

Evacuation elevators in underground metro stations – A Virtual Reality experiment

The number of metro systems around the world is increasing rapidly. With an increase of metro systems, the number of deep underground metro stations will probably also grow. In Sweden, this is exemplified with station Sofia at the extension of the Stockholm metro system, which is planned to be situated around 100 meters below ground. With this sort of deep underground metro stations, the need of elevator evacuation may be more prominent around the world. However, there are knowledge gaps on the behavioural aspects of elevator evacuation in this sort of environment.

Research objectives

The objectives of the study were:

- to investigate if evacuation exit choice, i.e., stairs versus elevators, in an underground metro station can be affected using different design/information measures, and
- to investigate if accepted waiting time for evacuation elevators can be affected using a count-down timer showing expected elevator arrival times.
- to study if different ways of simulating virtual movement affects the results.

Methods

The study was performed using unannounced evacuation experiments in Virtual Reality. Different scenarios with different information/guidance systems were tested along with different ways of simulating movement in the model

The tested systems were:

- Base-line design (basic guidance)
- Enhanced information and guidance through signs and spoken evacuation alarm
- Guidance in a smartphone
- Count down timers above the elevators
- Movement simulation with Cybershoes®

Results

The results of the study show that the basic acceptance for using elevators for evacuation in underground metro stations is low. However, this acceptance can be affected significantly with information/guidance systems.

The study also show that the accepted waiting times are low and only 5-20 % of the participants waited more than two minutes. However, this acceptance can probably be affected by count-down timers above the elevators and with these, around 50 % of the participants waited more than two minutes.

This study can be used as a guidance for evacuation design and for evaluation of information/guidance systems in underground metro systems where elevator evacuation is considered.

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