

# Swiping Burger

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## Expose

## Design

Within-, Between-group or Split-plot  
Independent and Dependent Variables  
Participants and Location  
Questionnaires

## Analysis Methods

## Discussion

# 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 → Room11 → Room2 → Room12 → Room23 → Room13
- ▶ Room1 → Room16 → Room2 → Room17 → Room33 → Room18
- ▶ Room1 → Room21 → Room2 → Room22 → Room43 → Room23
- ▶ Room1 → Room26 → Room2 → Room27 → Room53 → Room28

# Tasks - Realization

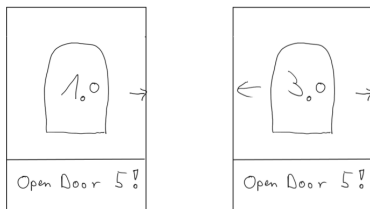


Figure: Navigation with swipe gestures

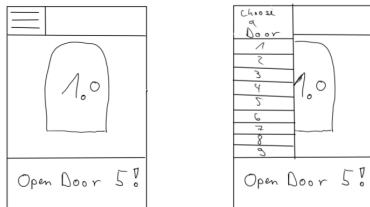
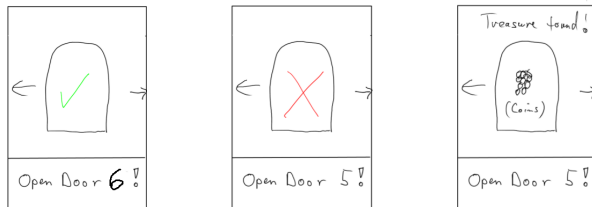


Figure: Navigation with Hamburger menu

## 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.

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# Within-, Between-group or Split-plot

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

→ 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.

# 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”

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# 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  $\sigma_x^2$  being the time required for traveling  $d$  pages using Hamburger Menu navigation.
- ▶ We hypothesize that

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

- ▶ 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  $\sigma_{y,d}^2$  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  $H_0^{\text{swipe}}$  and can not reject  $H_0^{\text{burger}}$ :
- ▶ Compare per-distance means  $\bar{y}_d$  of Swipe navigation with overall mean  $\bar{x}$  of Hamburger Menu navigation:

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

- ▶ 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.

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# Discussion

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