**MOTIVATION**

- Hearing aid users complain about loudness.
- Clinical audiological methods don’t reflect real-life situations (Mueller and Bentler 2005).
- How should the laboratory be to reflect reality?

**RELATED WORK**

- Lower loudness preference in the laboratory than the field (Smeds et al. 2006).
- Loudness studied in the laboratory (Heeren et al. 2003, Appell 2002) to predict loudness perception and ratings.
- Visual cues play a role in the laboratory. Sounds are perceived less loud with visual cues (Fastl 2004).

**METHOD**

- Loudness and annoyance ratings of vehicle noise in the field:
  - 4 different vehicles (car, motorbike, van, street sweeper)
  - 5 driving urban actions (stand by, accelerate, 30 km/h, 50 km/h, break to stop) and 3 for the street sweeper (stand by, brushes on, brushing forward).
  - 72 rated driving actions per participant.
- Participants:
  - 19 NH listeners (9 female, mean age 50 yrs, SD: 19.2, PTA=3.8 dB HL, SD: 4.7)
  - 20 HI (12 female, mean age 72 yrs, SD: 12.0, PTA=38.5 dB HL, SD: 6.8) with NAL-NL2 and trueLOUDNESS (Oetting et al. 2018).
- Categorical Loudness Scale (CLS) and ICBEN numerical annoyance scale (0-10).

- Field experiments recorded with a 360º camera (Xiami Mi Sphere Camera), a tetrahedral microphone (Core Sound TetraMic) and a level meter.
- Stimuli available at https://gerardllorach.weebly.com/work.html

**RESULTS**

- Ratings in the field were lower than predicted for stimuli below 40 sones.
- Annoyance ratings were highly correlated to loudness ratings ($r = 0.82$, $p<0.001$).
- Little variation in the driving actions and consistent ratings of the participants.

**CONCLUSION**

- Reality replication (in progress):
  - Same acoustic levels with different laboratory conditions, e.g., mono, stereo, first-order-ambisonics; desktop screen, head-mounted display, CAVE.
- Level adjustment:
  - Participants choose the gain of the stimuli to match reality.

**FUTURE LABORATORY EXPERIMENTS**

- Participants:
  - 19 NH listeners (9 female, mean age 50 yrs, SD: 19.2, PTA=3.8 dB HL, SD: 4.7)
  - 20 HI (12 female, mean age 72 yrs, SD: 12.0, PTA=38.5 dB HL, SD: 6.8) with NAL-NL2 and trueLOUDNESS (Oetting et al. 2018).
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**REFERENCES**


