

Pocket Transfers:
Interaction Techniques for
Transferring Content from Situated
Displays to Mobile Devices

Ville Mäkelä, Mohamed Khamis, Lukas Mecke, Jobin James, Markku Turunen, Florian Alt



Presented by: **Pantea Habibi**



Outline

- Overview of system
- Research Design
- Study Design & Results
- Implications
- Critique & Discussion

1

Overview of system



System

- Pocket Transfers: interaction techniques that allow users to transfer content from situated displays to a personal mobile device while keeping the device in a pocket or bag.



Techniques

- Touch
- Mid-air gestures
- Gaze
- Multimodal
- QR code: Baseline

Visualization - feedback



Implementation

- Display: popular news portals
- Android mobile App
- Users (determined via Kinect) automatically paired with their mobile devices (determined via Bluetooth) when entering the space.
- Matching locations



Novelty

- user study design
 - preparation for, and halting of, the interaction
- novel content transfer techniques
 - keep mobile device in pocket during the transfer
- **Multimodal interaction for content transfer**
 - Gaze and mid-air

2

Research Design



Purpose of Research

- ◉ In many situations users want to transfer content from public displays to personal mobile devices.
- ◉ Increasing number of situated displays appear in urban areas -> more opportunities for transferring content to personal mobile devices.
- ◉ Most of existing methods for transferring content to mobile devices require users to **look at and hold** their device in their hands.

Unit of analysis:
Individuals



Conceptualization

- Concepts:
 - overall performance
 - Efficiency: Fast/speed
 - overall experience
 - Usefulness, preferences, suitability



Research Questions

- What is the **performance** and **user experience** of pocket transfer techniques? What are the positive and negative aspects of each technique?
- How **useful** is it to keep the mobile device in a pocket with each technique?
- Are different techniques **preferred** based on the length of the interaction, or the presence of other people?



Operationalization

- Performance:
 - Amount of time users spend on a task.
 - Number of errors occurred during the task being done by users.
 - (Objective)
- Experience:
 - Asking users about their opinion for each technique and setting – self report
 - (Subjective)



Metrics

- Variables: (dependent)
 - Performance
 - Completion time
 - Error rates
 - Experience
 - Users' ratings

Independent variables:

Techniques: (5 levels)

Touch

Mid-air

Gaze

Multimodal

QR code

Use cases: (2 levels)

Single item

Multi items



Levels of measurement

- Performance
 - Completion Time: Ratio
 - Error count: Ratio
- Experience
 - Rating: Interval

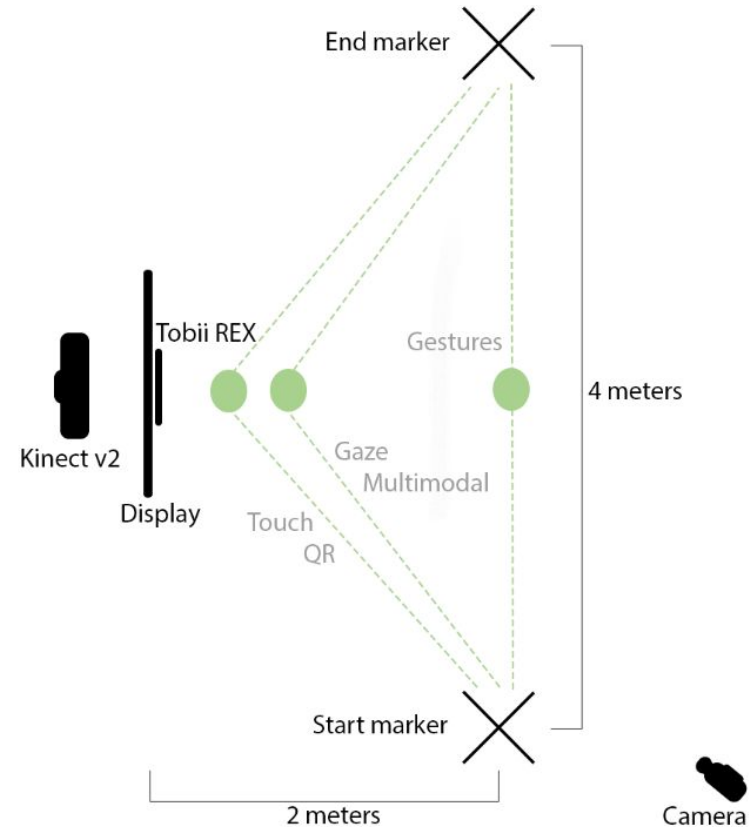
3

Study Design & Results



Study Setup

- Real-life situations
- Distance to the display varies depending on the technique.
- Preparation time





Study Design

- Cross-sectional
- Conducted Controlled Experiment
- Within subject experiment
- N=20, age:19-29
- To avoid order effect: Latin Square Design
- **Hypothesis:** preferences towards the techniques might differ based on whether the user intends to transfer one or several content items.



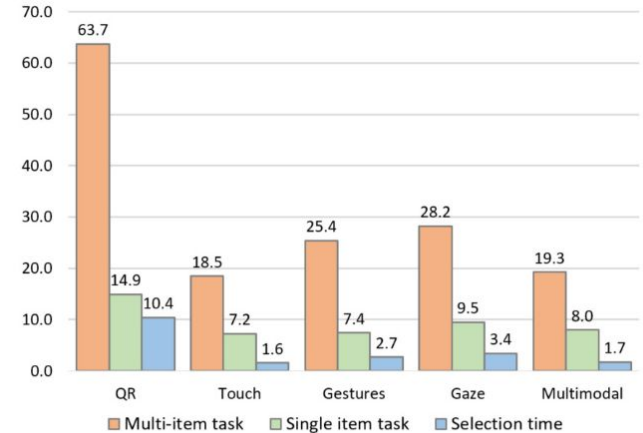
Study Procedure

- consent form and a background questionnaire
- Practice phase
- Two use cases for each technique:
 - Single item (5 times)
 - Multi(5) items (2 times)
- For each technique: $5 + 2 * 5 = 15$ tasks
- 5 techniques so: $15 * 5 = 75$ tasks
- Questionnaire and semi-structured interview



Results (Performance)

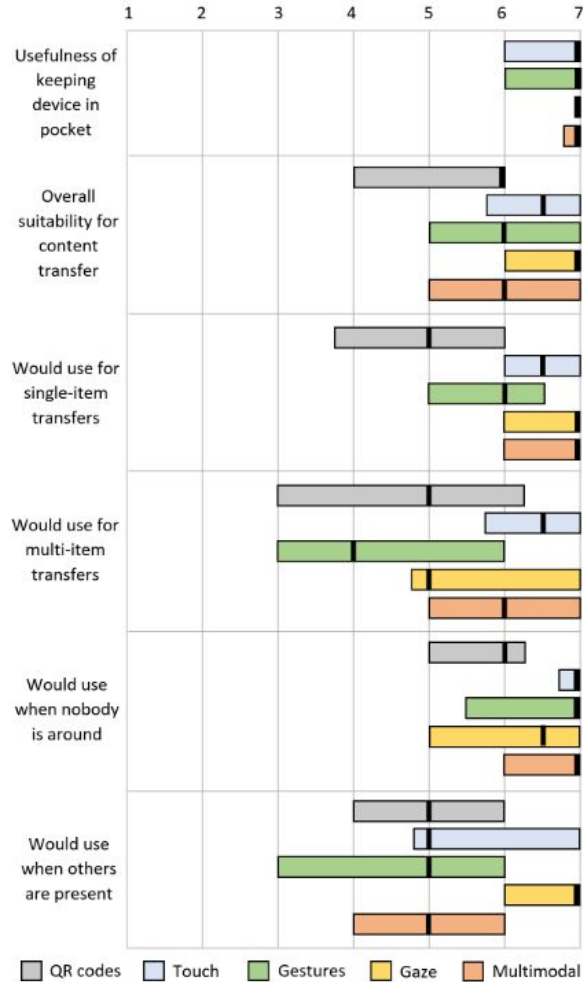
- Completion Time:
 - Touch** and **Mid-air gestures**:
Fastest techniques for transferring a single content item.
 - Touch** and **Multi-modal**:
Fastest techniques when transferring multiple items.
- Error Rate:
 - Low across all conditions.



Completion times for single item and multi-item tasks with each technique.



Results (*Experience*)



Boxplots for statements regarding all content transfer techniques. Boxes represent inner quartiles, and the middle lines represent medians.



Choosing empirical methods

- Performance: (both single and multi tasks)
 - Type of data: continuous
 - Type of question: differences
 - Differences between: means
 - How many treatment group: more than 2
 - Parametric assumption satisfied: ANOVA → repeated measure Anova with Greenhouse-Geisser
 - Significant ($p < 0.0005$): post hoc test → Bonferroni
- Experience:
 - Type of data: continuous
 - Type of question: differences
 - Differences between: means
 - How many treatment group: 2
 - Parametric assumption not satisfied: Mann-Whitney U
 - $p < 0.05$

Parametric Assumptions:

1. Independent, unbiased samples
2. Data normally distributed
3. Equal variances

4

Implications



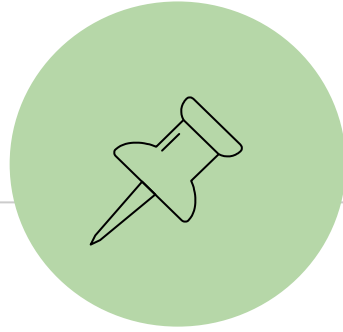
Design Implications

- Pocket transfer techniques are fast and convenient regardless of modality, and should be considered especially for frequent users when designing content transfer systems.
- **Touch** should be used when the display is reachable and when familiarity and efficiency is important, or when it is unclear how the display will be primarily used.
- **Mid-air gestures** should be used in calm spaces where people are not always around, where people are expected to transfer single items, or where the display is not along the primary walking paths.



Design Implications

- ◉ **Gaze** should be used in crowded spaces where sensitive content might be available (e.g., selections might imply political interests, or contain personal information), or where users are expected to carry items (e.g., a drink or a bag).
- ◉ **Multimodal** should be used when users are expected to transfer multiple items, and when the display is unreachable. In crowded spaces, the design should allow subtle gestures (e.g., against the body) when confirming content transfers to avoid drawing attention.



Study Design Recommendation

Interaction techniques should be evaluated with various realistic tasks that include preparation for, and halting of, the interaction, especially when different modalities are compared.

5

Critique & Discussion



Critique

- Strengths
 - Study Design
 - Interaction techniques (especially multi-modal)
- Weaknesses
 - Multiple simultaneous users
 - Number of users kinect can track
 - Crowded areas (people are so close)- not reliable pairing



Discussion

- ◉ "Design Implications" seem sort of obvious.
- ◉ Using location: how reliable could that possibly be in a realistic setting?
- ◉ Why are there only 20 subjects also all the subjects are post-graduate and doctoral candidates?
- ◉ factors affect the transfer speed and efficacy, versions, etc.
- ◉ Why is the time to completion measured?
- ◉ UI widening in QR code test that is not in other tests. Could this contribute to poorer QR performance?
- ◉ User prior experience (or lack of experience) with QR App and Phone not addressed. Would users familiar with iOS have worse performance than Android users?
- ◉ Study participants either kept phone in pocket or lowered in hand. How were these time differences accounted for?
- ◉ The distance/calibration glitches that occurred during the experiment was a cause of frustration or disengagement?
- ◉ Ability to associate a Bluetooth device with a particular user - especially with multiple simultaneous users.
- ◉ Expecting like long-term fatigue and trouble with larger groups of people.



Thanks!

Any **questions** ?