

A Study on the Sense of Burden and Body Ownership on Virtual Slope

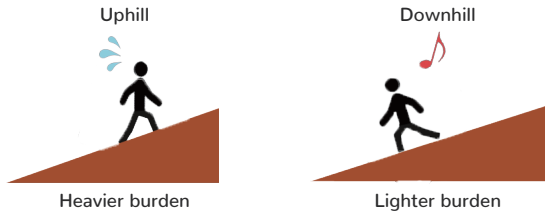
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Background

- Walking on virtual slopes in virtual environment (VE) while walking on a flat floor in real environment (RE)

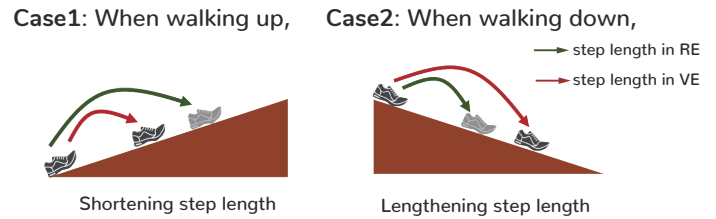
Goal

Reproducing the physical burden on slopes



Related work

Research of perception when walking on virtual slopes^[1]
 Method : Changing step length in accordance with the gradient



Result: Shortening step length make the virtual slope steeper

Experiment

Content : Investigate the perception of burden and body ownership while walking on virtual slopes

Task

Walk up (down) four slopes and answer some questionnaires

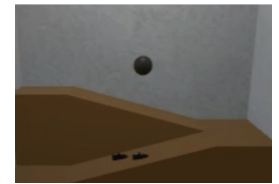
Parameter

18 (6 gradients x 3 step lengths) conditions were conducted

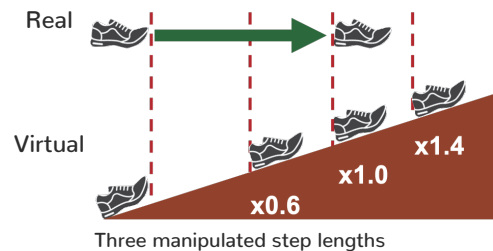
- Six Gradients of Slope : $\pm 5^\circ$, $\pm 15^\circ$, $\pm 25^\circ$
- Three Manipulated Step Lengths : x0.6, x1.0, x1.4



Real environment



Virtual environment



Three manipulated step lengths

Questionnaire

We evaluated the perception with 7 Likert scale

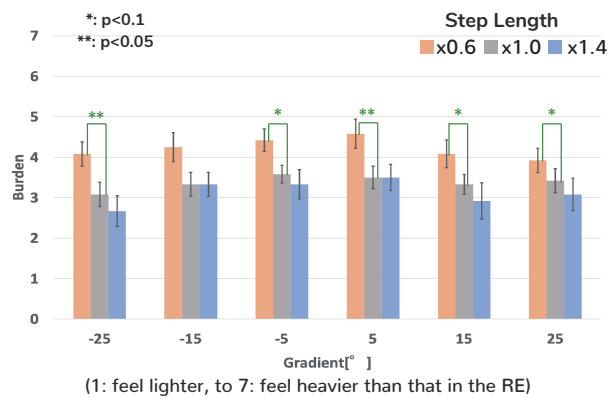
- the Sense of Burden
How did you feel a burden while walking on slopes in the VE?
- the Sense of Body Ownership
Did you feel the sense of body ownership in the VE?

Scales

12 university students attend on 1.2-hours experiment

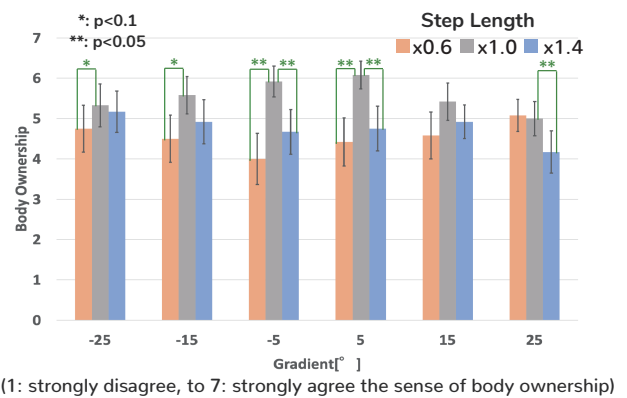
Results and Discussion

Result1: the Sense of Burden



- Shortening step length can give users heavy burden but, we cannot get significant difference on -15° slopes → there are not enough data
- Lengthening step length cannot give users lighter burden → it is difficult to reduce a burden

Result2: the Sense of Body Ownership



The body ownership is reduced by;

- Changing step length when walking on gentle slopes
- Lengthening step length when walking on steep uphill
- Shortening step length when walking on steep downhill

Future work

Investigate the sense of burden and body ownership on an inclined floor

References

[1] Matsumoto et al., Walking Uphill and Downhill: Redirected Walking in the Vertical Direction, SIGGRAPH '17 Poster.