

AS LIGHT AS YOUR FOOTSTEPS

A shoe-based wearable device for real-time modification of footstep sounds for illusory changes in body weight

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Introduction

People’s body perceptions are highly malleable, as demonstrated by neuroscientific studies on sensory-driven illusions¹.

- Sounds in combination with tactile and/or proprioceptive cues, can change people’s body perceptions, as seen in the footsteps illusion²
- There are individual differences in the effects, e.g. according to body ideals³ or symptomatology of eating disorders⁴
- Here we present our shoe-based system that allows for real-time modification of footstep sounds⁵.

Do you want to try our system and share with us your feelings?

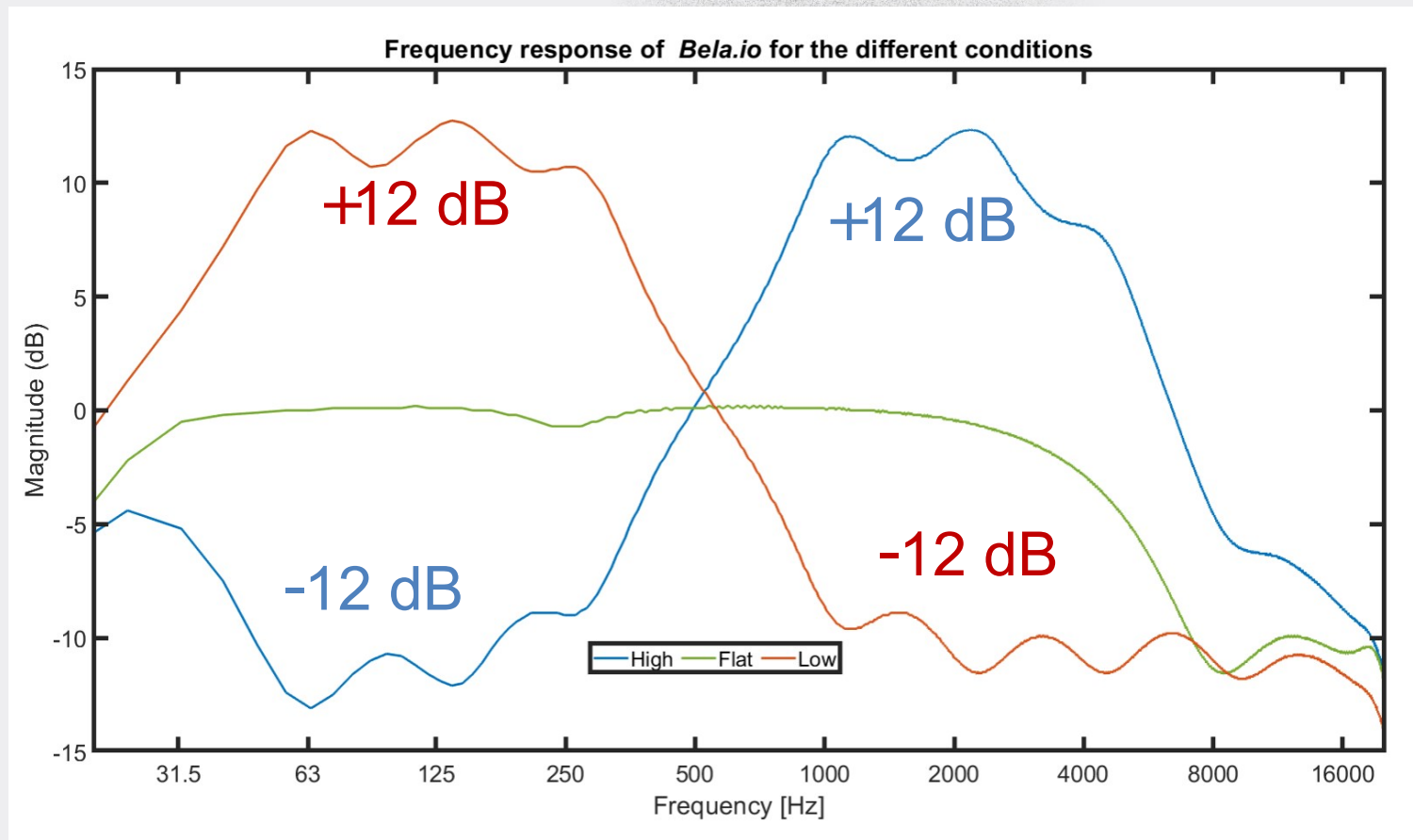
Our system^{2,5}

- Binaural microphones capture the footstep sounds.
- Bela.io device for real-time sound processing.



3 Sound Conditions:

- High Frequency: (63–250 Hz) -12dB, (1–4 kHz) +12 dB
- Low Frequency: (63–250 Hz) +12 dB, (1–4 kHz) -12 dB
- Control: no modification of frequency spectra



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Visit: www.bodyintransit.eu



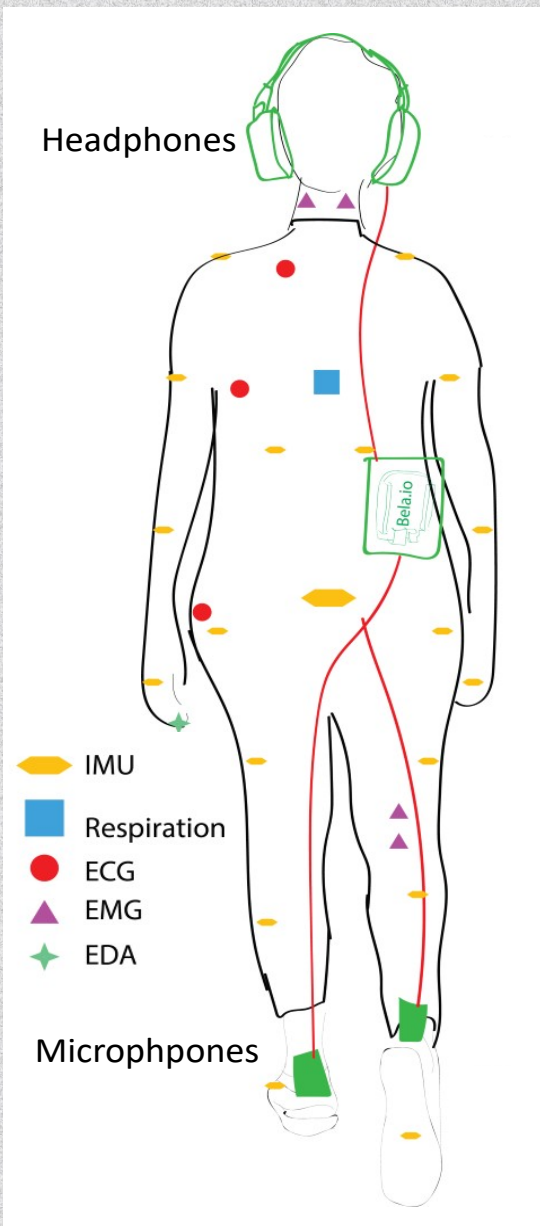
What is the footsteps illusion?²

Dynamic modification of footstep sounds can lead people to:

- Perceive their body as thinner/lighter
- Walk more dynamically
- Feel happier

How do we measure this illusion?

- Body visualizer⁶
- Body behavior IMUs (gait)
- Physiological sensors
 - EMG
 - ECG
 - EDA
 - Respiration
- Self reports



How to personalize the technology?

Investigating individual differences on this body illusion due to:

- Body concerns
- Eating disorder symptomatology⁴
- Levels of physical activity
- Sensory imagery
- Social support networks
- Body ideals related to gender³

Screening Questionnaires:

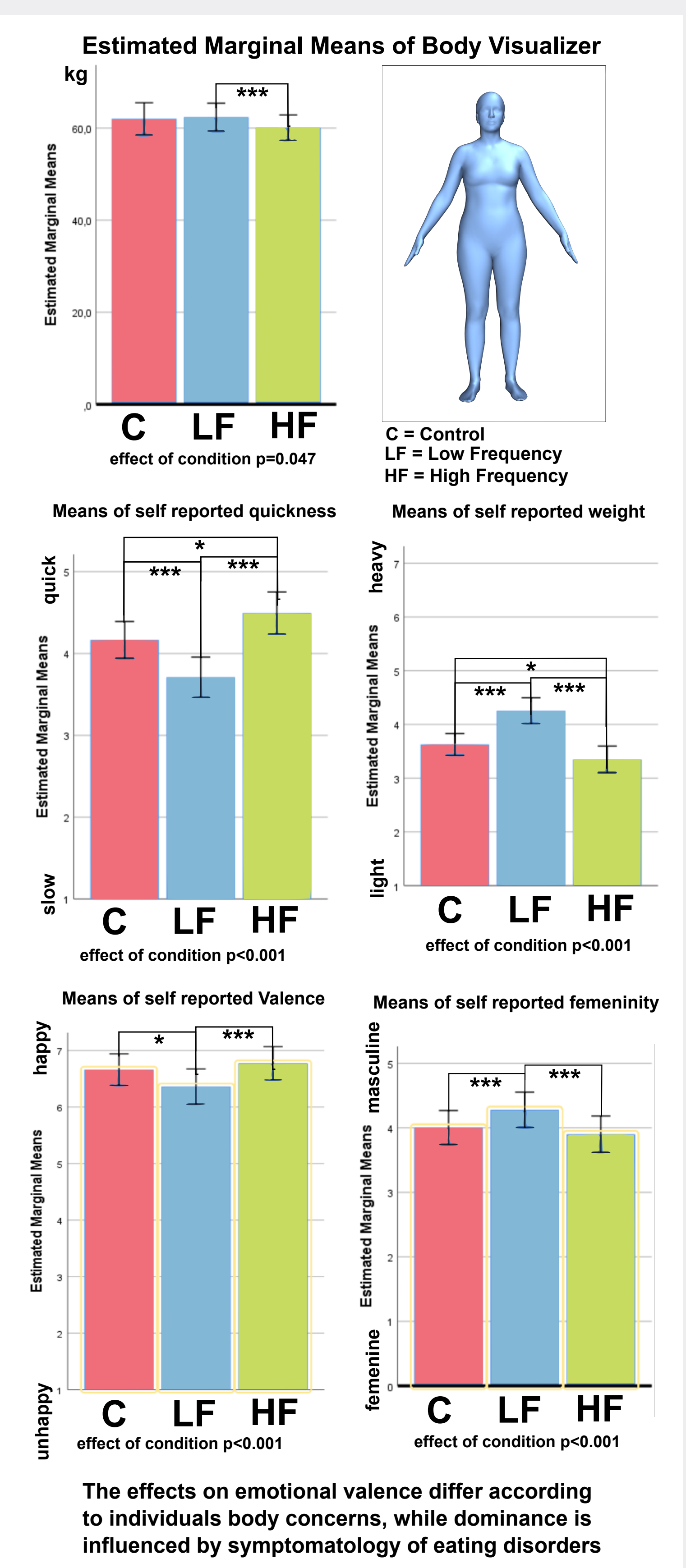
- Multidimensional Body Self Relations Questionnaire (MBSRQ)⁷
- Eating Disorder Examination Questionnaire (EDEQ)⁸
- International Questionnaire of Physical Activity (IPAQ)⁹
- Betts' Questionnaire Upon Mental Imagery¹⁰
- Social Support Networks Questionnaire¹¹

Data from General and Subclinical Population

Participants screened: N= 178 Participants selected: N = 104:
According to level of physical activity (PA) and symptomatology eating disorder (SED)

- LOW PA, LOW SED (M: EDEQ < 1.08, F: EDEQ < 1.90) : 26
- LOW PA, HIGH SED (M: EDEQ ≥ 1.08, F: EDEQ ≥ 1.90) : 18
- HIGH PA, LOW SED (M: EDEQ < 1.08, F: EDEQ < 1.90) : 38
- HIGH PA, HIGH SED (M: EDEQ ≥ 1.08, F: EDEQ ≥ 1.90) : 21

Effects on body perception



Our preliminary results replicate the overall effect of sound condition in perceived body weight. With high frequency sound participants visualized their body as slimmer, and self/report feeling lighter, quicker, and happier. Further, we find individual differences in the effects. Our preliminary results inform the personalization of future body transformation technologies based on real/time modification of self/produced sounds. The created database will also allow to understand the relationship between sound, body perception, behavior and emotion through the implementation of ML algorithms.

Our research also opens opportunities for designing novel systems and therapies for people with negative body perceptions and to support physical activity.

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