we can not assume homogeneity of variance in this case, we evaluate the hypothesis using the Friedmann test.

Swipe Navigation vs Hamburger Menu Navigation

- In case we can reject H_0^{swipe} and can not reject H_0^{burger}:
- Compare per-distance means $\bar{y}_d$ of Swipe navigation with overall mean $\bar{x}$ of Hamburger Menu navigation:

$$H_0^{(d)} : \bar{y}_d = \bar{x} \; \forall d \in D$$

- We evaluate these hypotheses using the Welch's t-test, because we can not assume equal variances.
- In the end, we (hopefully) find the distance d^*, for which the required time with Swipe navigation exceeds the required time with Hamburger Menu navigation.

Table of Contents

Discussion

- Where would you expect the point of intersection d^* to be?