

S. DANSCHUTTER, K. JANSSENS. **Improving the accessibility and safety of stairs by providing adequate lighting and sufficient contrast.** *Gerontechnology* 2016;15(suppl):78s; doi:10.4017/gt.2016.15.s.790.00

**Purpose** Ageing people often prefer to stay at home for as long as possible, even when the environment they live in is unfit or unsafe. Stairs are particularly dangerous places where falls can result in severe consequences<sup>1</sup>. It is believed that the risk of falls and injuries can be reduced by improved stairway design<sup>2</sup>. This requires a multifaceted approach where different stair elements are considered<sup>3</sup>. The current research is conducted to gain more insight into the visibility of stairs by comparing different light settings. A mock-up staircase with five steps, five different lighting settings and three possible cover materials were custom built. The following research questions were addressed: (i) Which light setting paired with which cover material most produces the best visibility in stairwells? (ii) What type of additional lighting is best suited and at what illuminance level to increase depth perception during stair descent? The choices made for the construction of the staircase were based on some preliminary tests rendering different light settings in a night settings, from a downward and upward viewpoint. Participants of varying ages (from students to older adults) took part in three studies that combined experimental designs with semi-structured interviews. Results will inform guidelines for adequate stair lighting in the home. **Method** Study 1: Ninety-six participants were recruited, divided over 4 pre-defined age categories: (i) 25-44 years: 26 participants, 15 male & 11 female; (ii) 45-64 years: 24 participants, 10 male & 14 female; (iii) 64-75 years: 23 participants, 10 male & 13 female; 75+ years: 23 participants, 10 male & 13 female. Forty different settings were created in Dialux Evo, and each participant was asked to rate 10 settings. Study 2: In total, 55 people participated, varying in age from 58 to 81 years (27 men and 28 women). In this study, the mock-up staircase was placed on an actual hallway staircase in night time setting. A qualitative approach and semi-structured (individual) interviews were used to evaluate the light settings: overall visibility, visibility of the separate steps, visibility of the form of the steps (profile). Study 3: Twenty-four participants between 18 and 25 years old (4 women, 20 men) evaluated the stairs in a controlled environment (laboratory setting) from a top view. Three settings were tested: lighting above the stair nose as a point of reference and two additional light settings: i.e. lighting under the stair nose and handrail lighting. Participants were asked to indicate the most suitable combination of lighting and staircase cover with regard to contrast and depth perception. **Results & Discussion** Study 1 was used as a preliminary test resulting in the exclusion of a number of light settings. Study 2 revealed that from the top, lighting under the stair nose is preferred, while from the bottom lighting, from the handrail is preferred. Study 3 indicated that the dark wood cover required a higher level of illuminance than the lighter shades of coverings in order to have sufficient contrast and depth perception. Results also show that the higher participants wanted the basis illumination level (lighting above the stair nose), the higher the requirement of illuminance level. Further tests with seniors are underway.

### References

1. Startzell JK, Owens D, Mulfinger LM, Cavanagh PR. Stair negotiation in older people: a review. *Journal of the American Geriatrics Society* 2000;48(5):567–580; doi:10.1111/j.1532-5415.2000.tb05006.x
2. Novak C, Komisar V, Maki BE, Fernie GR. Age-related differences in dynamic balance control during stair descent and effect of varying step geometry. *Applied Ergonomics* 2016;52:275-284; doi:10.1016/j.apergo.2015.07.027
3. Afifi M, Parke B, Al-hussein M. Integrated approach for older adult friendly home stair-case design. *Automation in Construction* 2014;39(1):117-225; doi:10.1016/j.autcon.2013.07.001

**Keywords:** staircase design, lighting, ageing at home, experimental studies

**Address:** Belgian Building Research Institute, Lozenberg, Belgium;

**E:** sda@bbri.be