

Introduction

The capacity to connect today's hearing aids to the cloud via a mobile phone opens up the possibility of collecting and storing large quantities of data. This can include information about the soundscapes in which the hearing aid (HA) is used and the HA settings at the time. By combining this information with real-time self-reported outcomes collected via Ecological Momentary Assessment (EMA) - a method in which questions are answered in real-time using mobile technology - we can obtain a detailed understanding of a user's listening difficulties.

In this poster we present data collected via both EMA and datalogging to illustrate the necessity of combining data from both sources if we are to obtain a good understanding of real-world listening challenges.

Aim

To examine associations between EMA survey responses and HA soundscape data logged via a mobile phone.

Method

Participants: 41 experienced HA users aged 26-79 years (M=64.8; SD=12).

Study hearing aids: Oticon Opn-S and Oticon More. Ambient sound pressure levels (SPLs) and signal-to-noise ratios (SNRs) detected by the HAs were logged and timestamped every 20 seconds. The HAs also categorised relative usage time as follows: <0.5 hr., 0.5-2 hr., 2-4 hr., 4-8 hr., 8-12 hr., 12-20 hr., 20+ hr.

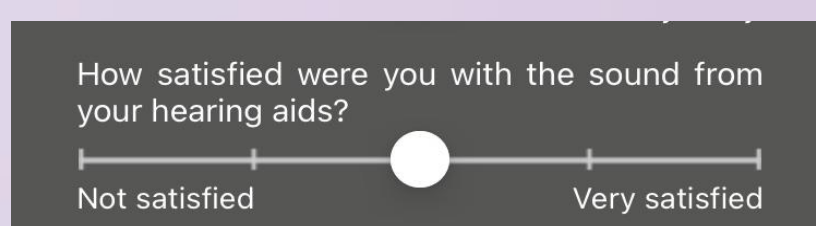
Protocol: Participants wore both pairs of HAs for two weeks each. Order of wear was counterbalanced across participants. Data from both HAs were combined for analyses.

Participants completed several EMA surveys each day using a mobile phone app. The app also stored the most common soundscape category derived over a 5-minute interval prior to the survey prompt/initiation. Surveys were self-initiated or initiated via a phone prompt.

The EMA survey asked about the listening situation (a pull down list), whether the situation was still happening at the time of survey completion, and for 6 ratings (see Fig 1 for response format).

Ratings and slider anchors: Noisiness: *Quiet-Very noisy*; Satisfaction: *Not-Very*; Ability to focus, Ability to ignore surroundings, and Ability to localise sound sources: *Difficult-Easy*; Ability to hear surroundings: *Not very well-Very well*.

Fig 1. Screenshot of app response format



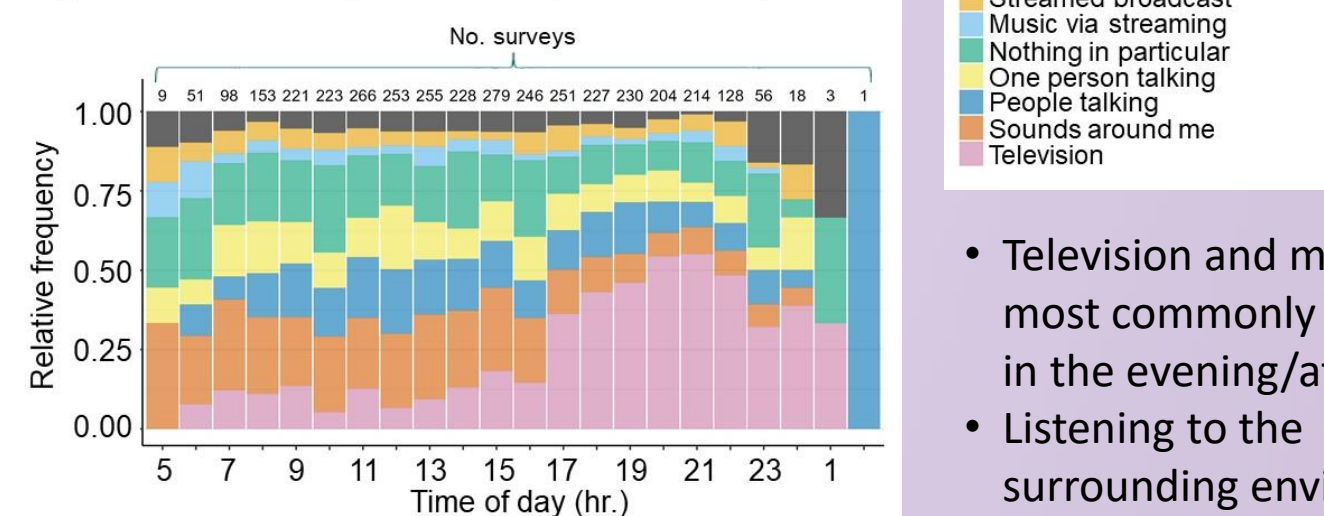
Results

On average, relative use time fell into the 12-20 hr. category and participants completed a median of 86 EMA surveys over their four-week trial. This demonstrates good study compliance.

Listening activities assessed by EMA

Figure 2 shows the listening activities reported at the time an EMA survey was completed by time of day.

Fig 2. EMA listening activities by time of day



- Television and music are most commonly listened to in the evening/at night.
- Listening to the surrounding environment and nothing in particular are common.

Listening environment extracted from datalogging

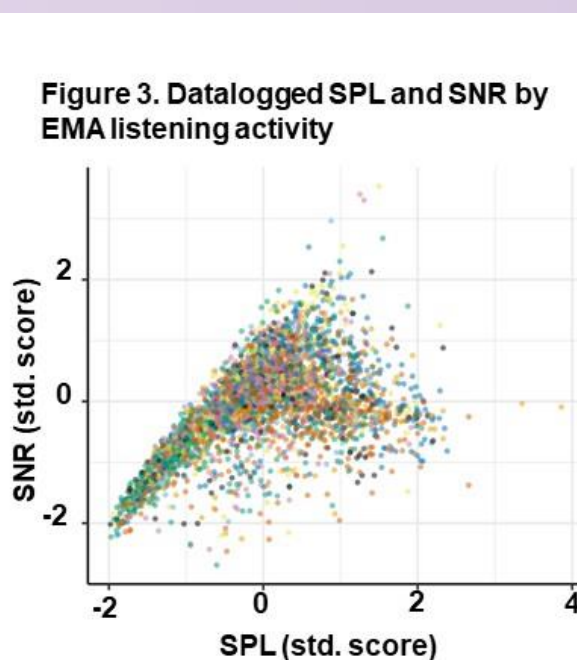
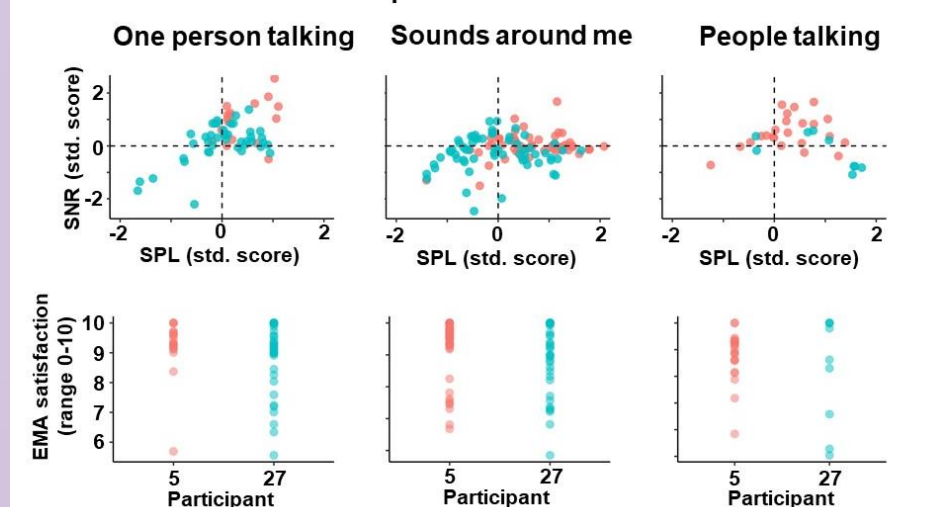


Figure 3 shows the SPL and SNR recorded by the hearing aids for each listening activity recorded by EMA. It illustrates just how variable the sound environment can be for each activity and thus that the datalogged soundscape does not reflect listening intent.

Listening environment relative to EMA ratings

Figure 4 contrasts data for two selected participants (orange vs blue dots) - the datalogged SNR relative to satisfaction ratings for 3 listening EMA-reported activities. It highlights the individual differences in sound environments for the same listening activity, and illustrates how they interact to impact satisfaction.

Figure 4. Data from 2 participants for datalogged SNR and EMA-rated satisfaction for three EMA-reported activities.



Discussion

Participants were willing to complete EMA surveys. They did this for a variety of listening activities and in varying sound environments. The data illustrates the importance of combining data from EMA with that obtained through soundscape datalogging when trying to understand variation in reported hearing aid outcomes.

Acknowledgments

This research was funded by Oticon and supported by the NIHR Manchester Biomedical Research Centre