

Very Low Bass Induces Movement in a Live Concert Audience



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INTRODUCTION

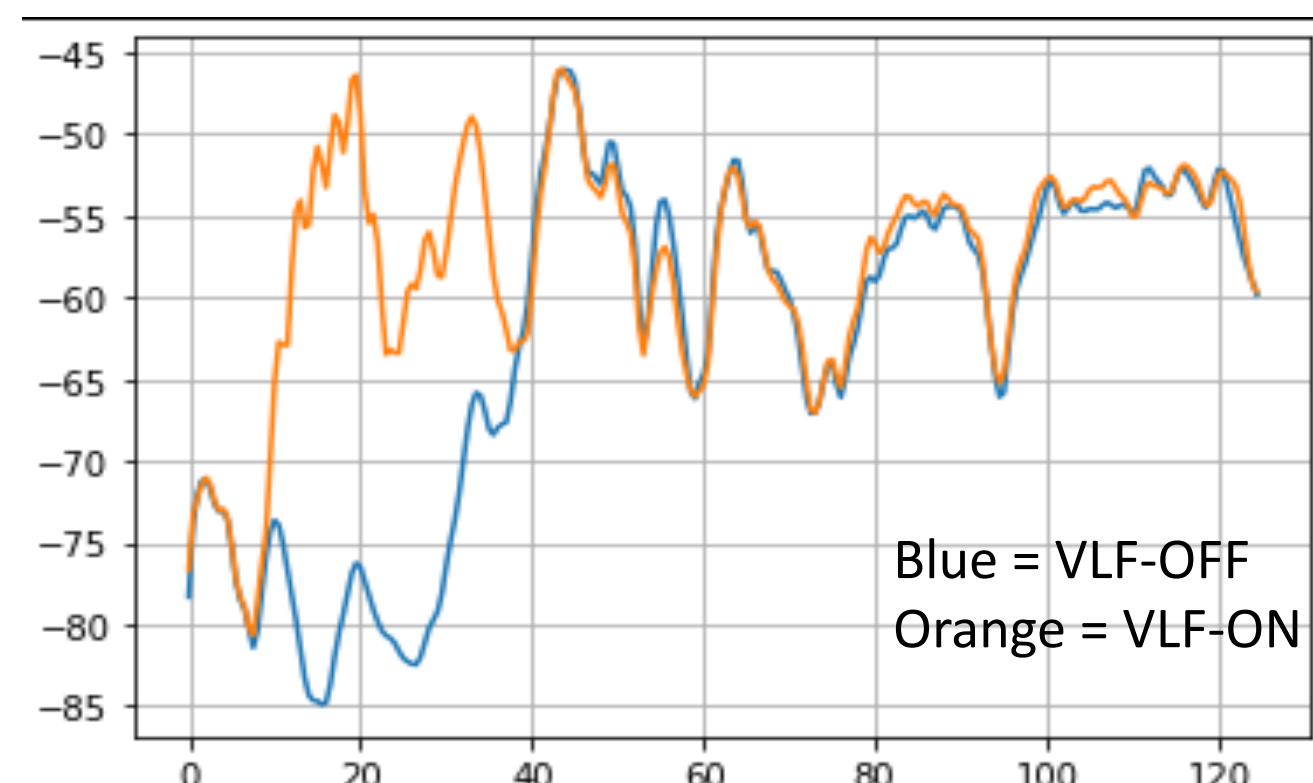
- Low (bass) frequencies are associated with improved timing¹ and movement/groove (the urge to move along with music)^{2,3}
- These influences of bass on timing, movement, and groove may be mediated by one or more of the auditory^{4,5}, vestibular^{6,7}, or tactile^{8,9,10} systems

RESEARCH QUESTIONS

- Can we **INDUCE** movement in audience members at a live concert by adding very low frequencies to the sound?

EXPERIMENTAL DESIGN

- 43 audience members were recruited at a live electronic music performance at the LIVELab
- Motion capture sensor caps
- Responded to text-message prompts during the concert, rating enjoyment
- Completed pre- and post-concert questionnaires
- During the concert, experimenters turned on/off Very Low Frequency speakers (Meyer Sound) every two minutes (nine segments of each).
- Follow-up 2AFC task (n=17) to test whether VLFs are detectable

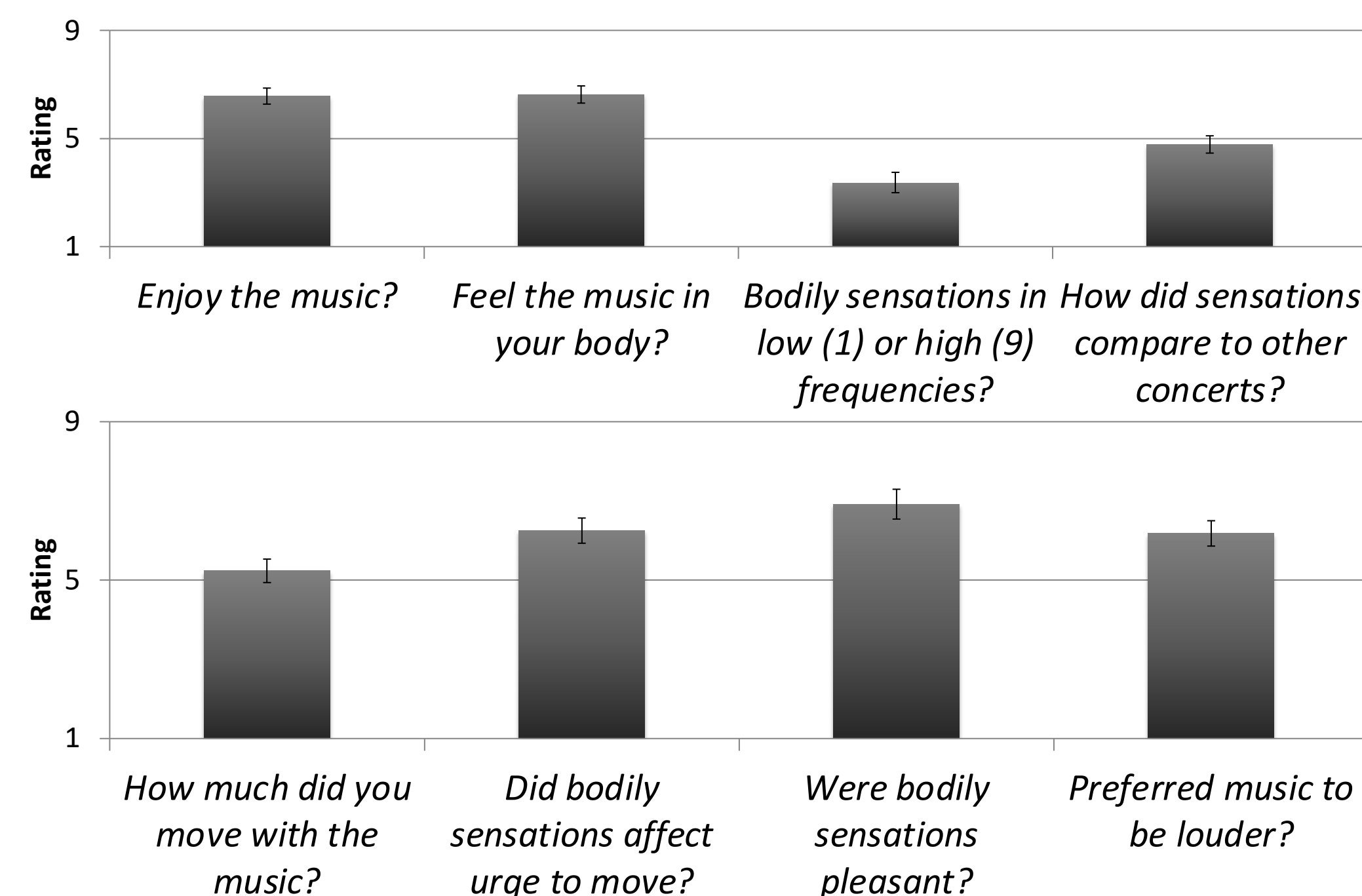


Spectral power of concert audio in 0-130 Hz range; ON > OFF for 10-35 Hz NB: Frequencies < 20 Hz are considered inaudible levels

ANALYSIS

- Normalized mean movement was compared between VLF-ON and OFF segments (9 each)
- Real-time enjoyment ratings were compared between VLF-ON and OFF segments
- Post-concert ratings were tested for reliability of subjective impressions and associations
- Movement and ratings were tested for correlation with demographic measures (music and dance experience, personality traits)

POST-CONCERT QUESTIONNAIRE



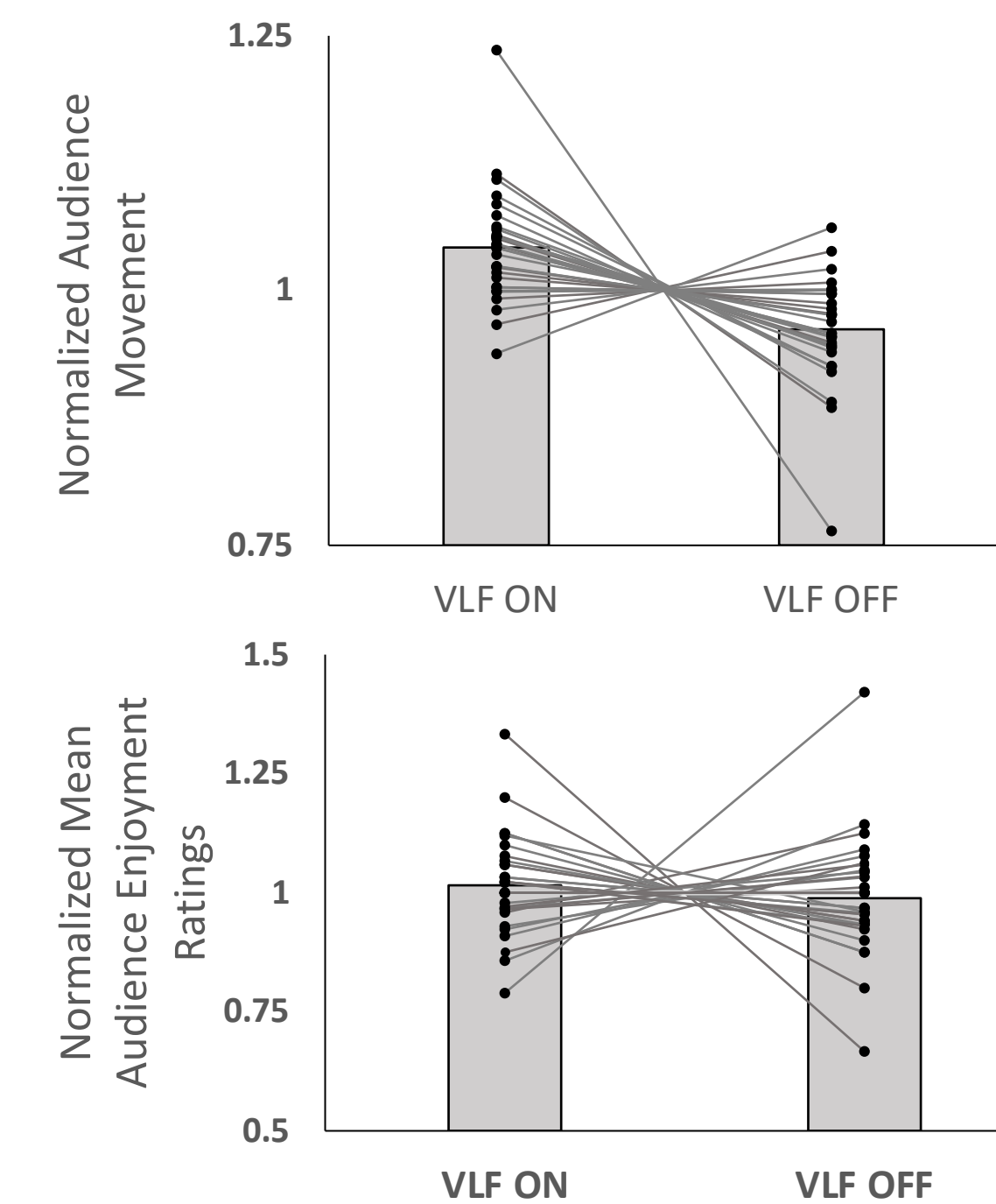
Post-concert subjective ratings indicated audience:

- Enjoyed and moved to the music
- Would have preferred the music to be louder
- Felt the music in the body, which...
 - ...was associated with low frequencies
 - ...was pleasant
 - ...affected the compulsion to move
 - ...was to a similar extent as other concerts

SPEARMAN CORRELATIONS (FDR CORRECTED)

- Raw movement correlated with post-concert movement ratings
- Movement ratings and enjoyment ratings
- Enjoyment ratings from in-concert and post-concert
- Bodily sensation pleasantness and sensations-urge-to-move ratings
- Bodily sensations and sensations vs. other concerts
- Bodily sensations vs. other concerts and movement/enjoyment ratings
- Raw movement and enjoyment differences due to VLF (Off > On)

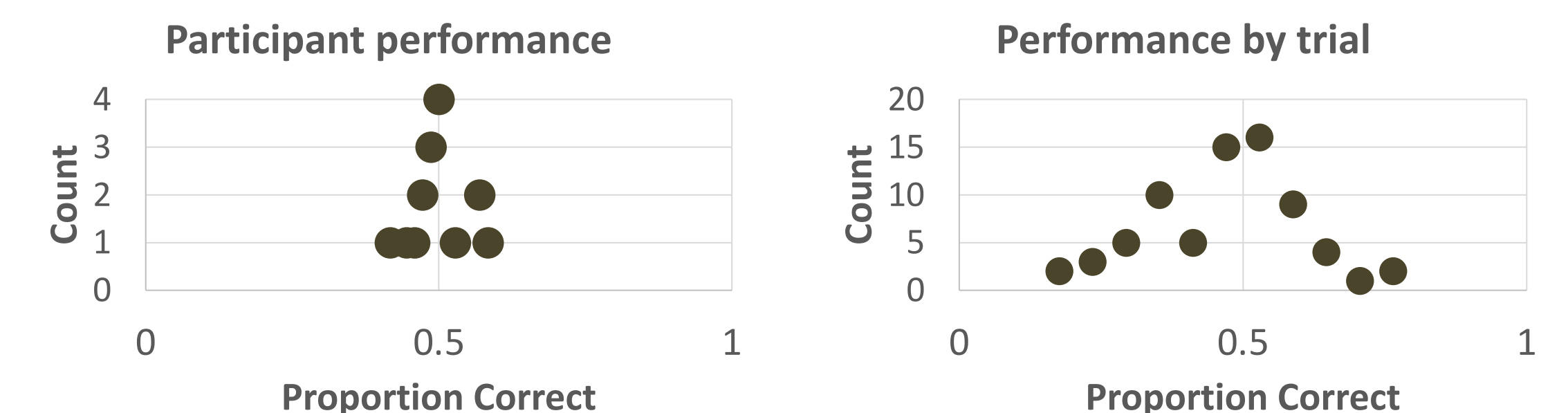
MOVEMENT AND IN-CONCERT RATINGS



Participants moved/danced ~8% more when VLF was ON compared to OFF ($t(41) = 4.74, p < .001$).
35 of 42 participants moved more for ON > OFF

No sig. difference between real-time (text message) enjoyment ratings between VLF ON and OFF.

FOLLOW-UP 2AFC TASK



Chance performance suggests VLF was not detectable during concert

DISCUSSION

- The addition of Very Low Frequencies (VLFs, ~10-35 Hz) to a live concert seems to have caused audience members (n=42) to move roughly 8% more
- Audience responses and follow-up experiment results suggest that VLFs were not detectable
- The mechanism of the bass-movement relationship may be mediated by the auditory, tactile, or vestibular systems

References

- ¹ Hove, Marie, Bruce, Trainor, 2014
- ² Stupacher, Hove, Janata, 2016
- ³ Butterfield, 2010
- ⁴ Zuk, Carney, Lalor, 2018;
- ⁵ Schönwiesner, Caron-Desrochers, & Lehmann, 2016
- ⁶ Todd & Cody, 2000
- ⁷ Todd & Lee, 2015
- ⁸ Verrillo, 1992
- ⁹ Leventhall, 2009
- ¹⁰ Hove, Martinez, & Stupacher, 2020