

# Passenger Information in Rail Transportation: A Virtual Reality Study

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## Introduction

### Background

- Inefficiencies in passenger turnovers on the platform can extend train dwell times at stations, consequently leading to delays throughout the entire rail network (Yuan & Hansen, 2007).
- Enhanced passenger information systems present a promising way for optimizing passenger flow on platforms, thereby minimizing transfer durations (Kattan & Bai, 2018; Drabicki et al., 2021).

### Approach of this study

- Conduction of a virtual reality study to evaluate different kinds of passenger information.
- Two different types of passenger information were focused on:
  - Information on occupancy rates inside the wagons
  - Information on designated doors for on- or off-boarding only

### Objectives of the study

- Evaluate the passenger information in terms of usefulness, usability and mode of information presentation.

## Method

### Procedure

- In a virtual reality simulation participants completed a scenario of an arriving train at the platform six times.
- Two types of information were displayed in three different modes.
- The information was displayed either at the arriving **train**, on the **platform screen** or on the **smartphone**.
- After every trial, the information was rated in terms of usefulness and usability.
- After completing the 3 scenarios of one information type participants ranked the preferred way of information presentation.

Information Display:

Train

Occupancy rates for wagons

Designated doors for on- or off boarding

Platform

Smartphone



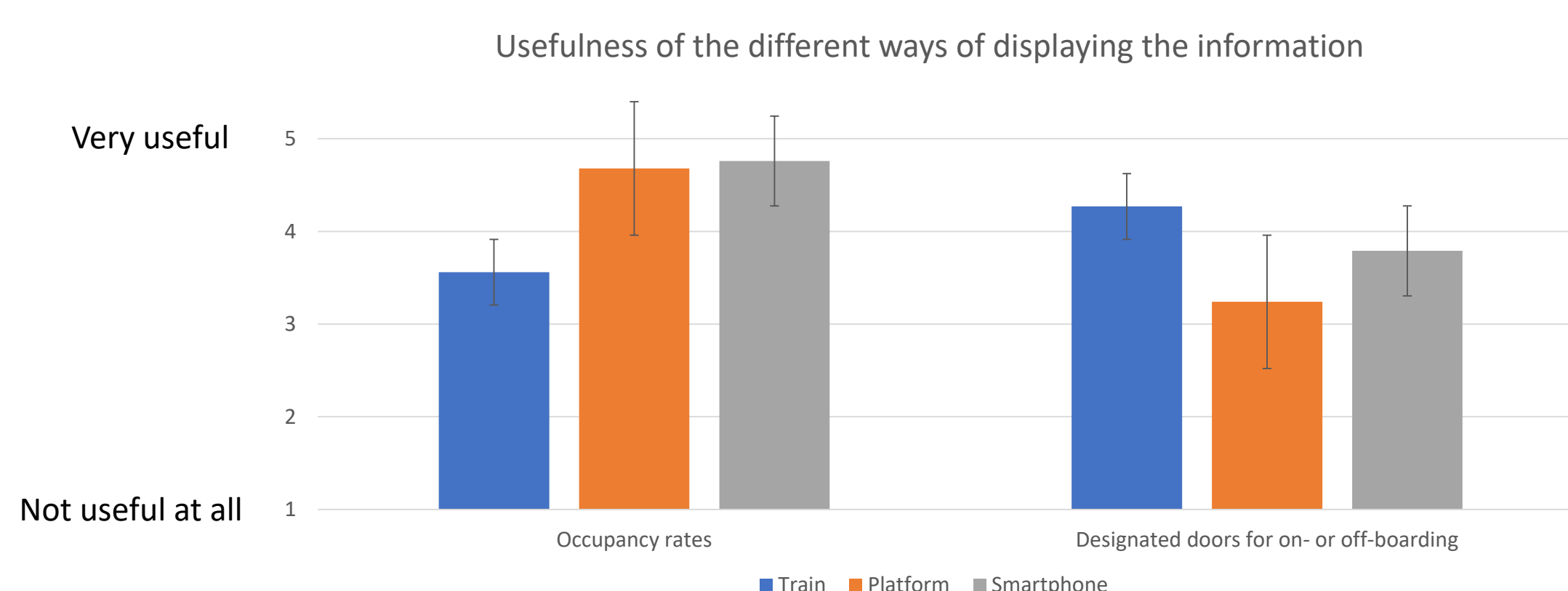
## Results

### Sample

<b>N</b>	32
<b>Gender</b>	
m	59.4% (19)
w	40.6% (13)
<b>Age (M, SD)</b>	43.47 (20.17)
<b>Frequency train use</b>	
< every 6 month	15.6% (5)
< once a month	21.9% (7)
1-2 times per month	25.0% (8)
Once a week	25.0% (8)
> Once a week	12.5% (4)
<b>Experience with VR</b>	
very little / none	31.3% (10)
little	25.5% (5)
some	43.8% (14)
much	6.3% (2)
very much	3.1% (1)

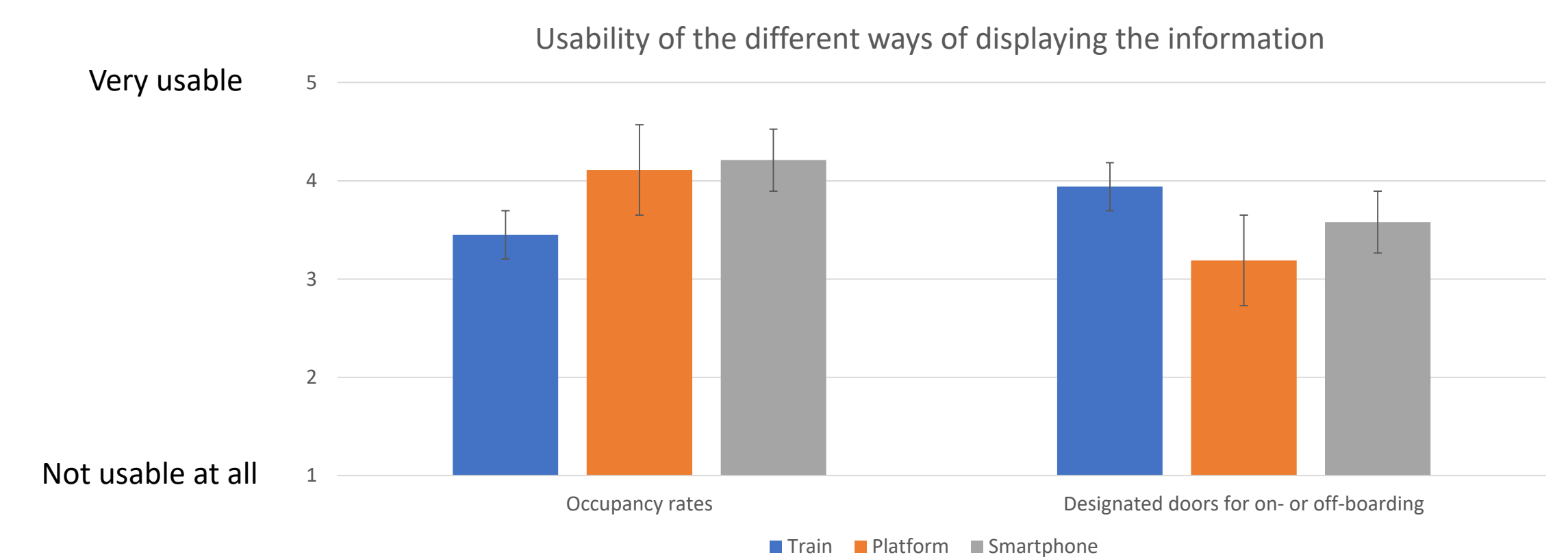
### Usefulness of the information

- Measured with the usefulness scale of the Technology Acceptance Model (Davis, 1985)



### Usability of the information

- Measured with a short form of the User Experience Questionnaire (Laugwitz et al., 2008)



### Ranking of the preferred way of displaying the information

Occupancy rates

	Train	Platform	Smartphone
Rank 1	9.4% (3)	31.2% (10)	59.4% (19)
Rank 2	15.6% (5)	53.1% (17)	31.2% (10)
Rank 3	75.0% (24)	15.6% (5)	9.4% (3)

Doors for on- or off-boarding

	Train	Platform	Smartphone
Rank 1	68.8% (22)	9.4% (3)	21.9% (7)
Rank 2	15.6% (5)	31.2% (10)	53.1% (17)
Rank 3	15.6% (5)	59.4% (19)	25.0% (8)

## Discussion

### Summary

- Overall, both types of information received highly positive evaluations, highlighting a significant demand for passenger information.
- Different kinds of information require distinct presentation methods to ensure optimal effectiveness:
  - Information on occupancy rates inside the wagons should ideally be provided prior to the train's arrival, either via smartphone application or displayed on the platform.
  - Information regarding doors designated exclusively for on- or off-boarding is preferred to be displayed directly on the train.
- Testing of both kinds of information in practice is a promising starting point to further study how to efficiently direct passengers on platforms.

### Conclusion

- The results of the present study are in line with previous studies (Petersen & Dotzauer, 2023) on the evaluation of passenger information and confirm that it is generally perceived as useful.
- In particular, crowding information can be used at various points in a travel chain (when planning the journey, shortly before the journey or directly on the platform) to guide passengers and prevent overloaded public transportation.
- Information on doors designated for on- or off-boarding also have the potential to make the passenger flow more efficient, but must be accompanied by complementary guidance of off-boarding passengers within the vehicle.

## Literature

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