

Analyzing Crowd Behavior on Train Station Platforms Using Different Information Designs

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INTRODUCTION & OBJECTIVE

At train station platforms, people tend to congregate near stairways. This leads to **congestion as well as concentrated boarding** [1], where passengers then board the wagons that stop by the stair. Delays, overcrowding, and inefficient dispersion on the train are common for this reason. The objective of this research project is to **evaluate passenger behavior with regards to different information design to disperse people along platforms** in a more efficient way. The result will be **quicker boarding and less crowding**, improving public transportation and making it a faster, less stressful and more efficient experience for passengers as well as transportation services.

CURRENT EXEMPLARY SOLUTIONS

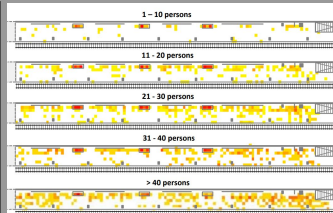
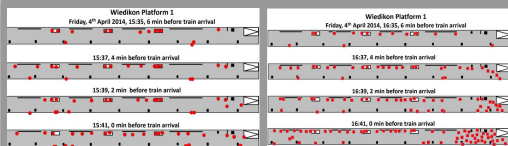
1. Platform Real-Time Crowding Information (RTCI): Placing sensors at entrances to wagons as well as between wagons to **track the flow of passengers**. This information will be shared to different stations to accurately update the information in real-time. Since most passengers already look at platform signs, the **crowding information** will be displayed there.

This information can be displayed as a simple heat map, or something like the Deutsche Bahn is trying, pictured below [3]. Our modifications to this trial they are running would be to make sure the platform signs are also displayed on the figure for clarity. This will allow people to know where to stand when the train pulls into the station.

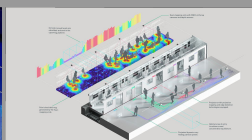
2. Changing positions of wagons: A study done in the Netherlands showed that **stopped the train 50 meters forward** reduced boarding time by 30 seconds during rush hour [5]. We can simulate these conditions very easily as it is not an infrastructure change, and use virtual reality to test the conditions. This will give us a good idea one whether this actually impacts the crowding and dispersal of the wagons and if it is a workable solution.

OUR APPROACH

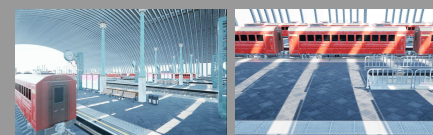
Using a virtualization tool such as Unreal Engine, we will use an existing scenario of the Cologne Train Station (as pictured below) to **vary passenger crowd and flow** along and to the platform during train arrival. **Our goal is to determine information design parameters** (i.e. visualizing features (dynamic, static) and content (i.e. color codes, redundancies, precision), its influence on passenger decisions as well as approaches to **promote better platform distribution**. Exploration will take into considerations aspects of usability such as efficiency and effectivity as well as individual feedback from potential users.



Crowding near staircases during rush hours and large population size (taken from Bosina et al. 2015 [2])



Depictions of different prototypical implementation on train station platforms in Hamburg and Stuttgart [3] using visual cues to inform passengers. Third image is heat mapping done by Adrian Leung [4].



Depictions of a train station based on the Cologne main station platform (left and right) designed in Unreal Engine 5.1

REFERENCES

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- [2] Bosina, Ernst & Britschgi, Samira & Miedler, Mark & Weidmann, Ulrich. (2015). Distribution of passengers on railway platforms.
- [3] Echtzeit-Auslastungsanzeige Jetzt Auch im Regionalverkehr. Startseite. (n.d.). <https://www.bahn.de/service/ueber-uns/inside-bahn/news/Echtzeit-Auslastungsanzeige-Regionalverkehr>
- [4] Leung, A. (n.d.). Dynamic Train Platform Distribution. adrianleung.io/05
- [5] van den Heuvel, J. (2016). Field Experiments with Train Stopping Positions at Schiphol Airport Train Station in Amsterdam, Netherlands. Transportation Research Record, 254(61), 24-32. <https://doi.org/10.3141/2546-04>

