

# Adaptively equating perceived duration of flat and percussive tones



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## Introduction

- Auditory research predominantly uses stimuli with flat amplitude envelopes (Schutz & Gillard, 2020).
- Consequently, perceptual research using other envelopes is scarce.
- This study aimed to encourage further, well-controlled research by matching perceived duration between envelopes.
- We presented flat and percussive tones in an adaptive staircase paradigm (Levitt, 1971; Leek, 2001).

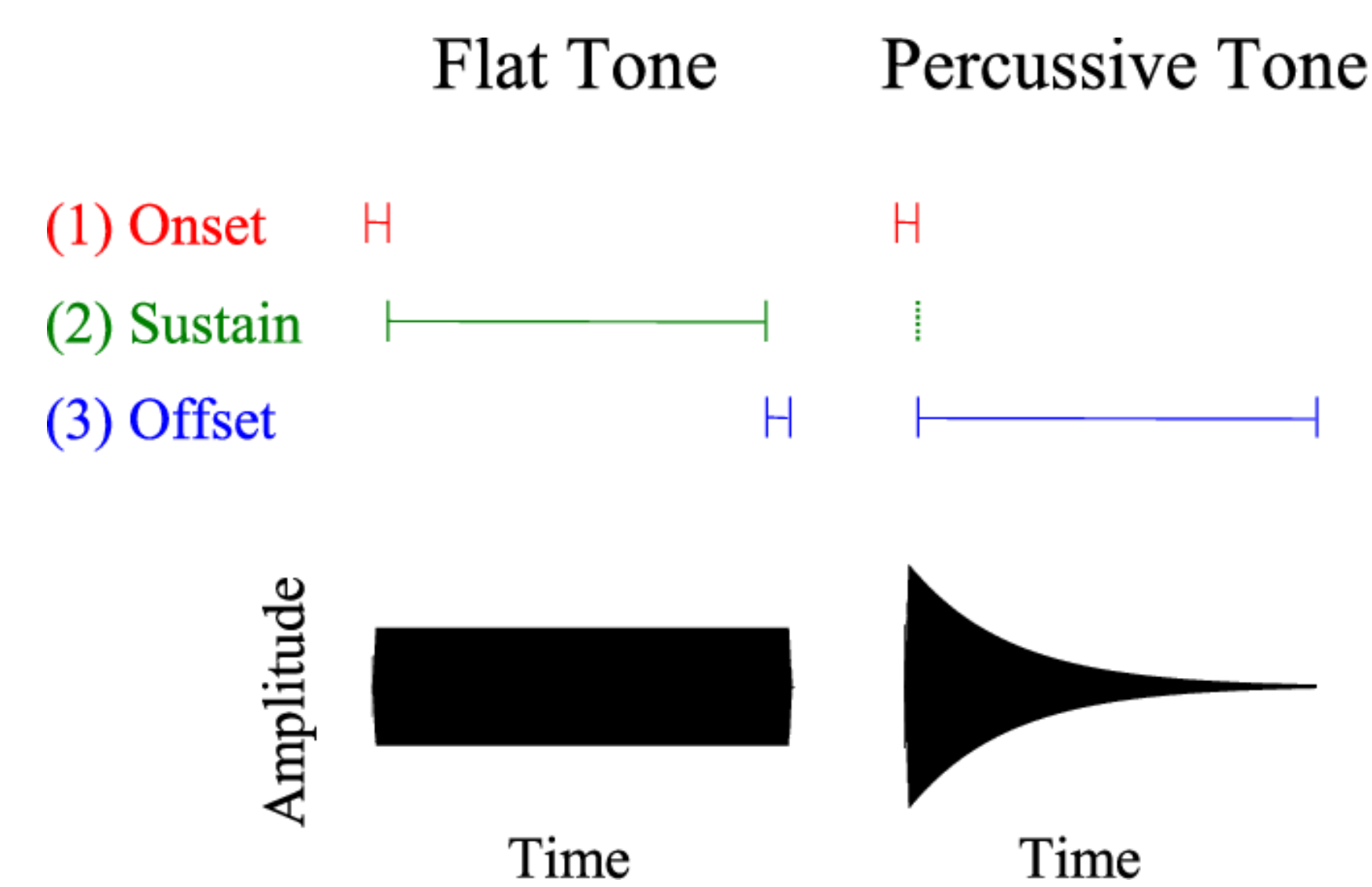


Figure 1: Diagram presenting the amplitude envelope of a flat and percussive tone.

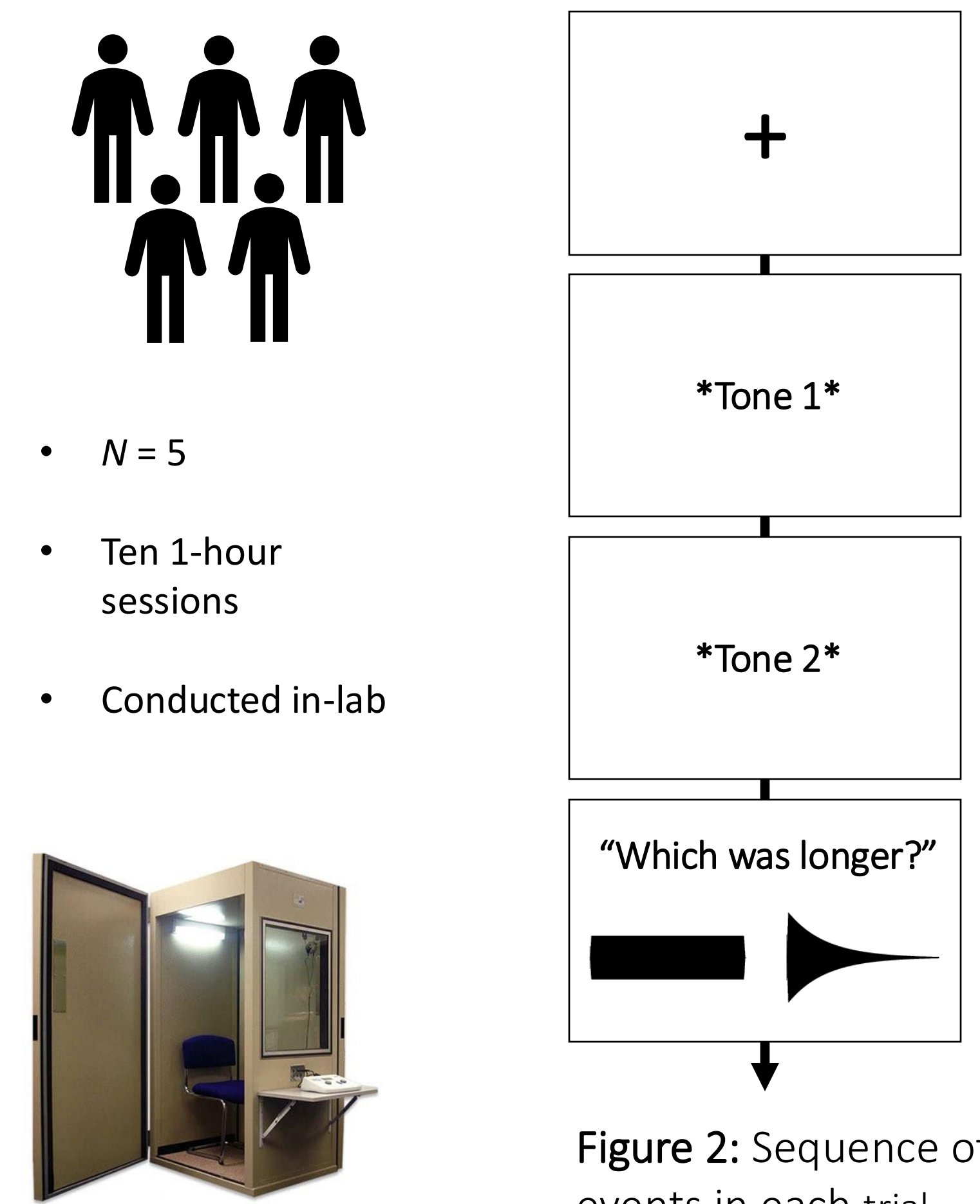


Figure 2: Sequence of events in each trial

## Method

2-Alternative Adaptive Staircase  
 Tone duration changes based on subject response.

- Two tones:
  - Standard: Fixed duration in all trials.
  - Comparator: Changes based on response (1-up 1-down)
- Interleaved: Comparator tone begins 300ms above and below standard tone.
- Consecutive termination: Staircase ends after four consecutive reversals in response direction
- Heterogenous (e.g. flat on percussive) and Homogenous (e.g. flat on flat) conditions.

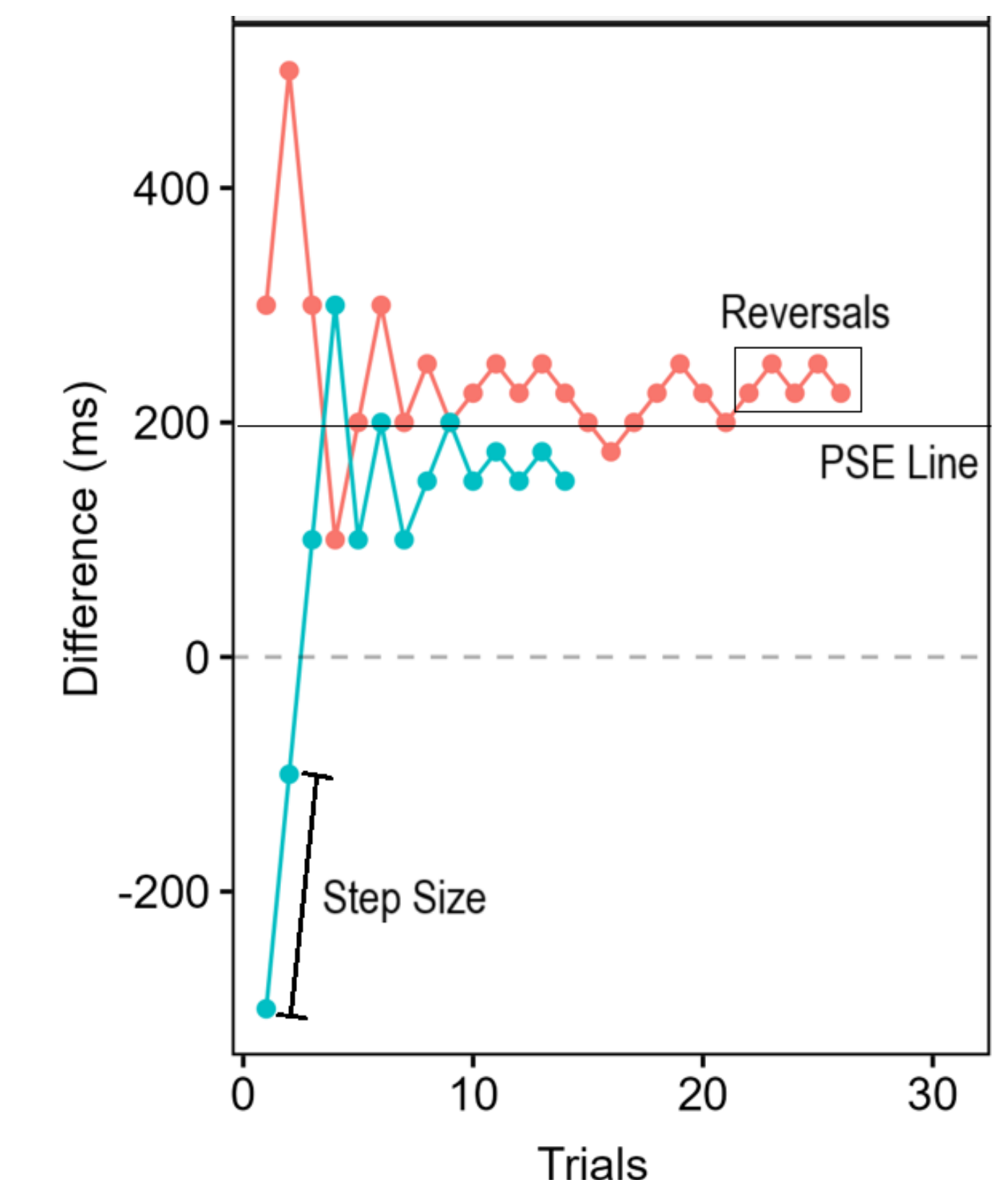


Figure 3: Example of interleaved staircase in a single subject

## Results

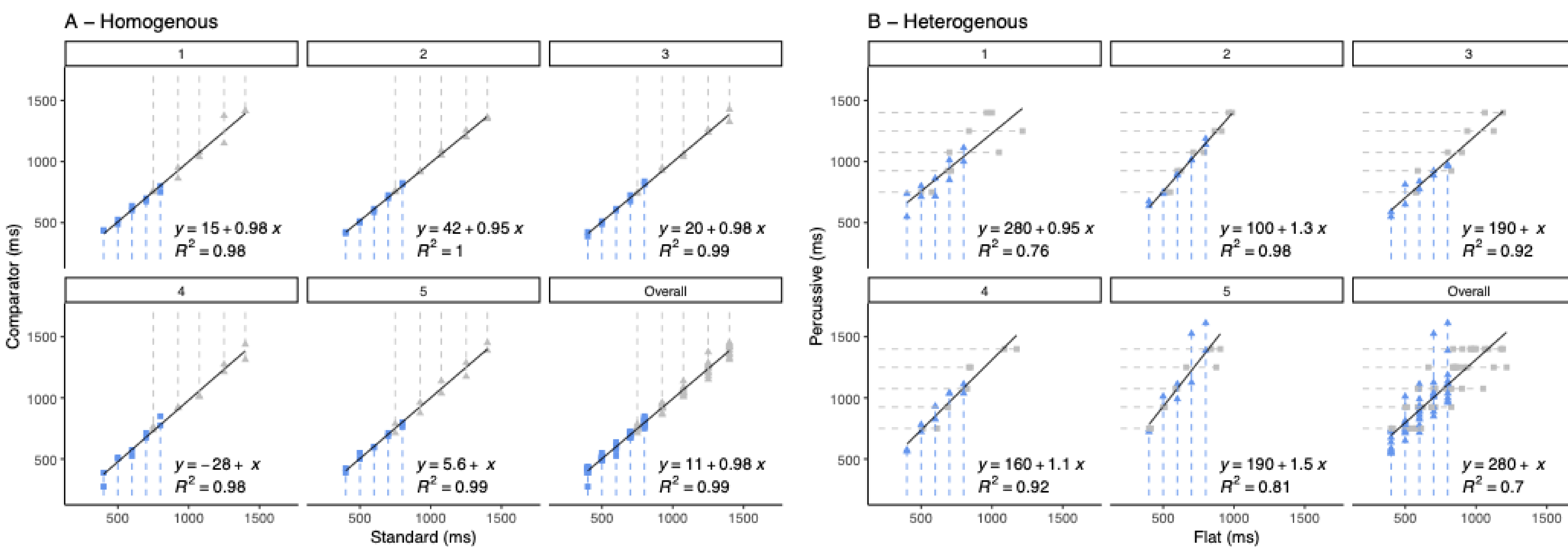


Figure 4: Linear regressions of standard duration against comparator duration for homogenous, and flat against percussive duration for heterogenous, for each participant and their combination. Dotted lines represent standard durations.

Overall ratio of perceived equality

- M = 1.47
- SD = 0.22

## Conclusions

- The final duration ratio of equal perception:
  - 1 for homogenous
  - 1.47 for heterogenous
- High consistency both within and across participants in homogenous condition.
- Lower consistency in heterogenous condition
  - Slightly lower within participants.
  - Moderately lower across participants.
- Equal perception may be a function of both slope and intercept.

## Selected references

- Leek, M. R. (2001). Adaptive procedures in psychophysical research. *Perception & Psychophysics*, 63(8), 1279–1292. <https://doi.org/10.3758/BF03194543>
- Levitt, H. (1971). Transformed Up-Down Methods in Psychoacoustics. *The Journal of the Acoustical Society of America*, 49(2B), 467–477. <https://doi.org/10.1121/1.1912375>
- Schutz, M., & Gillard, J. (2020). On the generalization of tones: A detailed exploration of non-speech auditory perception stimuli. *Scientific Reports*, 10(1), 9520. <https://doi.org/10.1038/s41598-020-63132-2>

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