

LEDs on the Go: Supporting Pedestrian Flows in Public Transit Networks with Accent Lighting for Increased Efficiencies and Ambient Information Display

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ABSTRACT

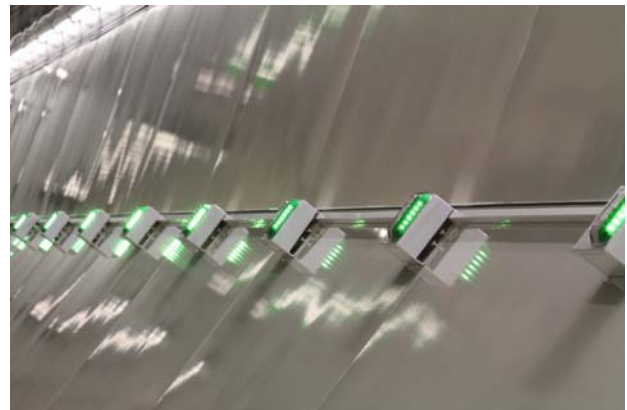
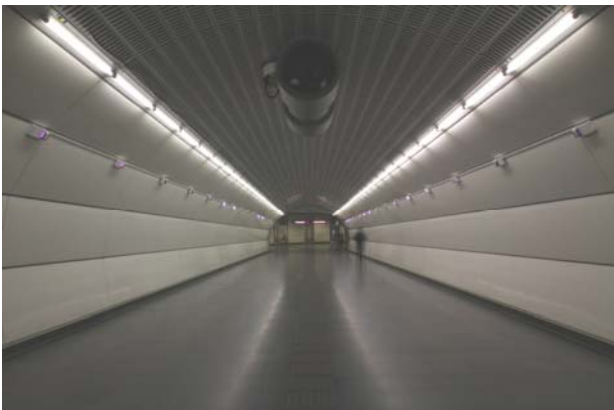
Public transit authorities are under increasing pressure to cut costs and increase ridership. With the advent of programmable LED (light-emitting diode) lighting and real-time data transportation providers have the opportunity to reevaluate the relationship between lighting and safety, passenger comfort, energy consumption and attractiveness. This paper reports on a study conducted in collaboration with the Vienna Transit Authority from November 28 through December 4, 2011. We explored the potential for using ambient accent lighting to support the flow of pedestrians through an underground subway tunnel. Video data was collected to observe walking speeds and inform future pedestrian simulation models that incorporate more fine-grained perceptual cues. In addition, a survey was conducted among 508 passengers to determine the acceptance rate of the installation. Initial results show that 80% of passengers appreciated the installation and most gleaned temporal and spatial cues from the ambient system.

INTRODUCTION

New lighting technologies based on programmable LED systems provide opportunities for public transit authorities to holistically examine their use of lighting for general illumination (for safety, comfort, efficiency) and accent lighting (for branding, information display, attractiveness). [2] In this study, we asked whether LED-accent lighting might contribute to increased efficiencies by supporting the flow of pedestrians through a public transit network and create a richer, more informative environment? We drew on work in the field of ambient displays which aim to subtly conveying information through peripheral, low-resolution cues such as color shifts or movement. [5,6] In perception research, studies have shown that people tend to underestimate their own speed when their central field of vision is inhibited. [4] The interdisciplinary study presented here links background from human-computer interaction with perception studies and simulations of pedestrian movements.

STUDY

In order to understand the relationship between ambient accent lighting and pedestrian flow in a public transit setting, we collaborated with the Vienna Transit Authority to conduct a field test in a subway station (U2-U4 Schottenring) from November 28 through December 4, 2011. The corridor was selected because it



Pedestrian passageway between U2 and U4 in the subway station Schottenring, Vienna, Austria. 15 two-sided LED light fixtures mounted on either side of the corridor at a height of 2.25m and 2m apart.

presents a neutral environment connecting two subway lines. It is approximately 30m long, appropriate for potentially impacting a person's walking speed. We installed 15 LED light fixtures along the walls of a pedestrian tunnel connecting two subway lines of the Vienna Transit Authority. The fixtures were two-sided and outfitted with filters in the colors of the respective subway lines. The lights on one side (green, U4) were programmed to update a chasing light at a speed of 1hz. The lights on the other side (purple, U2) changed their speed from 1hz to 3hz as a function of the subway arrivals on either platform at the end of the corridor. [3] Anonymous video data was collected to analyze people's walking speeds with and without the lights. In addition, interviewers conducted 30-second surveys with passengers at both ends of the tunnel.

Results

508 people were interviewed and many hours of video footage were collected. Approximately the same number of women and men were interviewed. The average age was 37. 80% of interviewees evaluated the installation as positive or neutral. Daily users of the corridor were --not surprisingly-- more likely to notice the installation. Both survey results and video footage show people more aware of the lights in the evening hours. Groups of people also had a slightly increased likelihood of noticing the lights. Qualitative estimations of the lights' function showed that people easily understood that the lights directed them towards the appropriate subway platform (133 comments). Especially the color-coding of the accent lighting reinforced the wayfinding infrastructure of the transit network. [1] Many also interpreted the speed of the lights in connection with subway arrival times and walking speeds in general (68 comments). Interestingly, several people thought the lights created a calming effect. Precise walking speeds are still being evaluated from video data, but require additional annotation. Interviewees also interpreted the lights as providing additional safety (66 comments) and improving the aesthetic experience of the bland tunnel (51 comments).

DISCUSSION AND CONCLUSION

The initial study described above provides evidence that ambient accent lighting has the potential to convey information about direction and speed to pedestrians moving through public transit networks without distracting them. Riders perceived the installation as attractive and felt supported in their goal to reach the train platform on time. Additional benefits such as safety and attractiveness were also recognized. More work is required on integrating real-time sensing and adaptive dynamic effects to be played on the lights. These results coupled with further lab and field tests will assist in developing more specific design guidelines for future explorations. Better design guidelines should also inform simulations of pedestrian movements which currently integrate minimal information on different visual environments. Through this interdisciplinary work, public transit providers stand to benefit from another tool to increase efficiency and improve the attractiveness of their networks.

ACKNOWLEDGEMENTS

The first author was a visiting scientist at AIT while this research was conducted thanks to a grant from the Austrian Federal Research Agency (FFG). We are extremely grateful to the Vienna Transit Authority (Wiener Linien) for their permission to conduct the study. Bartenbach LichtLabor's partner Swareflex loaned the LED fixtures.

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International Symposia on the Science and Technology of Lighting

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