

# Designing Safer Touch Displays

## Digitally Distributing Physical Touch on a Public Display

Lou Elah Süsslin, Vienna University of Technology

Ville Mäkelä, University of Waterloo

Florian Alt, LMU Munich

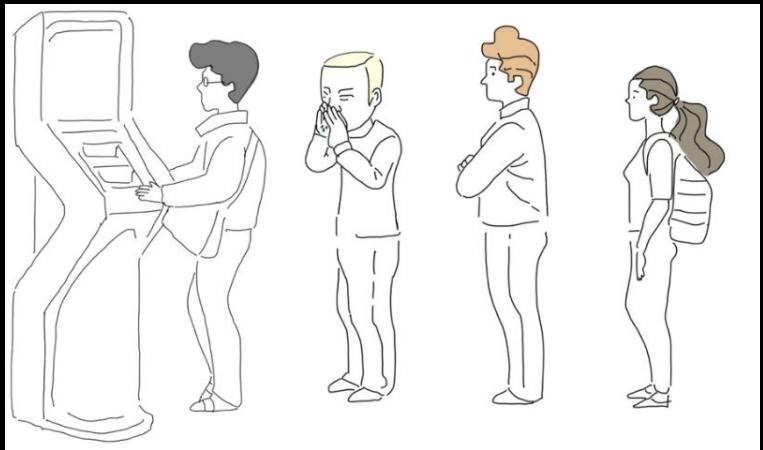
Linda Hirsch, UC Santa Cruz

Mensch und Computer 2025, Chemnitz/Germany

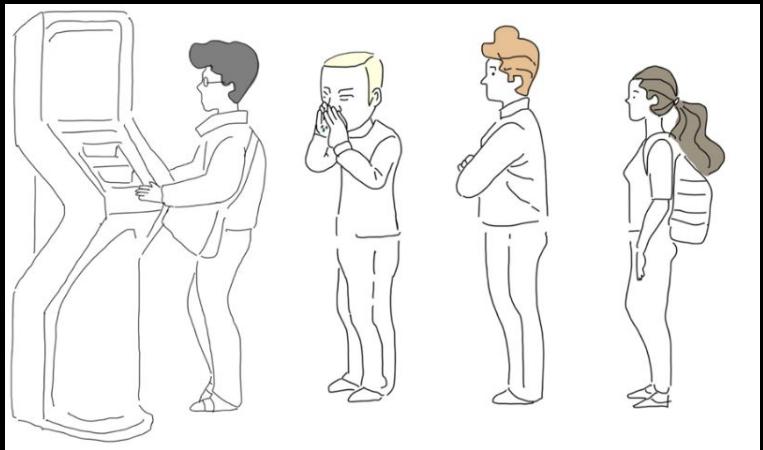


Seem familiar?

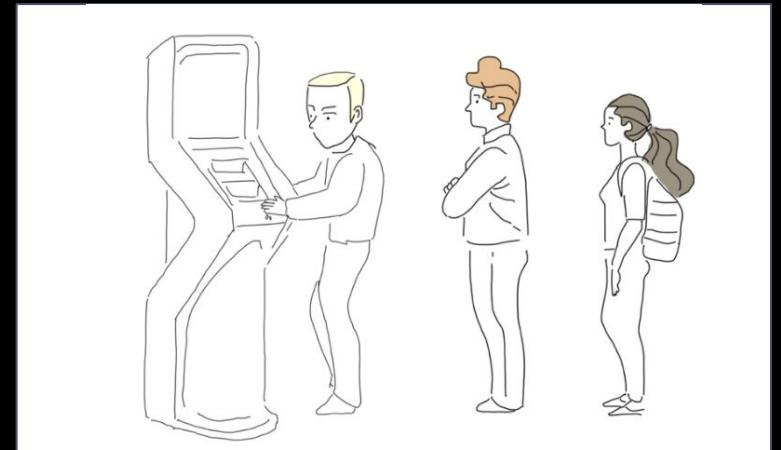
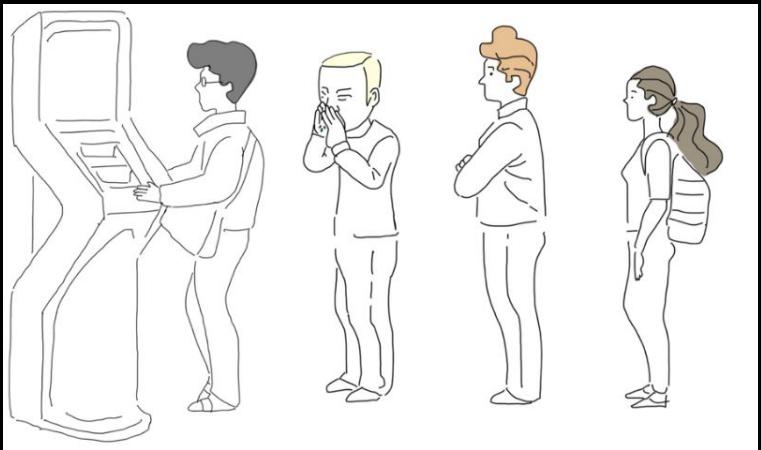
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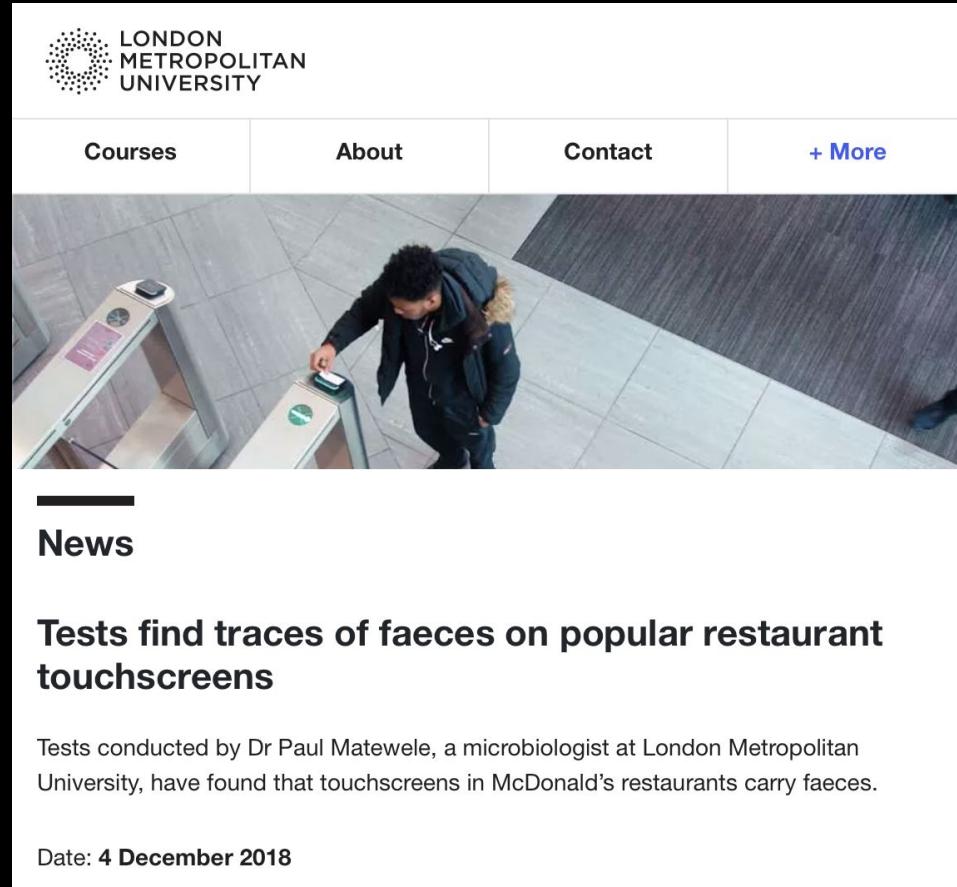
# Seem familiar?



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# Can get even worse!



The image is a screenshot of the London Metropolitan University website. At the top, the university's logo and name are displayed. Below the logo is a navigation bar with links for 'Courses', 'About', 'Contact', and '+ More'. The main content area features a photograph of a person using a touchscreen kiosk. Below the photo, the word 'News' is written in bold. A news article is titled 'Tests find traces of faeces on popular restaurant touchscreens'. The article's text states: 'Tests conducted by Dr Paul Matewele, a microbiologist at London Metropolitan University, have found that touchscreens in McDonald's restaurants carry faeces.' At the bottom of the news block, the date 'Date: 4 December 2018' is printed.

LONDON  
METROPOLITAN  
UNIVERSITY

Courses     About     Contact     + More

News

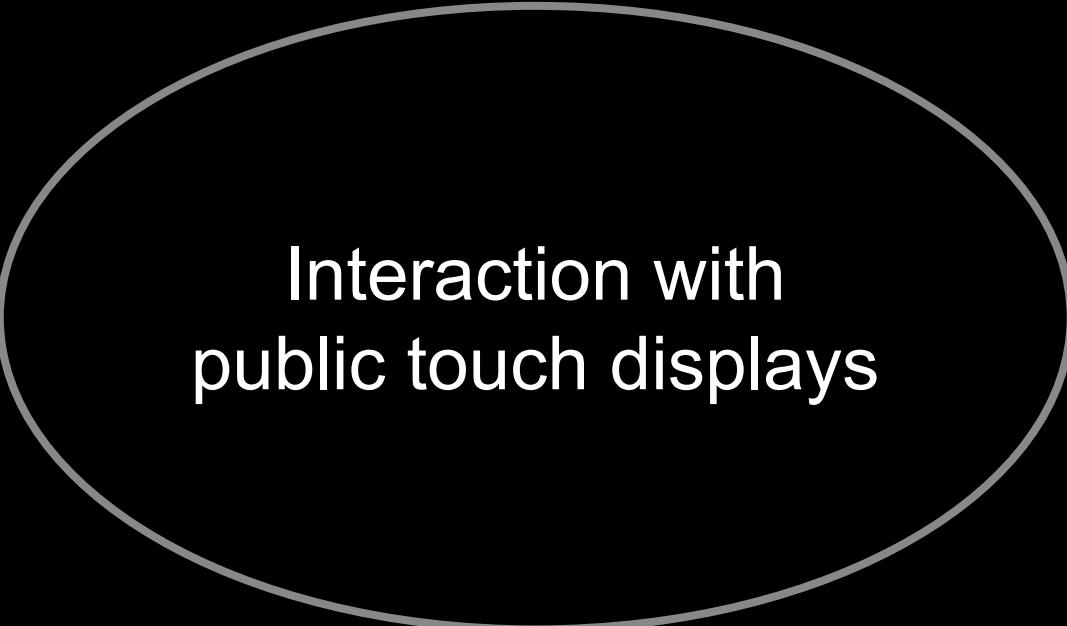
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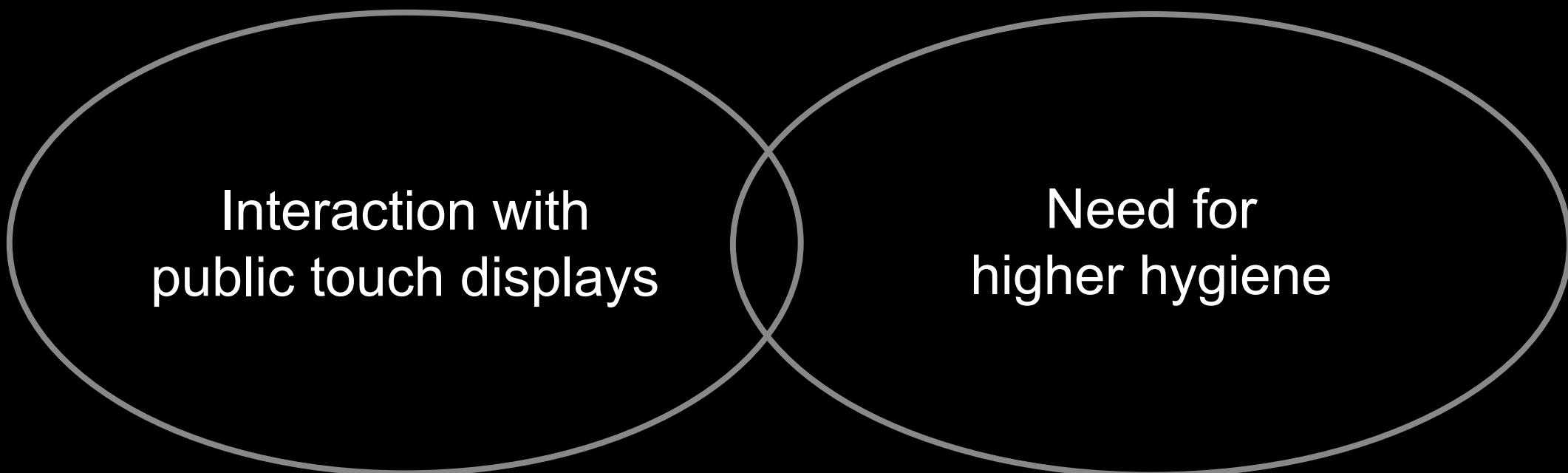
# Large Scale Problem

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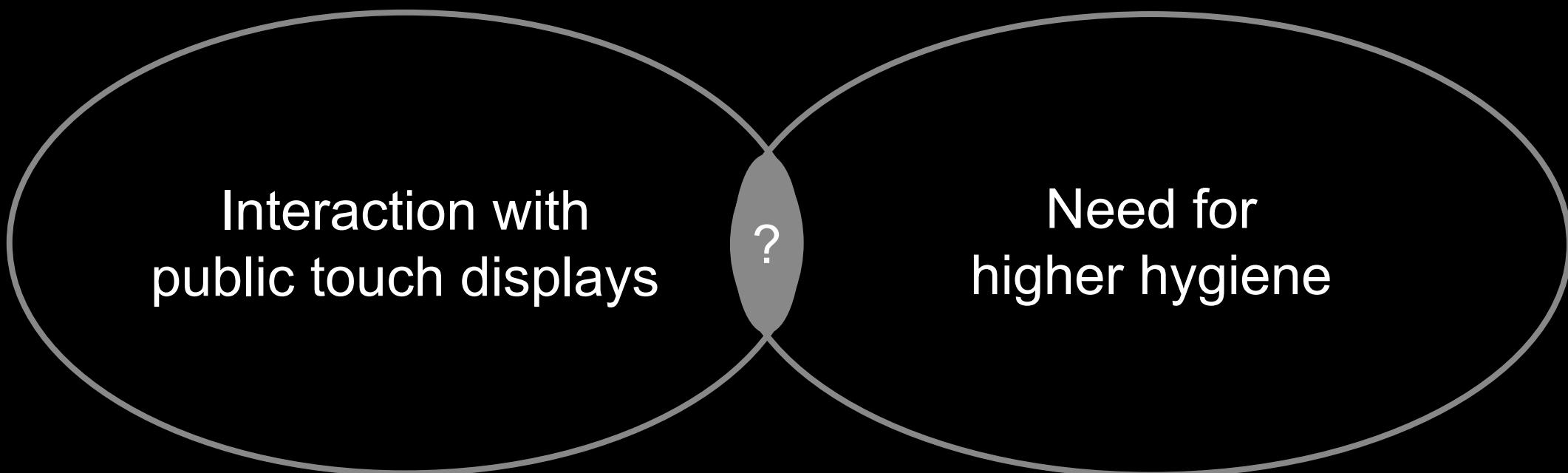


Interaction with  
public touch displays

# Large Scale Problem

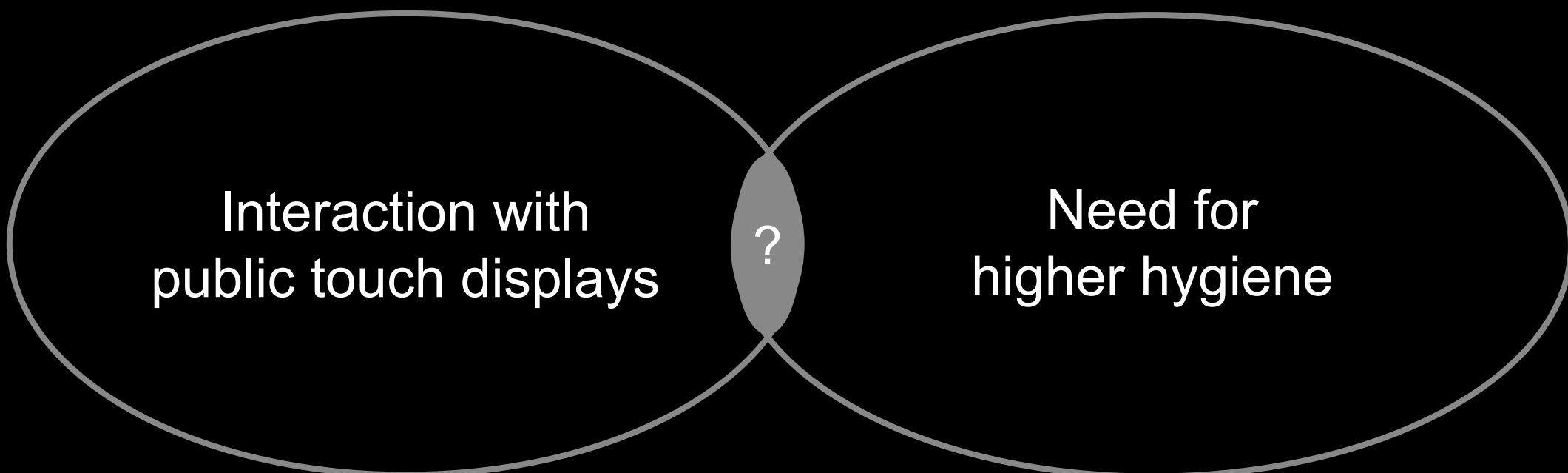


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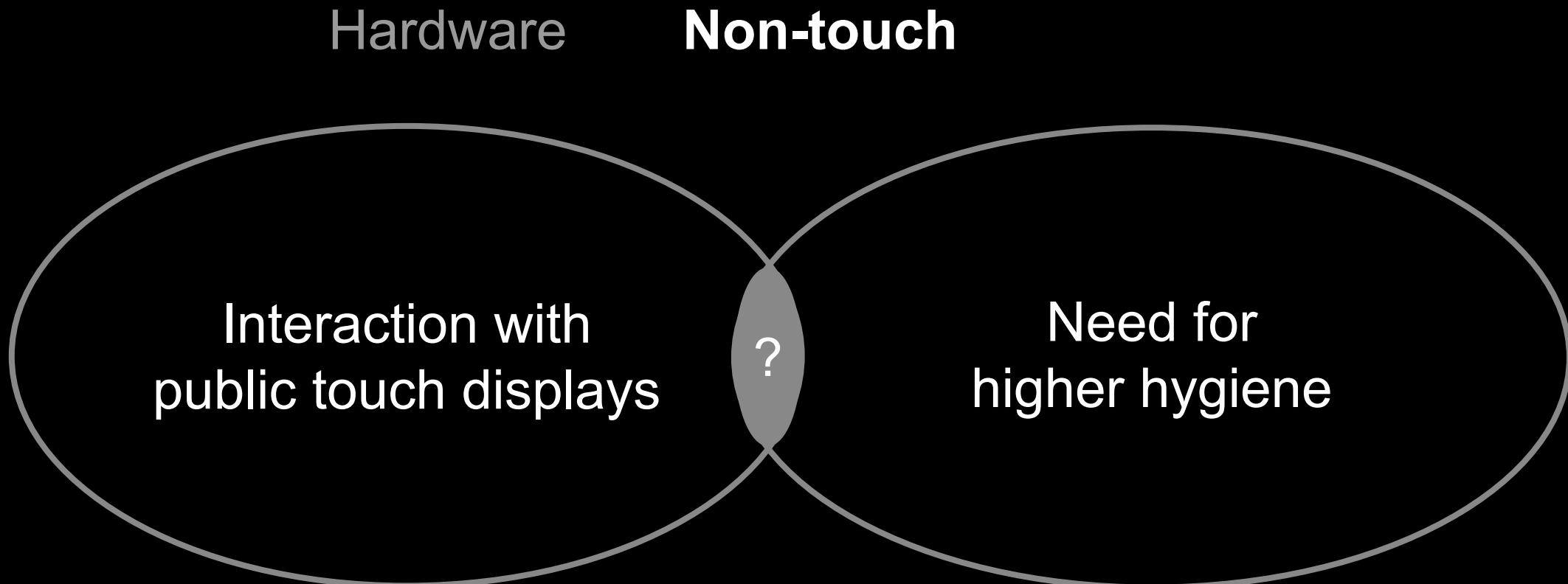


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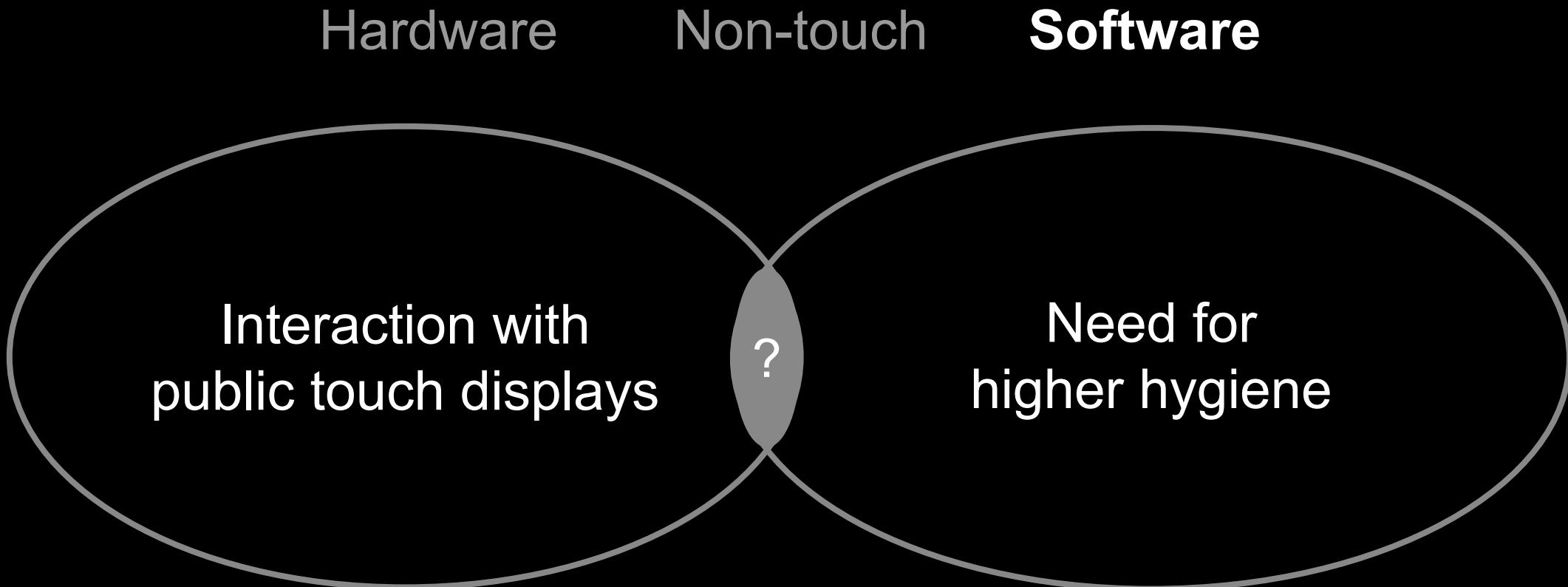
## Hardware



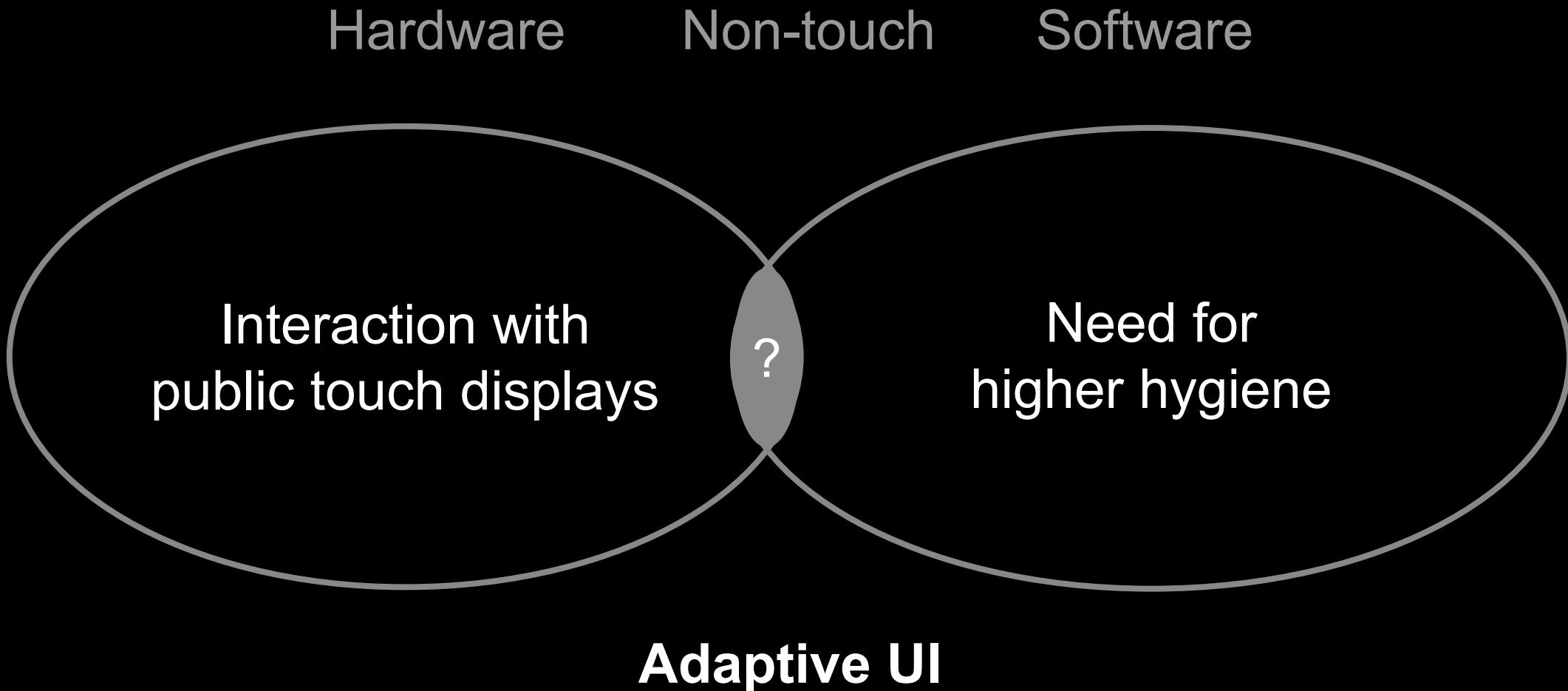
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RQ1

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RQ2

*How do the interface adaptations impact the perceived usability?*

# Concept: *GUI Rearrangement*

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(UI, Prev' Users Touch)

Rearrangement

UI'

# Concept: *GUI Rearrangement*

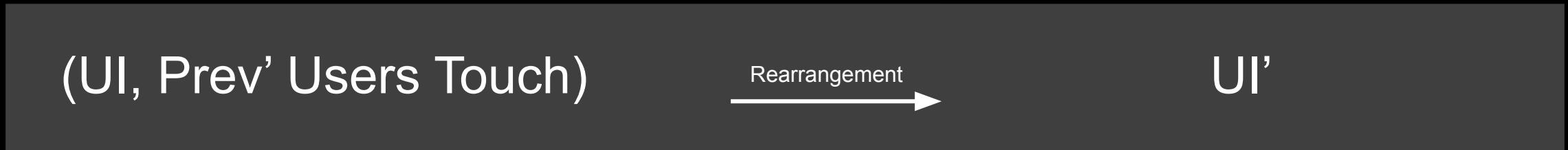
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Rearrangement



UI'

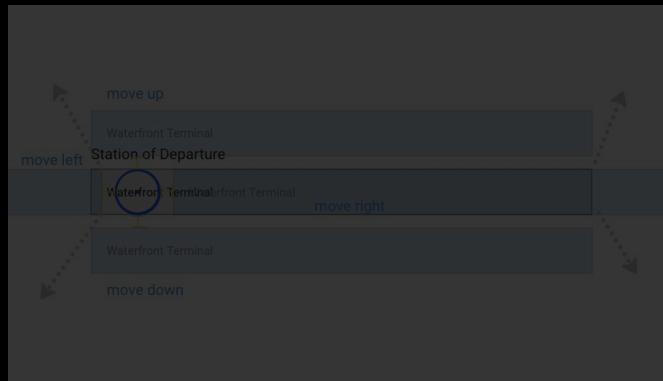
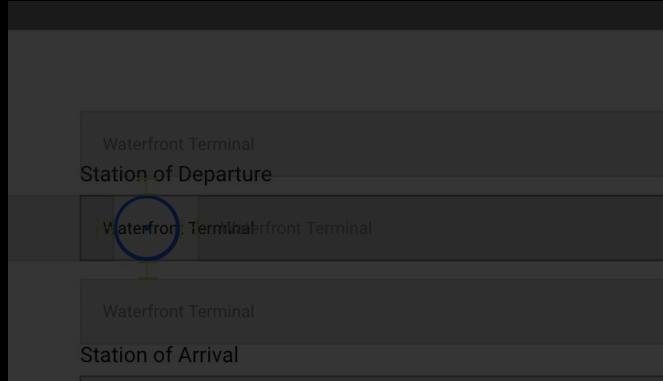
# Concept: *GUI Rearrangement*



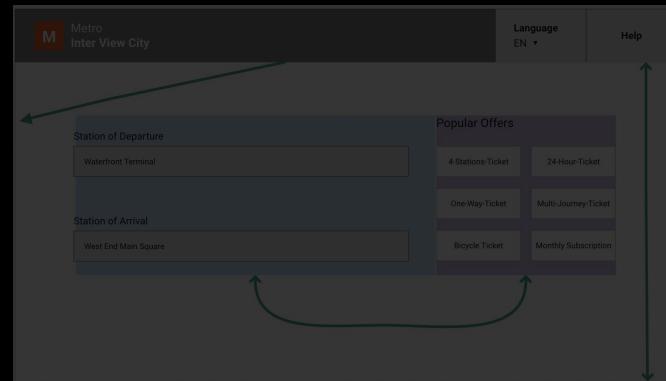
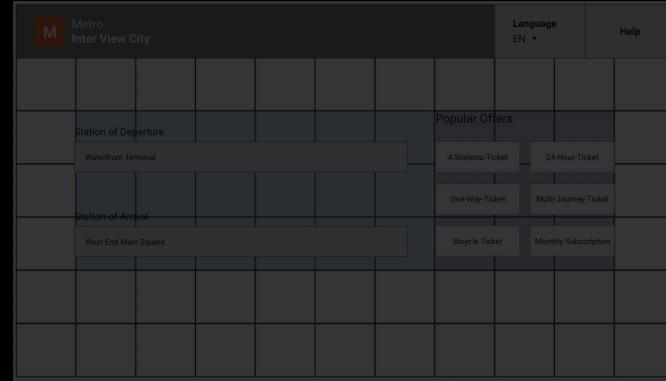
- Different users tap buttons in different places
- Reduces Touch Overlap
- Increased interaction hygiene?

# Rearrangement Strategies

Raindrop



Rule-based

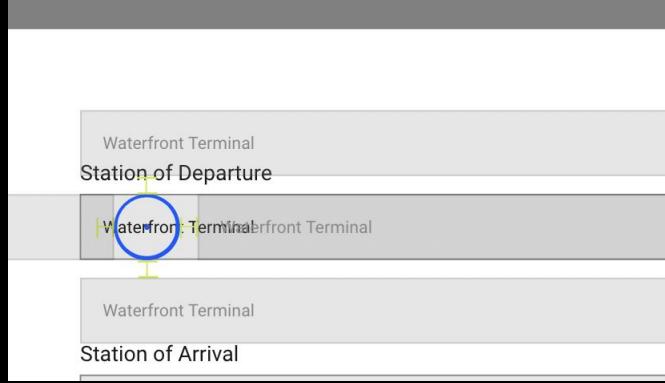


Priority-based



# Rearrangement Strategies

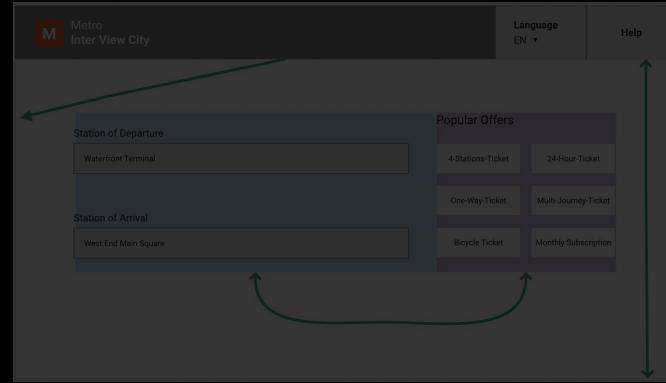
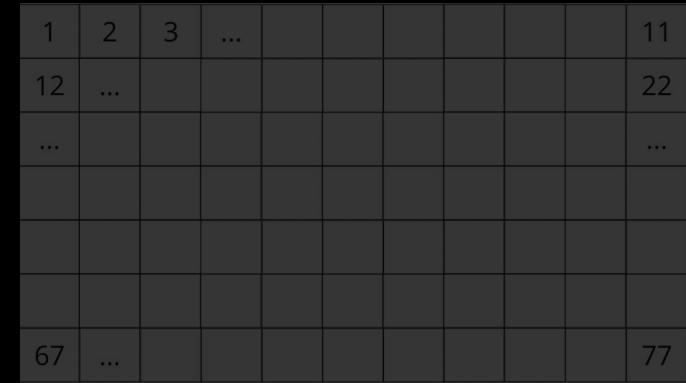
## Raindrop



## Rule-based

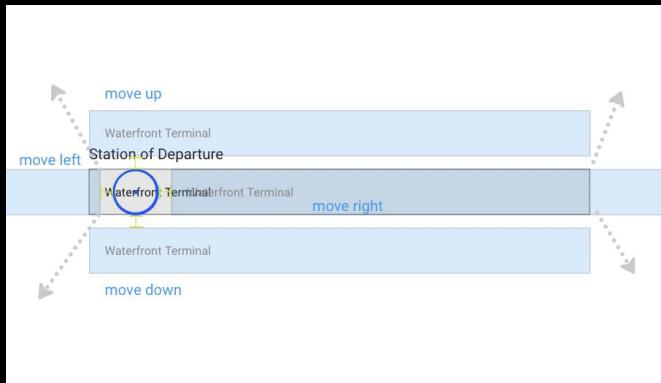
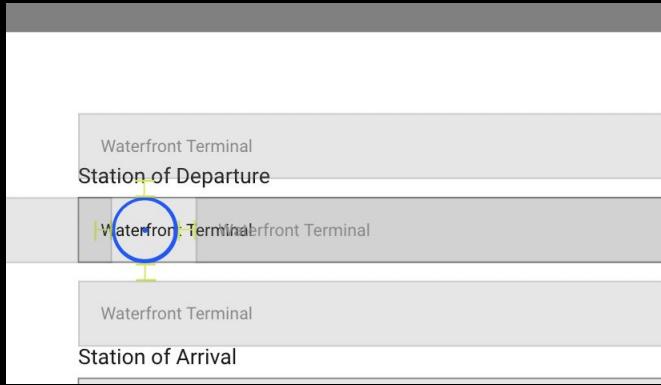


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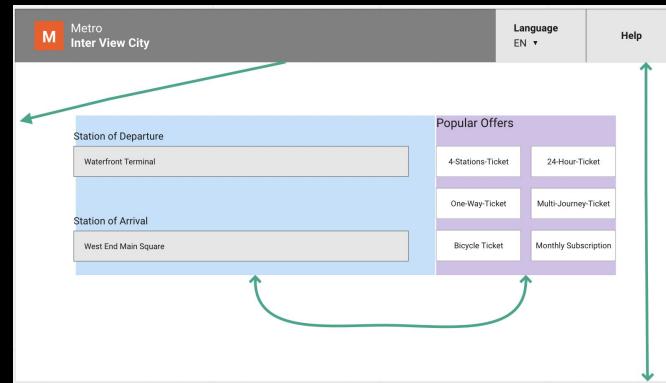
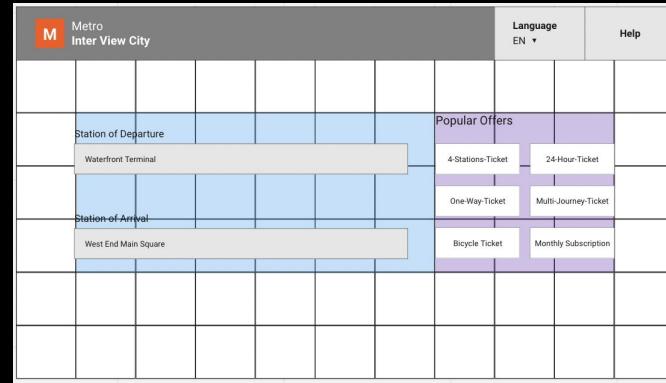


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## Raindrop



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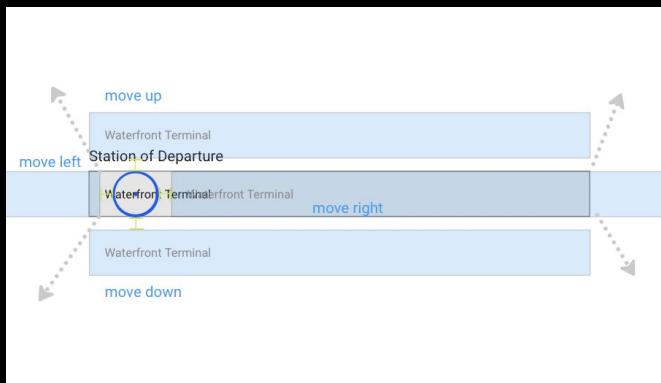
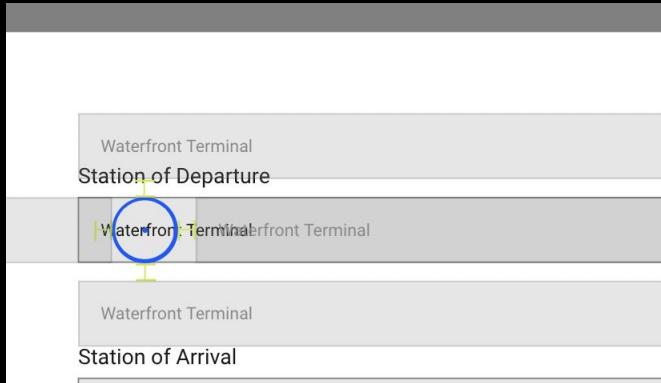


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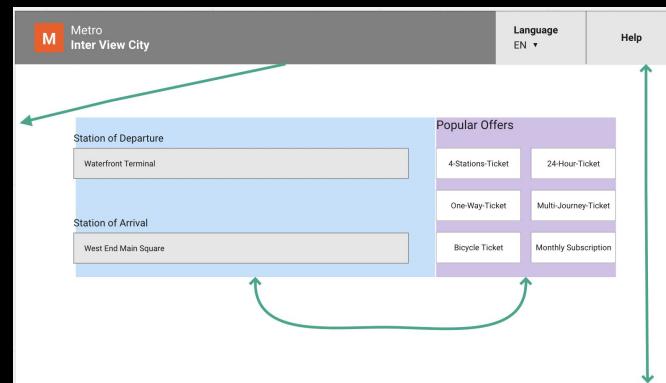
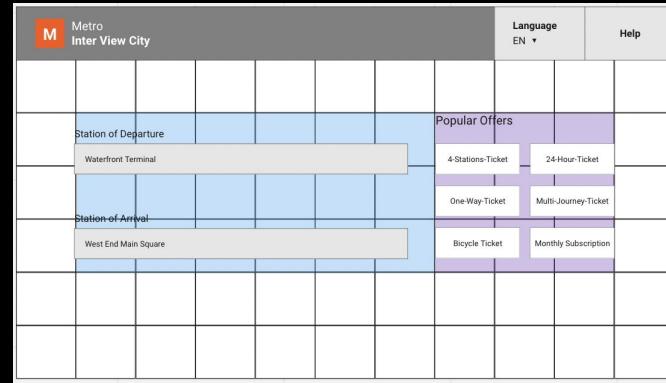


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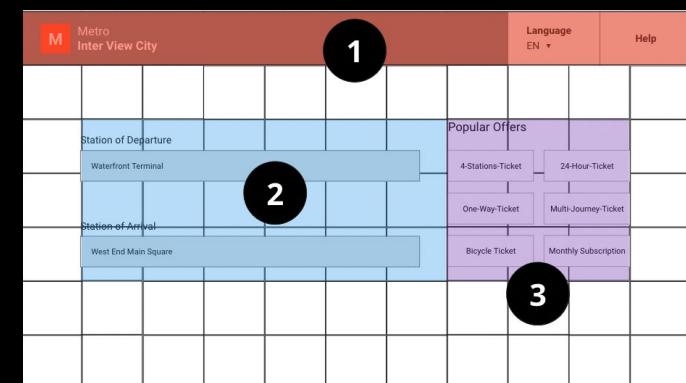
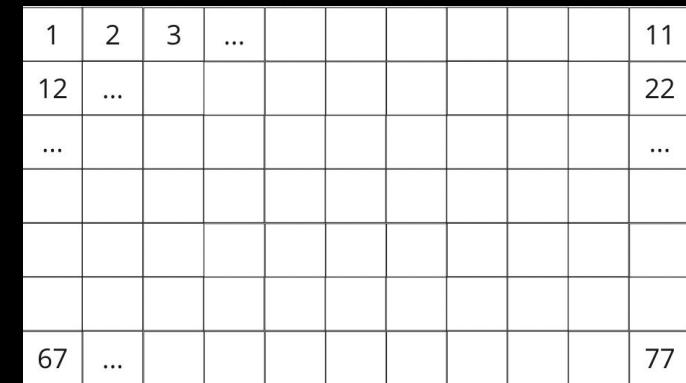
## Raindrop



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# HCI Expert Interviews

## Setup

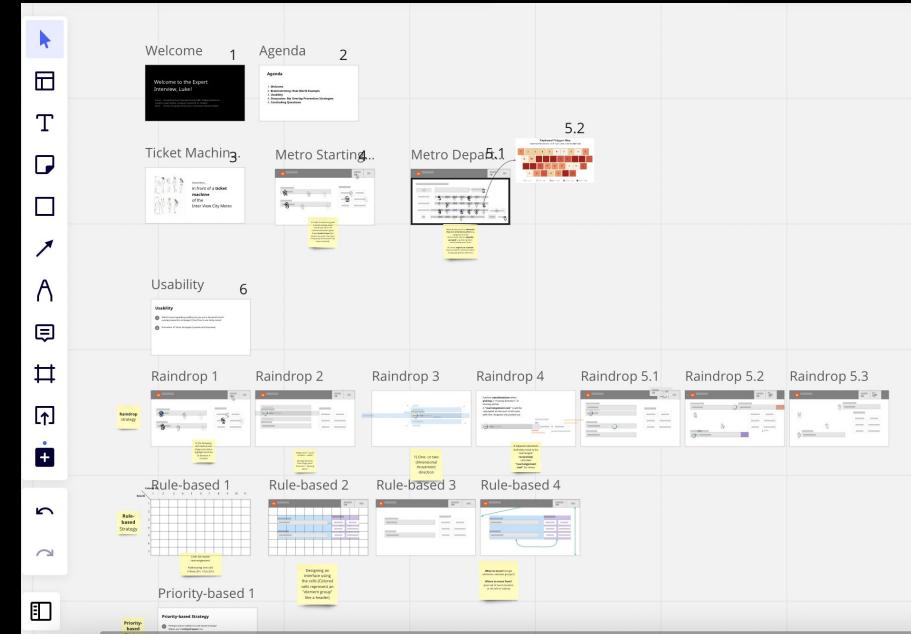
- 30–40 min 1:1 video interviews
- Remotely with collab whiteboard
- Public touch scenario, simplified UI

## Goal

- Brainstorm further touch overlap reduction strategies
- Collect feedback on our three strategies
- Focus: Usability, limitations, alignment with common heuristics

## Participants

- Four experts, all with a PhD
- Extensive HCI experience (8.5–20 years)
- Expertise in Public Displays or Adaptive UI



Collaborative whiteboard setup, Miro

# HCI Expert Interviews

Preferred Rearrangement Strategy: Rule-based

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Clear(-er) implementation

# Study Design

## Methodology

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Lab Setup for Study

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- Exploratory, within-subjects, mixed-methods lab study (N=26)
- Snack and Drink machine UI on an Acer T232HL touch display
- Six experimental conditions



Lab Setup for Study

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Participants (N=26)

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- All familiar with public displays & touch interaction
- Most used public displays at least weekly (14/26)

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- Layout condition
  - Rearranged Vertically (RV)
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  - Baseline
- Traces Condition
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### Dependent variables

- Average Task Completion Time
- Perceived Usability Score
  - Hedonic TAM, 7-point Likert scale

# Study Design

## Procedure

# Study Design

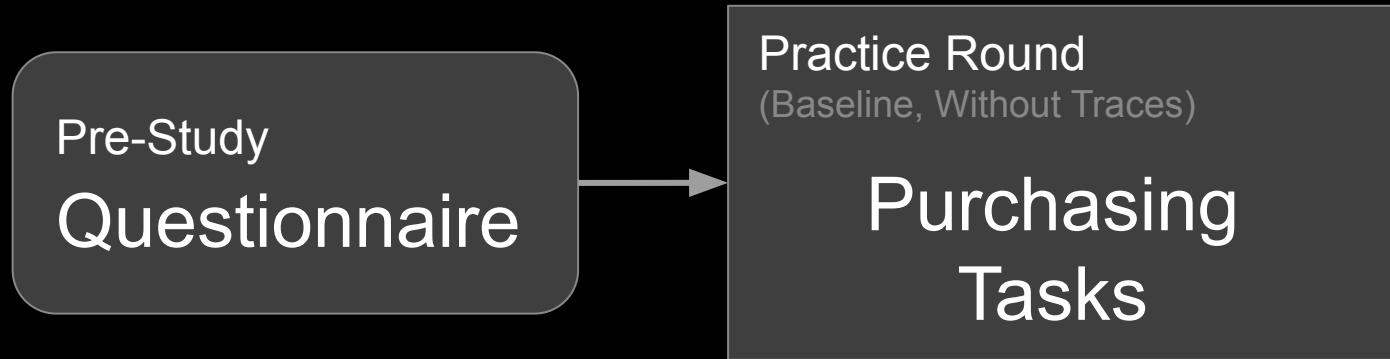
## Procedure

Pre-Study

Questionnaire

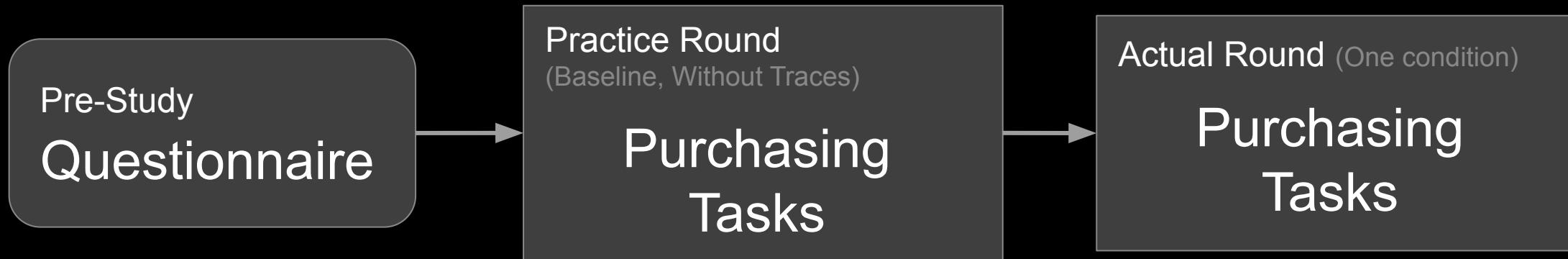
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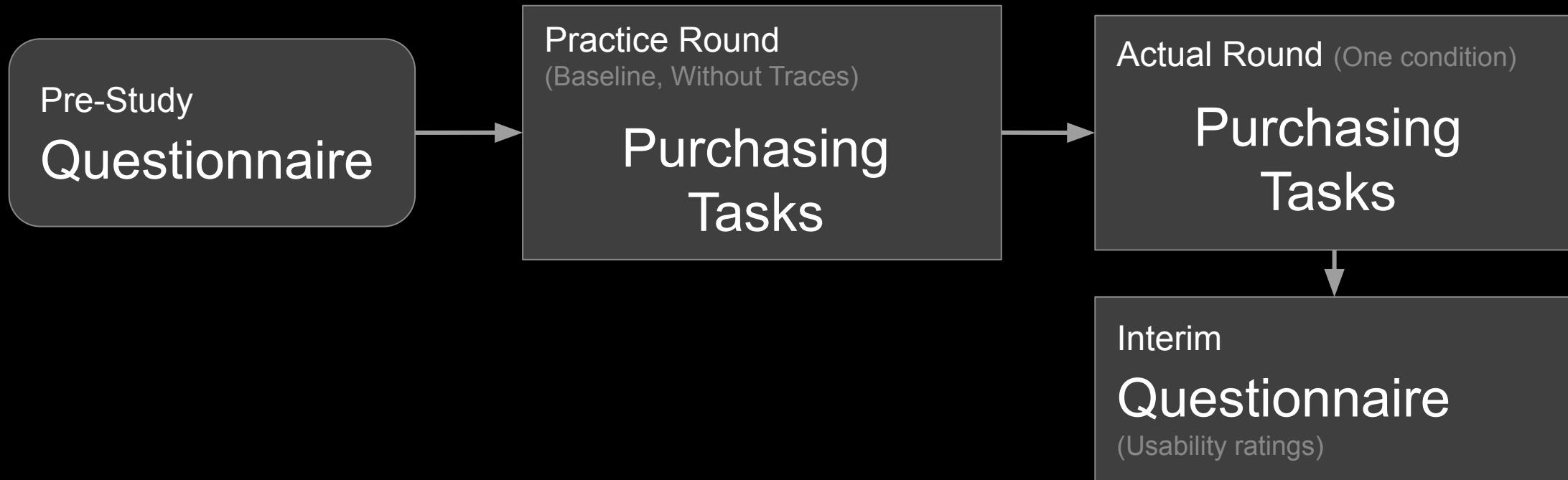
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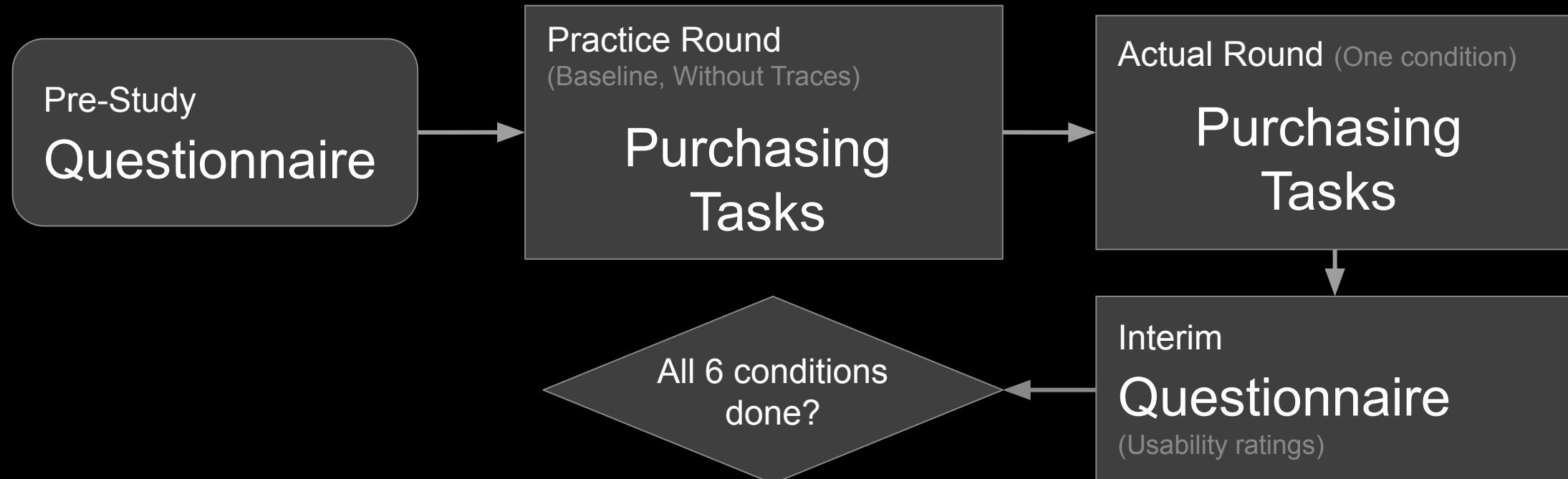
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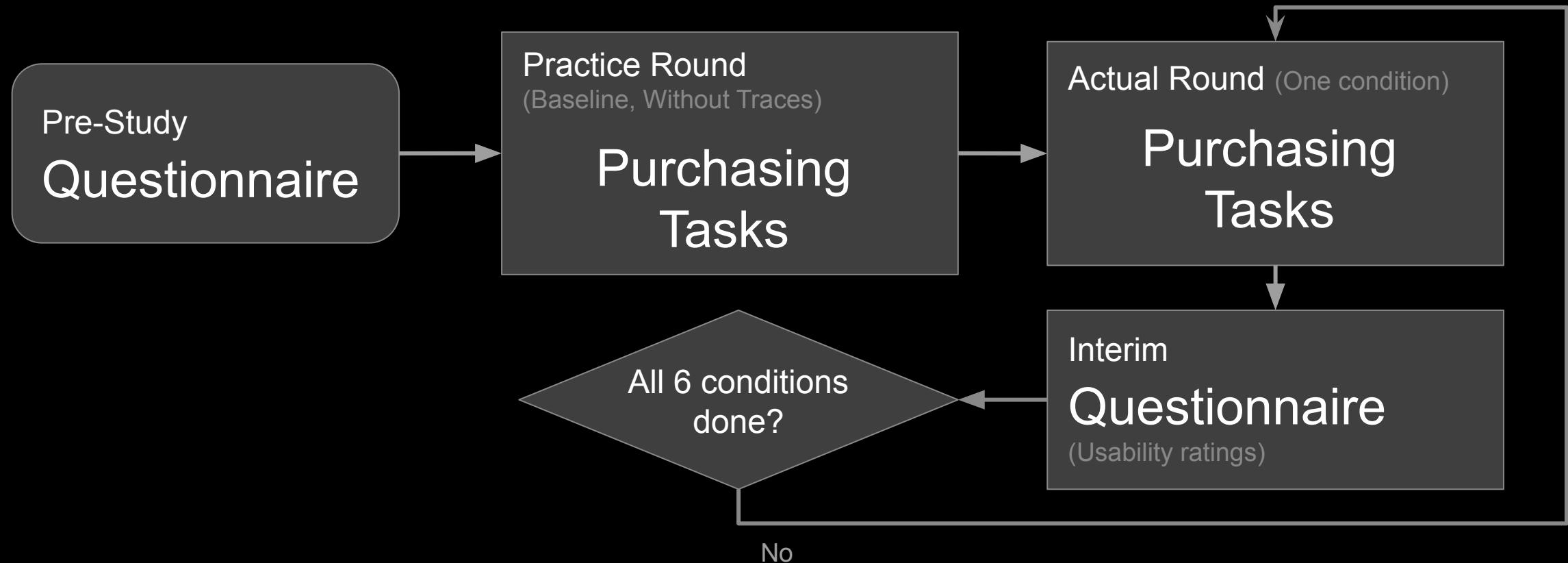
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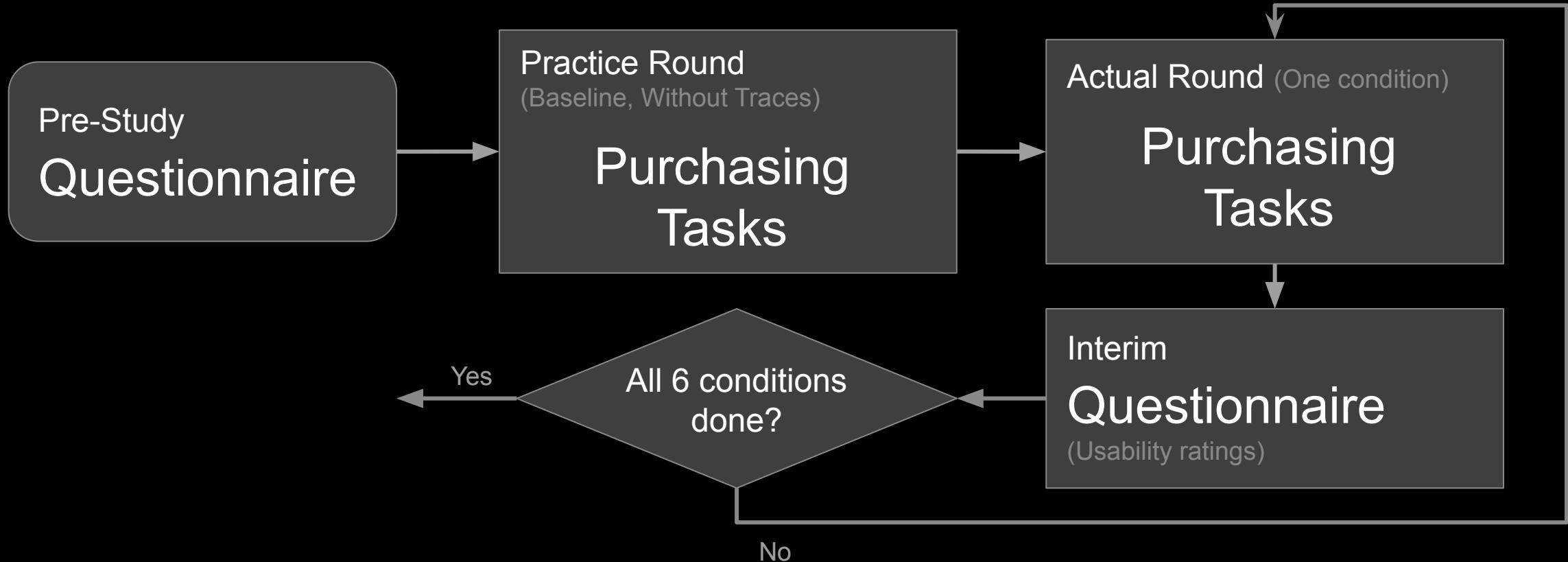
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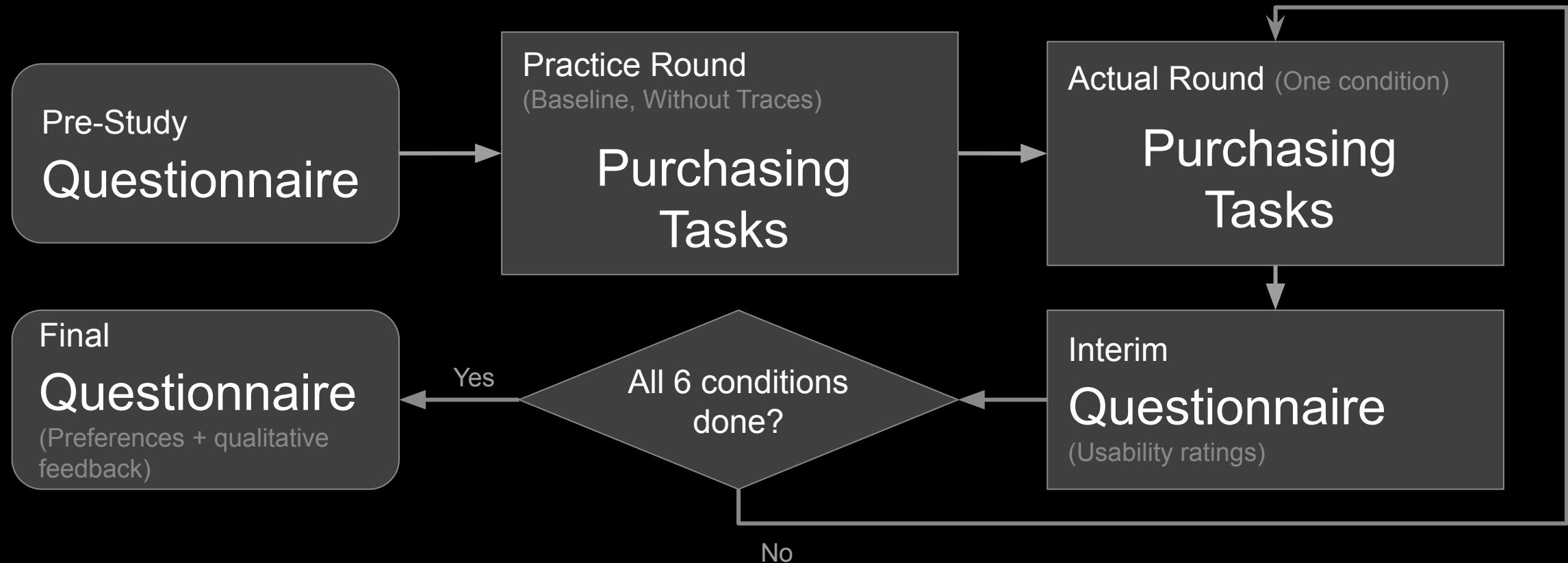
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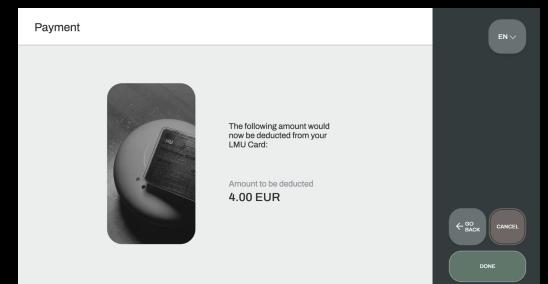
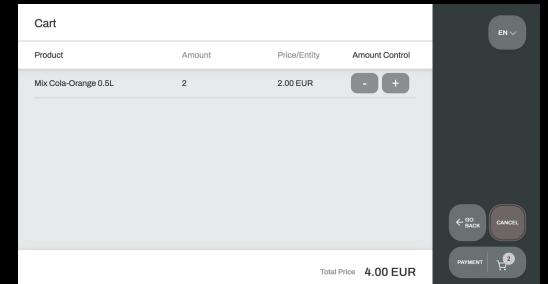
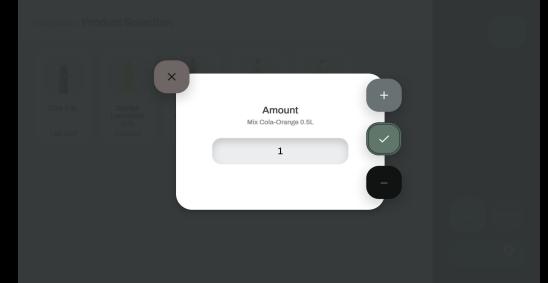
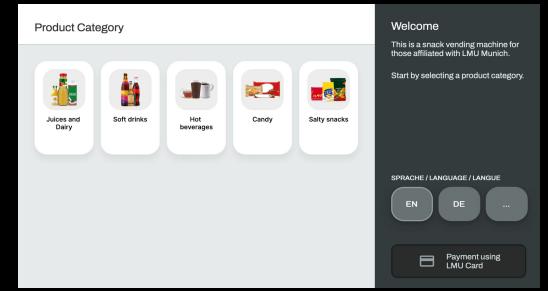
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# Study Prototype

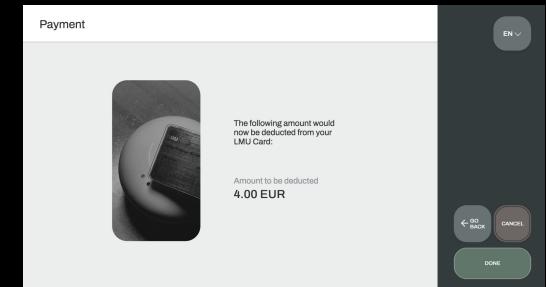
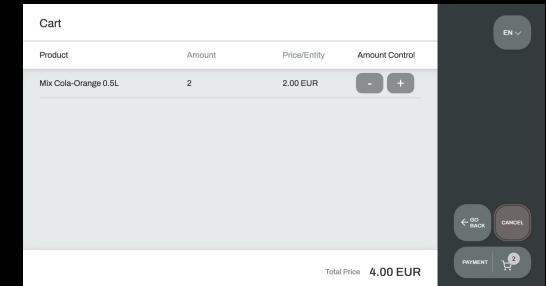
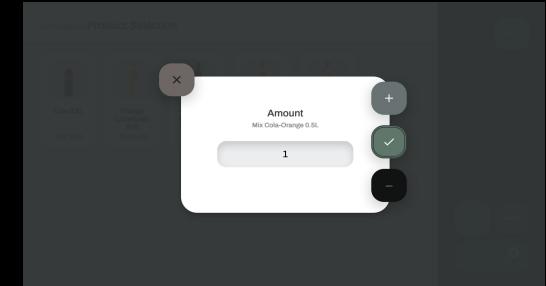
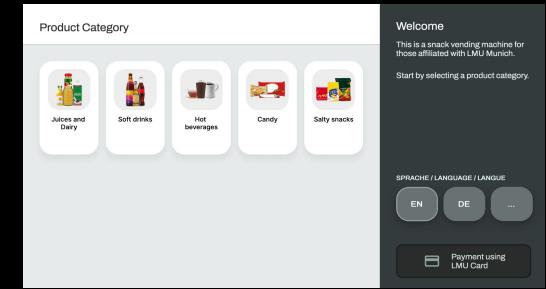
## Baseline Layout of UI (Control)



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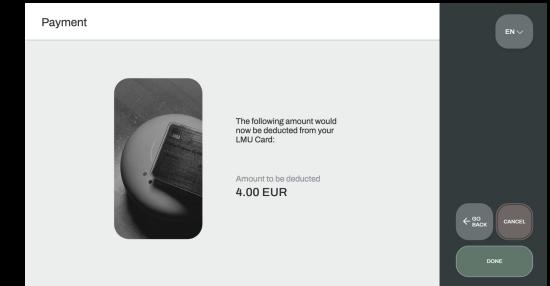
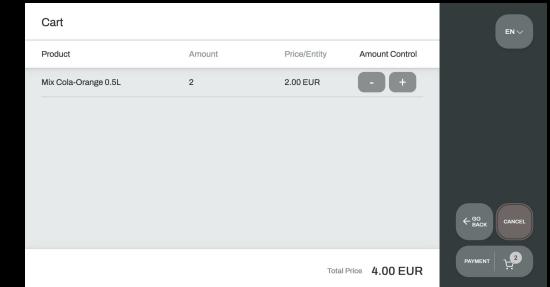
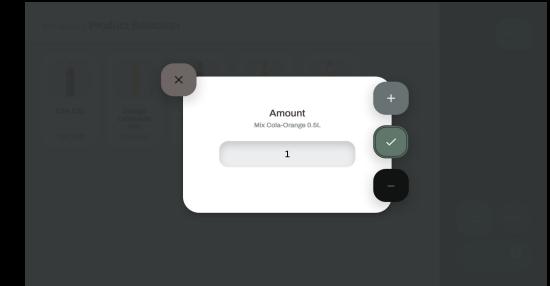
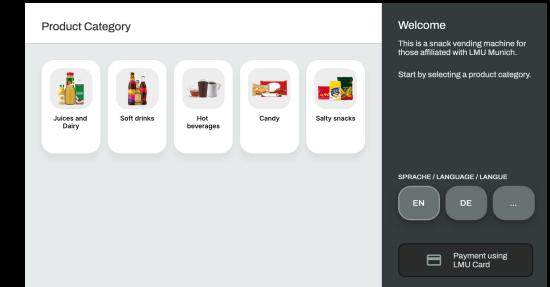
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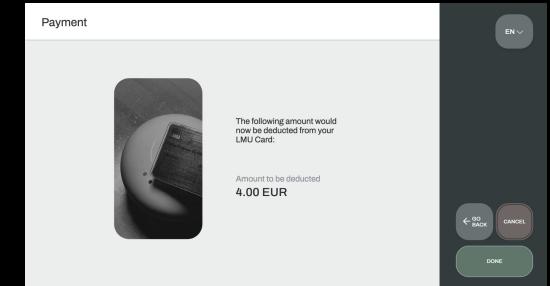
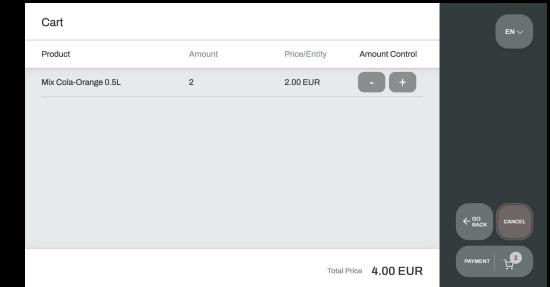
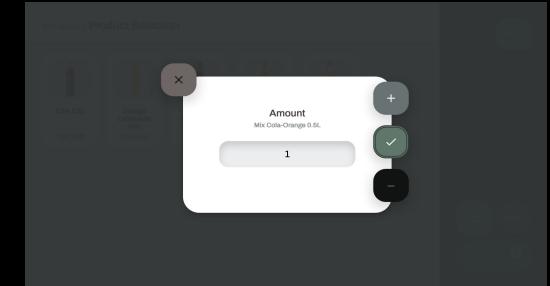
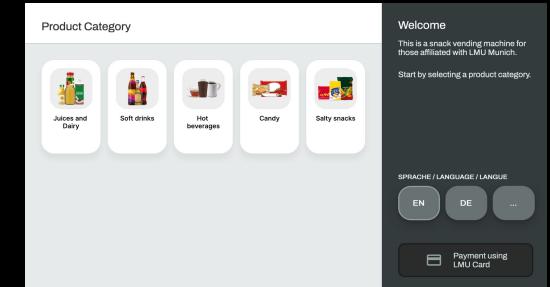
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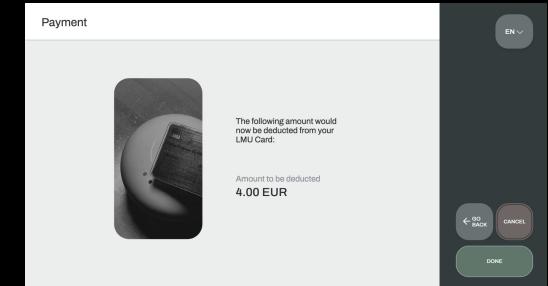
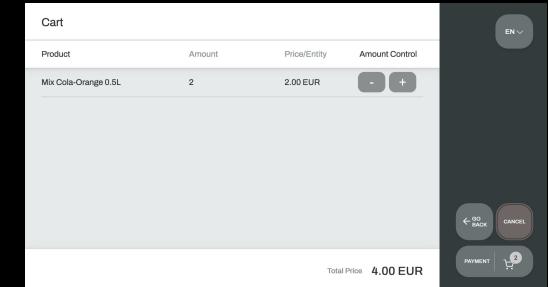
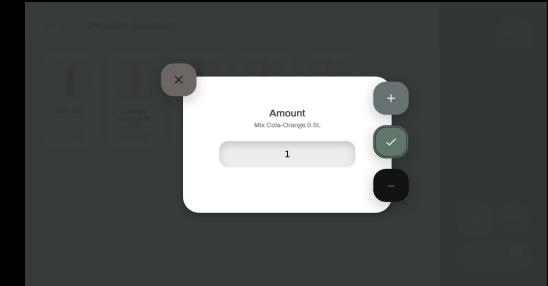
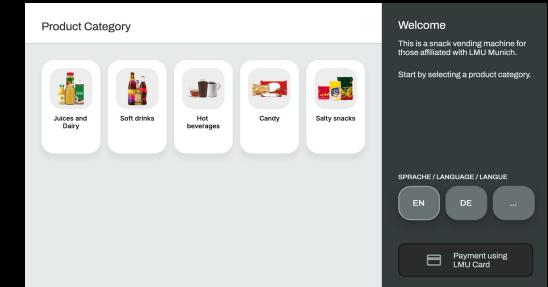
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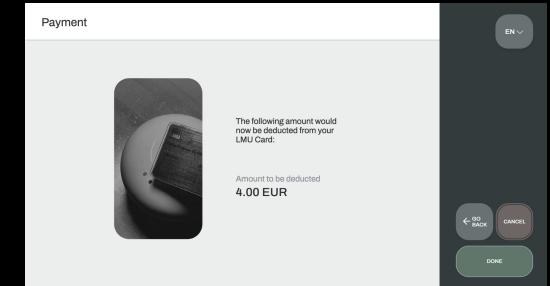
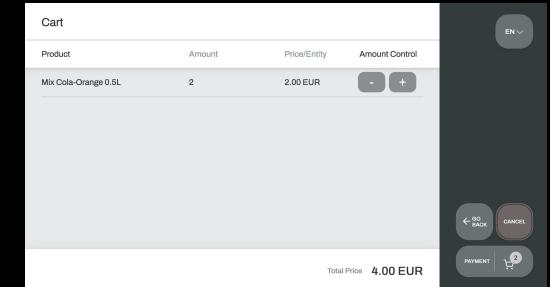
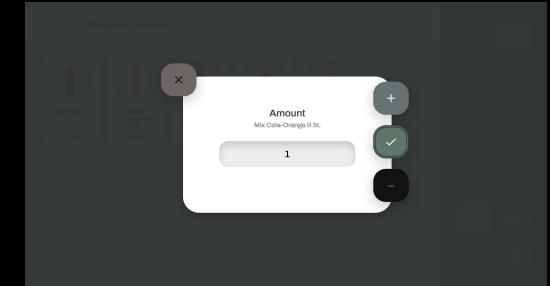
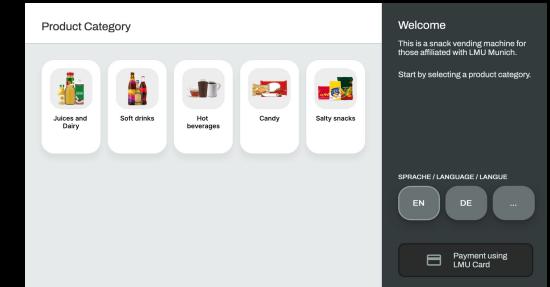
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  - Elements differentiated by shape/size
- Implemented via ReactJS (MVC-Architecture)



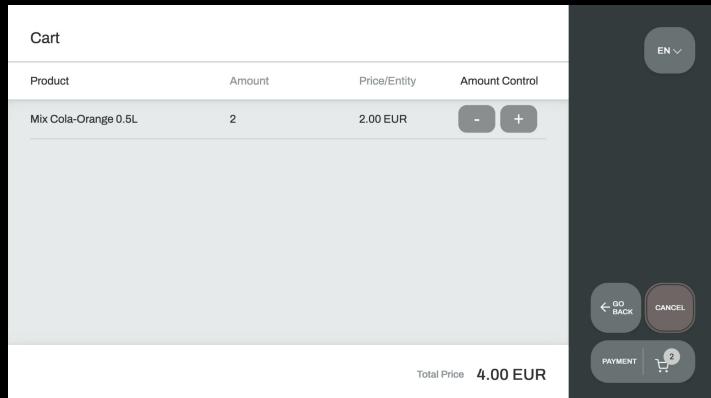
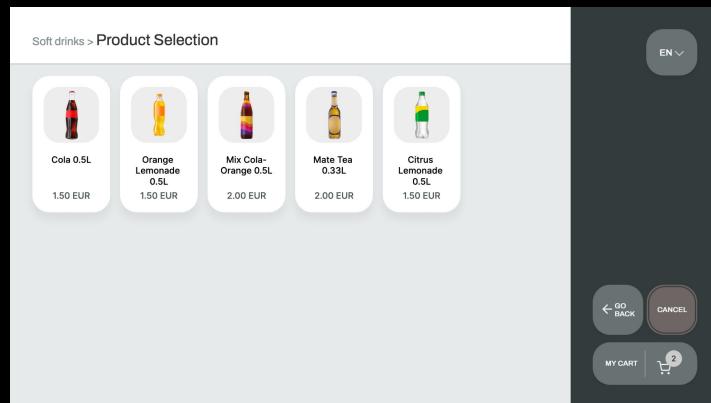
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How Rule-based Rearrangement Works

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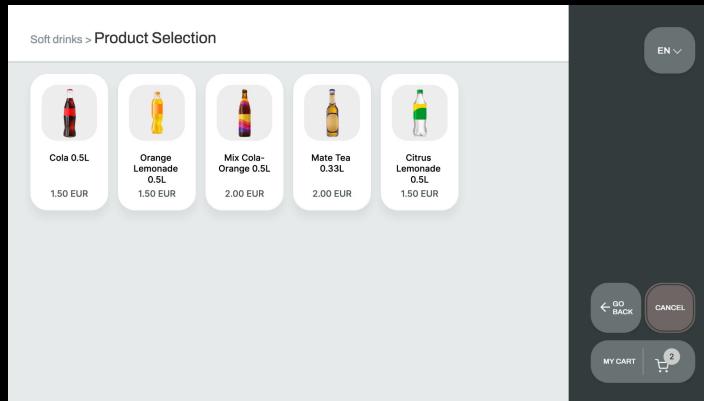
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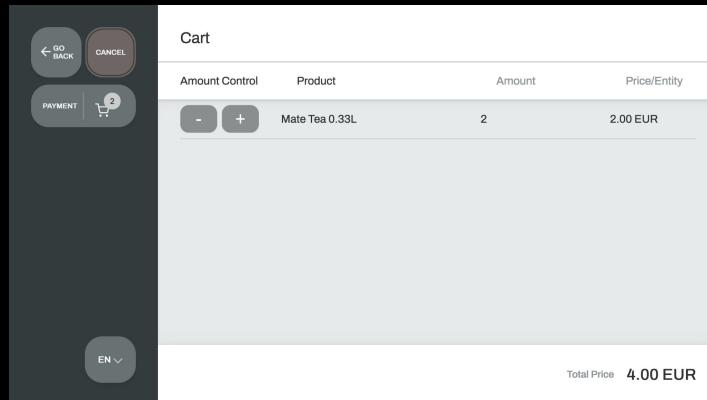
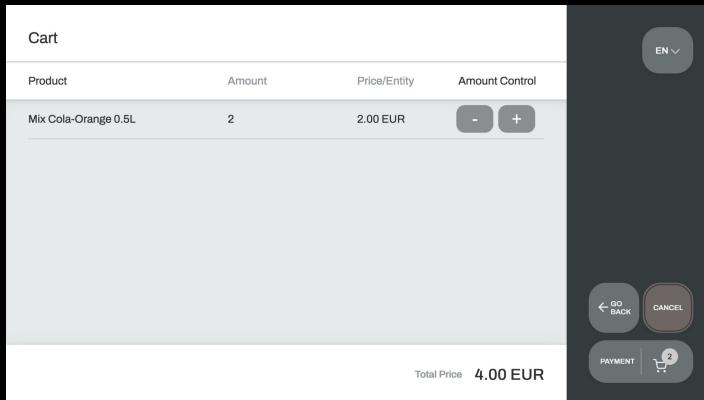
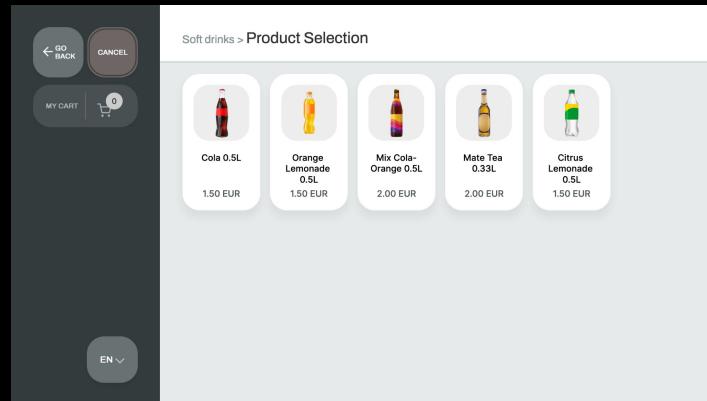
# Study Prototype

## How Rule-based Rearrangement Works

Baseline



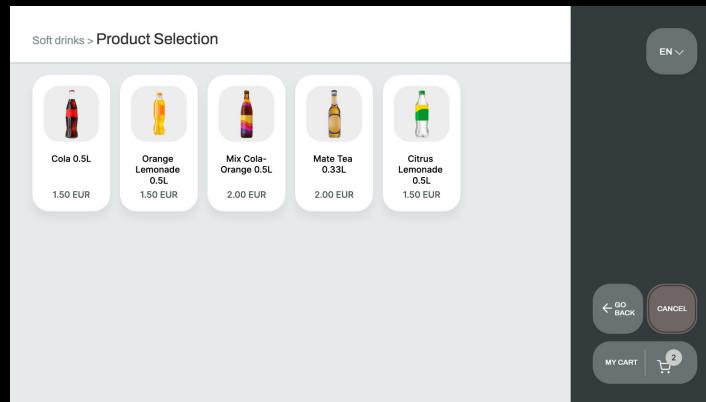
Rearranged Horizontally



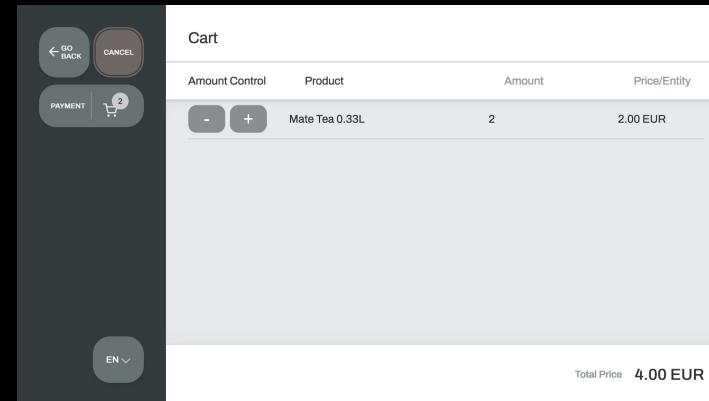
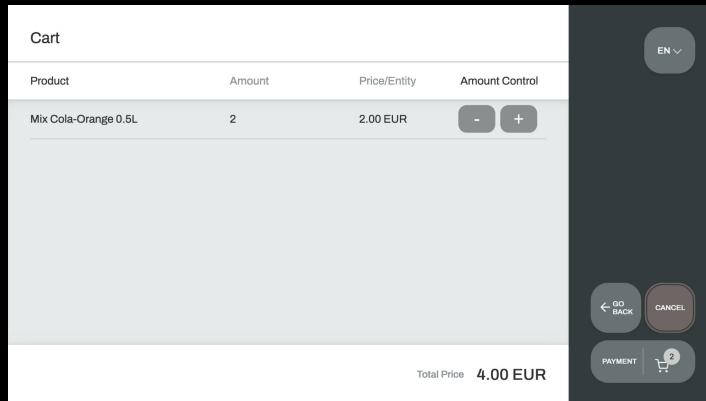
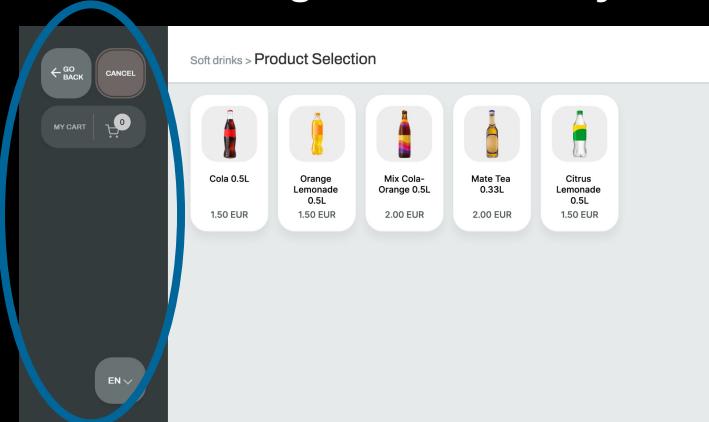
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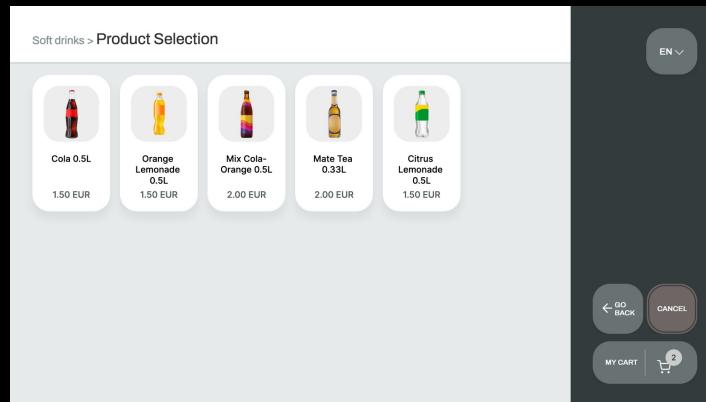
Rearranged Horizontally



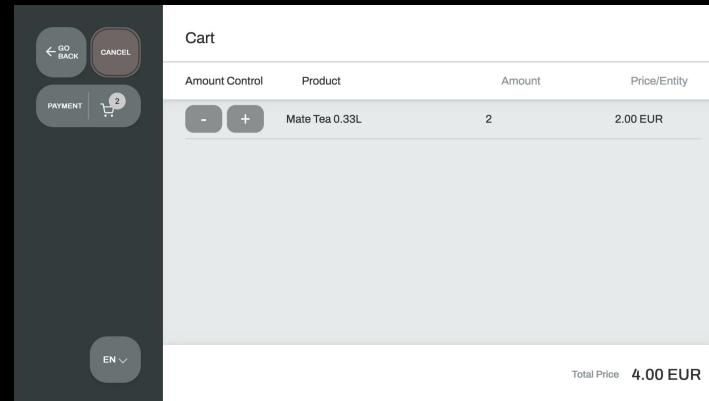
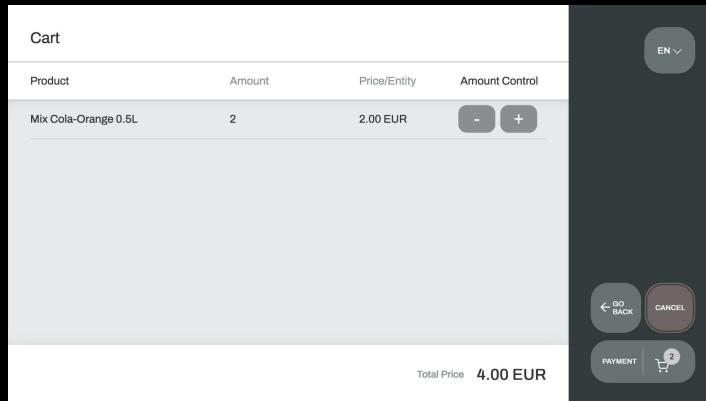
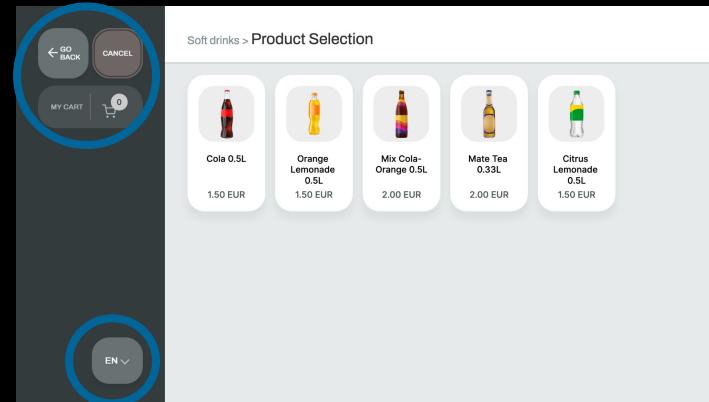
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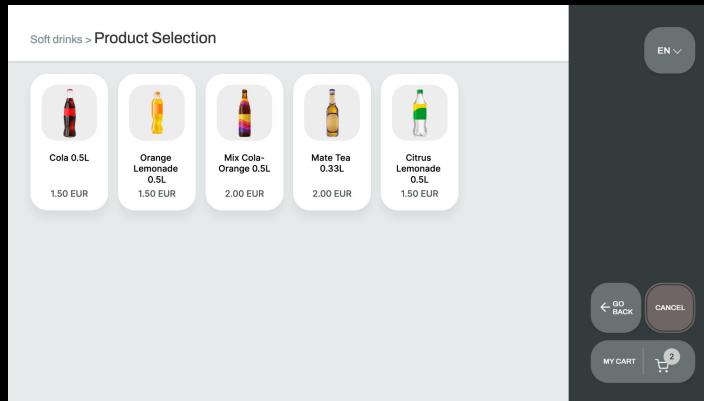
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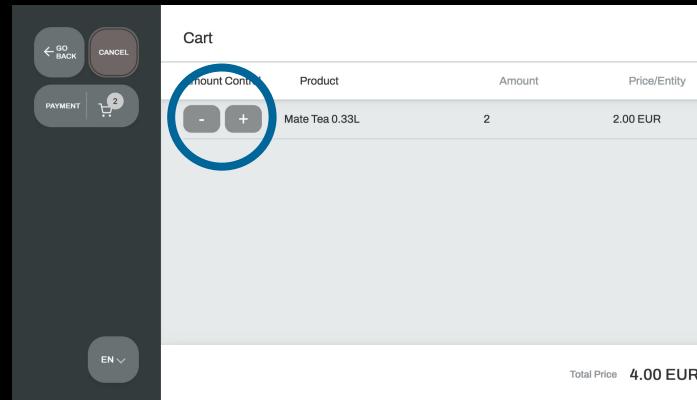
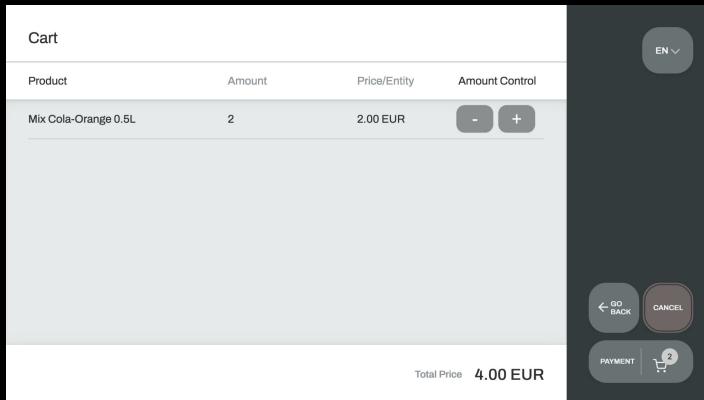
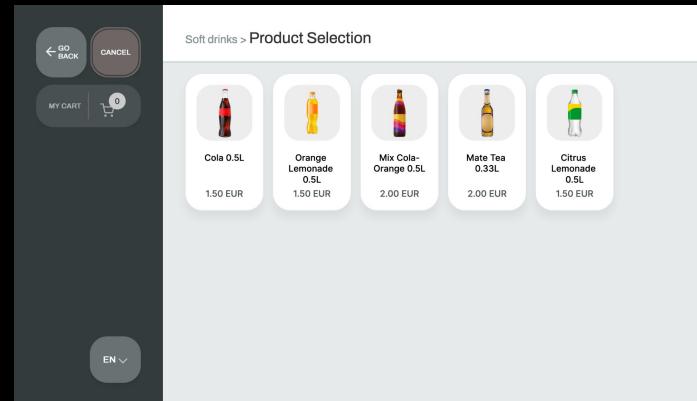
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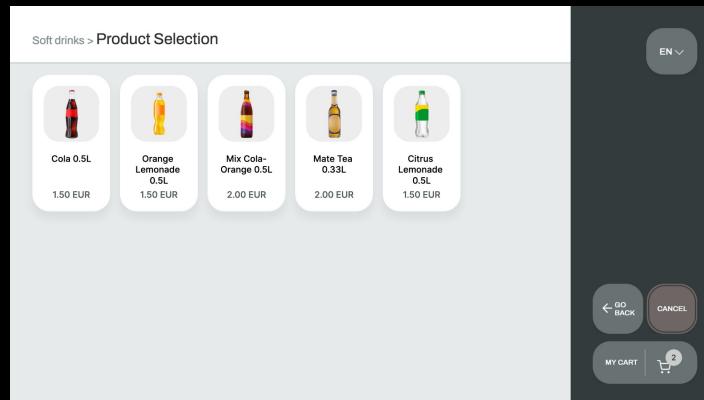
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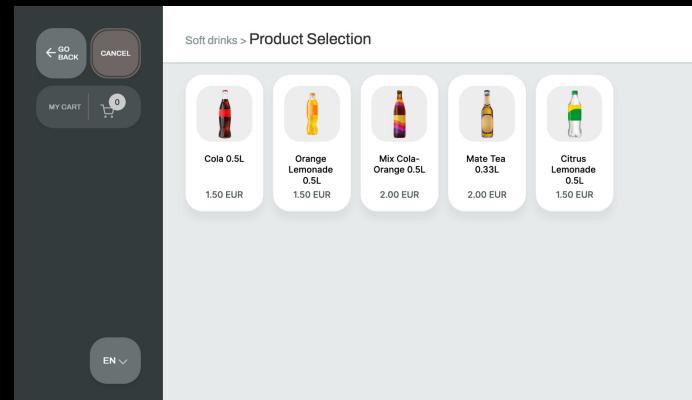
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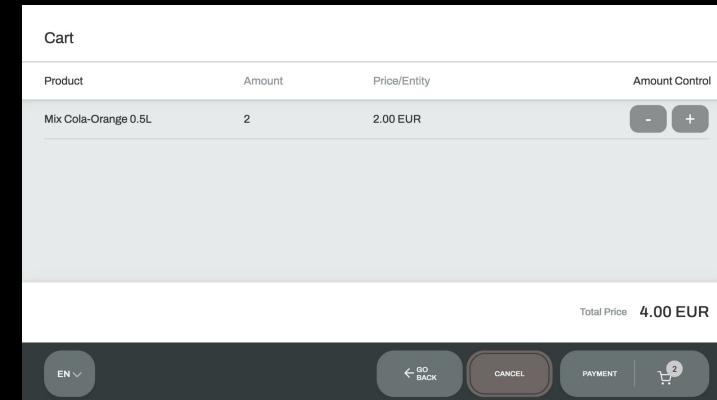
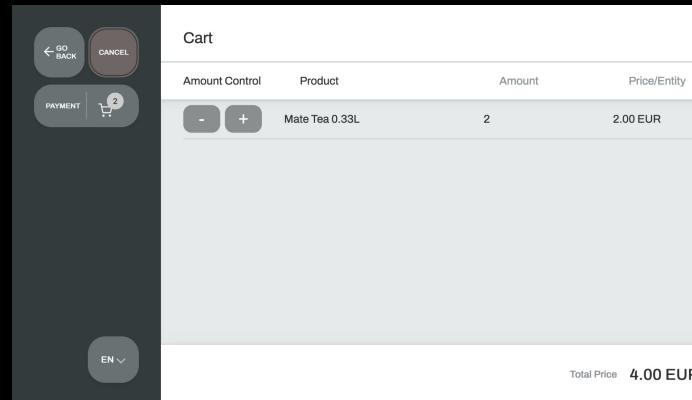
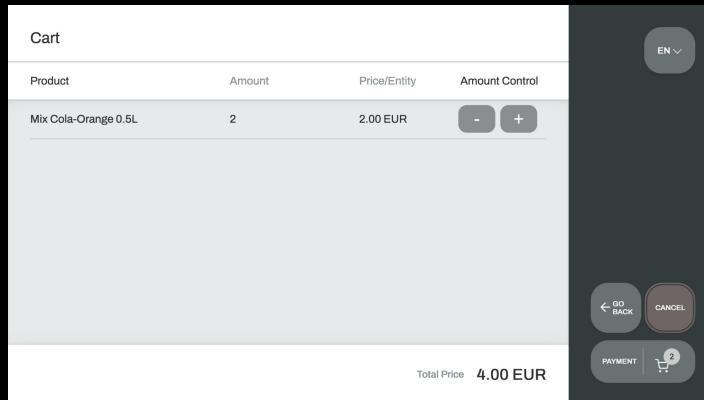
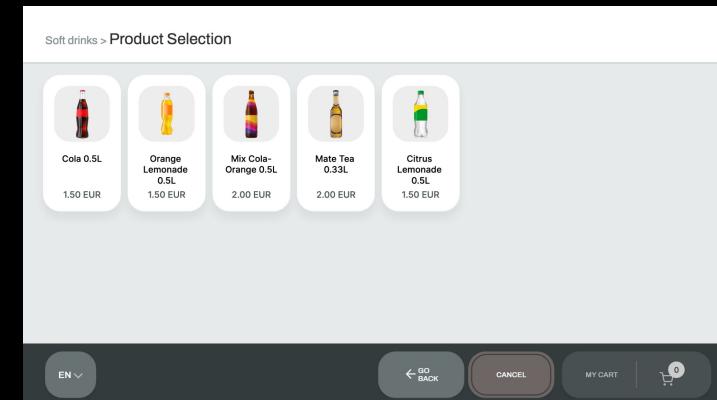
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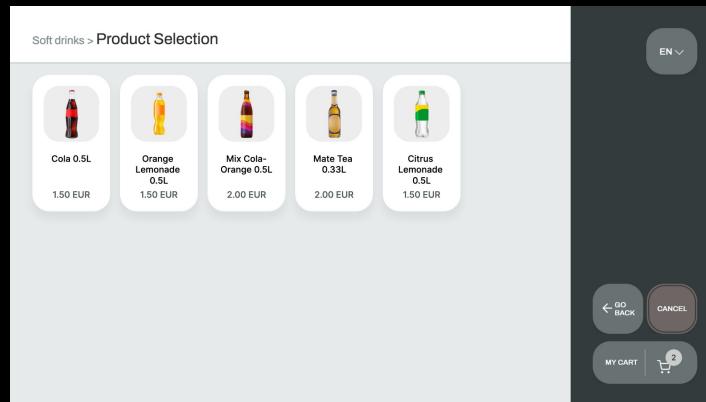
Rearranged Vertically



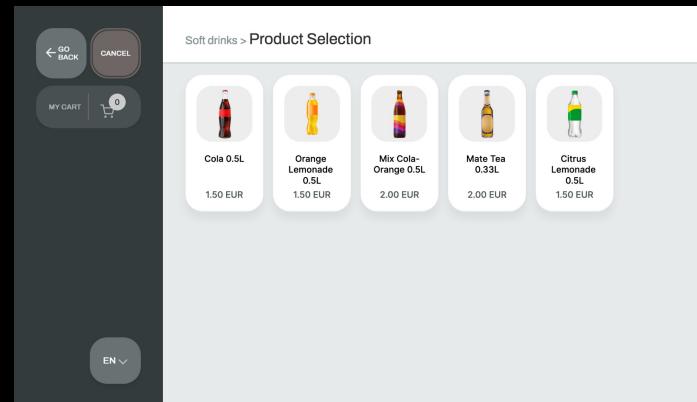
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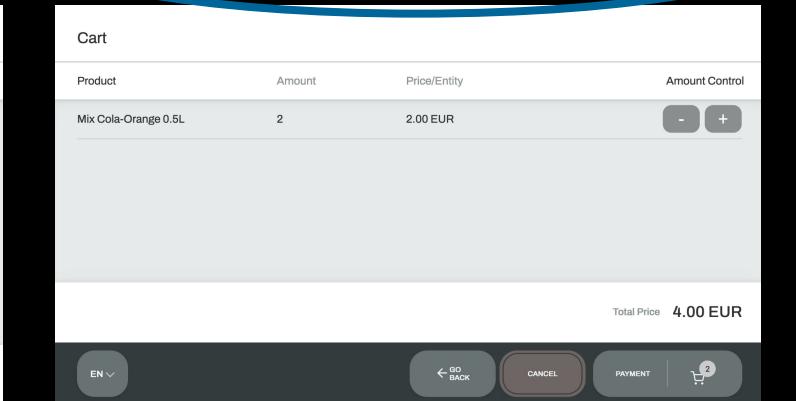
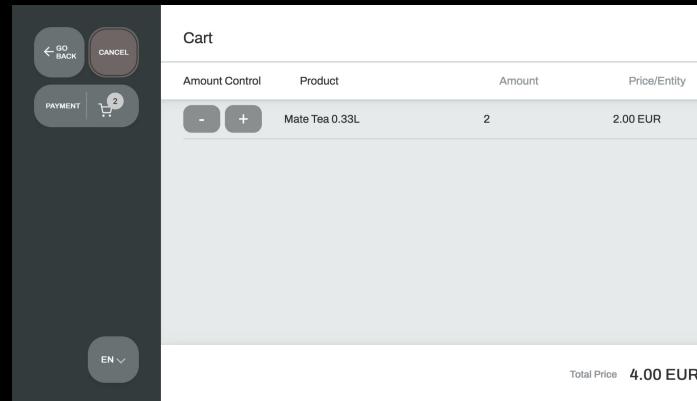
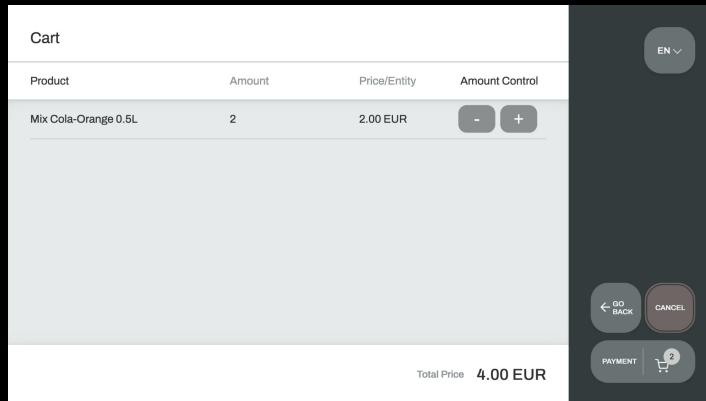
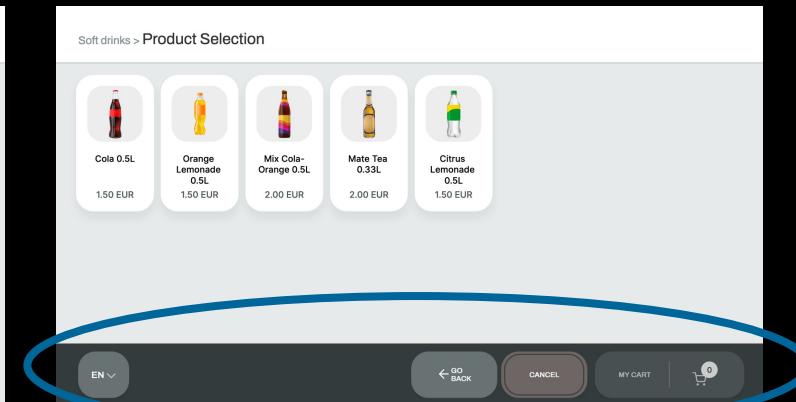
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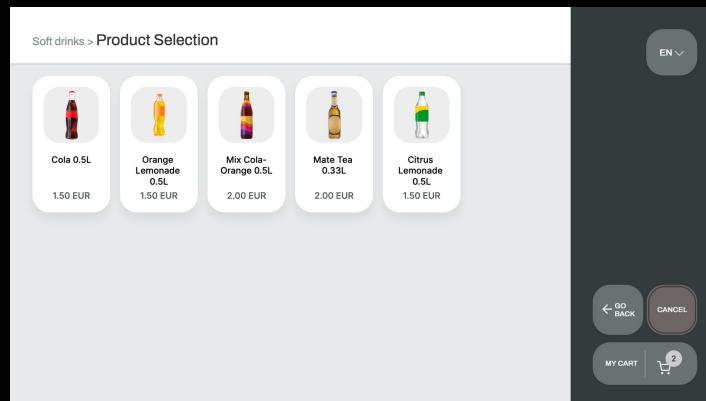
Rearranged Vertically



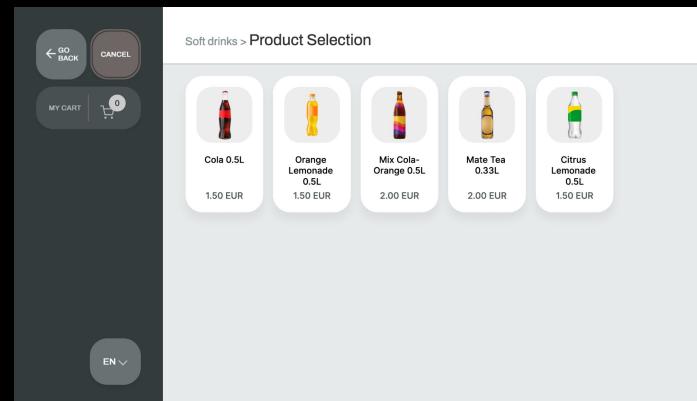
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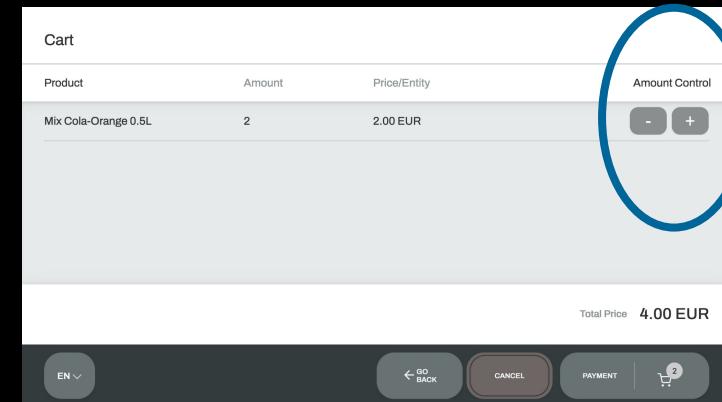
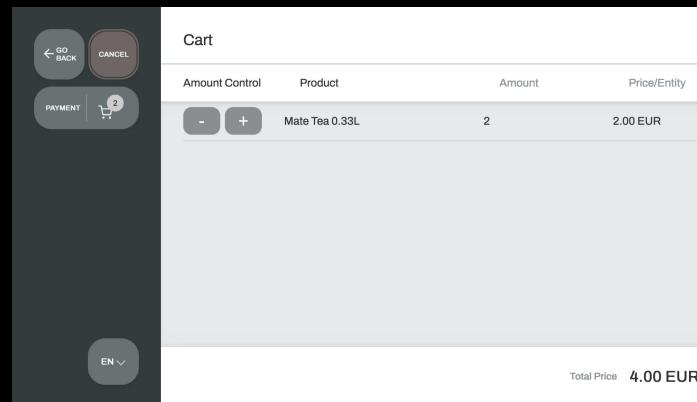
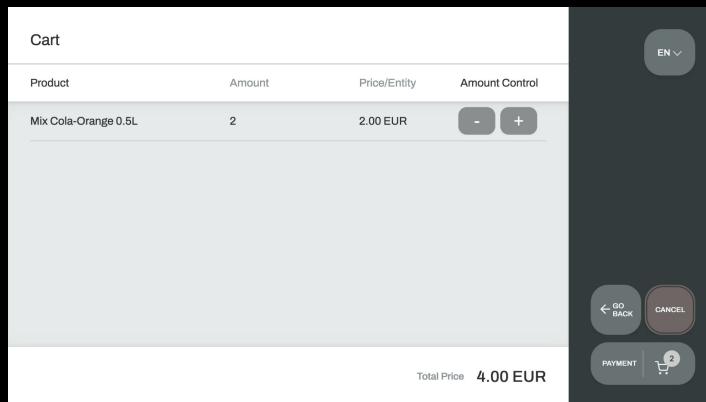
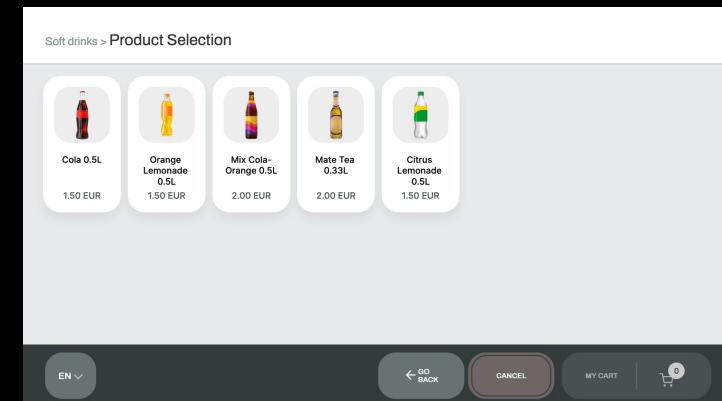
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# Key Findings RQ1

Reducing Touch Overlaps

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Optional / user-controlled traces  
→ hygiene perception & comfort

# Key Findings RQ2

**Impact on Perceived Usability**

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Baseline faster to use

RH (-2.33 s,  $p = 0.023$ ), RV (-2.14s,  $p = 0.042$ )

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Right-handed adaptation

→ arm repositioning

# Other Findings

## Hygiene & Privacy

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Rearrangement & hygiene  
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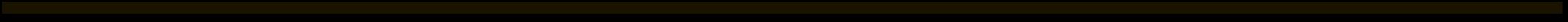
Rearrangement & privacy  
→ input reconstruction harder

Touch traces & privacy  
→ Revealing

# Implications

## Practical

Touch  
Traces



## Academic

Rearr-  
angement

# Implications

	Practical	Academic
Touch Traces	Optional/temporary	
Rearrangement		

# Implications

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- Context-specific interface optimization for PDs

Let's explore **hygiene** as a  
UI optimization objective!

Thank you!

Lou Elah Süsslin  
[suesslin@pm.me](mailto:suesslin@pm.me)