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# Data analysis from real-world hearing assessment

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## Motivation & Objectives

Ecological Momentary Assessment (EMA) is a promising approach to evaluating the impact of hearing loss and the benefit of rehabilitative interventions in real-world settings.[1]
However, abandoning controlled test conditions certainly underlines the need for both technical validation of the gathered data and patient-centered interpretation.

This contribution presents a framework that provides an ad-hoc analysis for individual EMA data derived using a smartphone-based system (see poster P-05 in this session[2]

## Data types

Smoothed acoustical features (no recordings)

- Stereo RMS Levels
- Power Spectral Densities (PSDs)
- Zero Crossing Rate (ZCR)

Digital questionnaire

- Situations, activities, and sound sources
- Assessments, e.g., listening effort, speech understanding, loudness, disability

Individual data exemplified

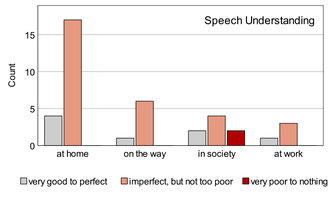
- Female, 62 yrs, high freq HL, before HA fitting
- EMA for 5 days (47 hours), 13.3 GB

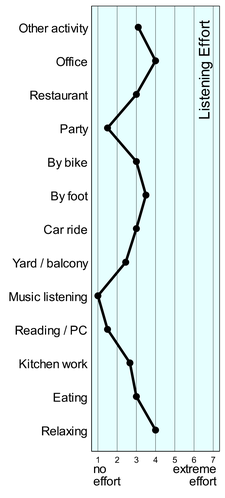
## Study participant's view

**Feedback** to EMA results was given during the appointment based on 16 easily comprehensible figures showing

- Proportional distribution of assessed situations
- Descriptive statistics
  - Speech understanding
  - Listening effort
  - Disability

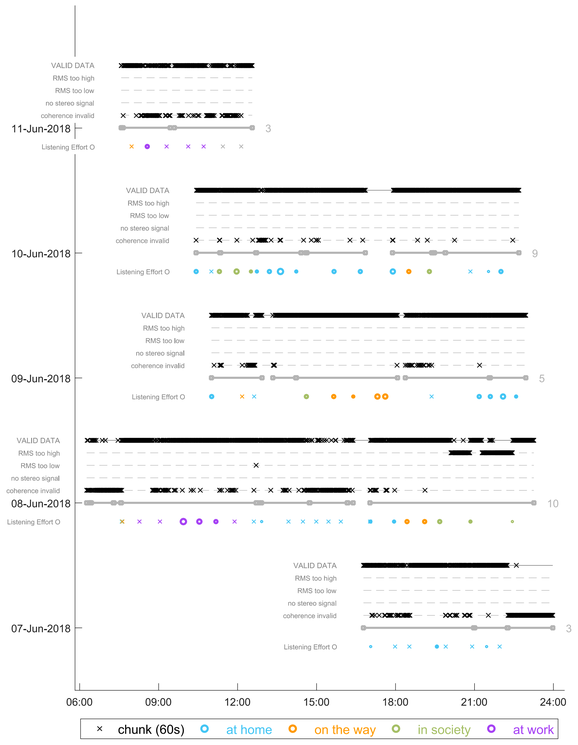
  split by situation, activity, and target source




## Data overview and validation

7-11, Jun 2018




The **overview** figure provides condensed information on

- Data availability
- Validity of acoustical feature data
- Assessments by situations

→ versus time

Fast check for

- RMS within the dynamic range
- Stereo or mono signal
- Reasonable max. coherence (real part)

→ summarized in the variable VALID DATA

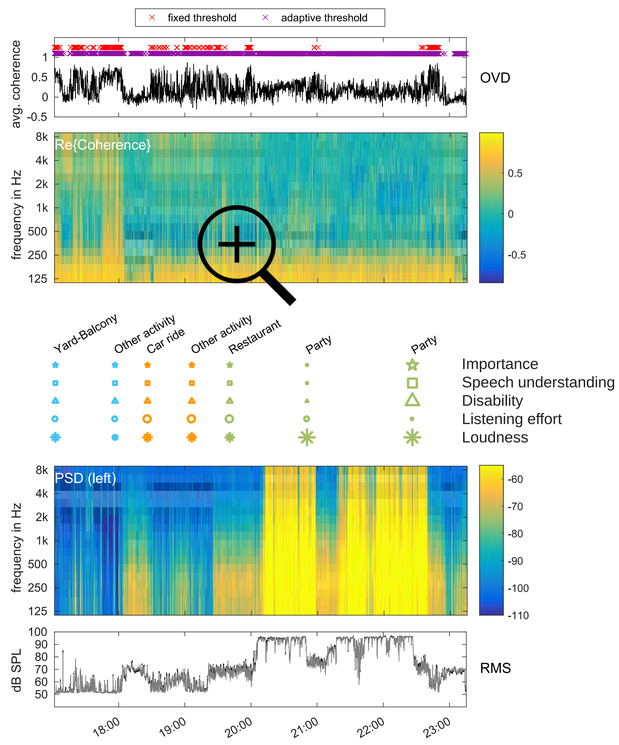
Count of data transfer interruptions/parts

Display of selected assessments, e.g.,

- Listening effort ○
- Any assessment given except listening effort x

## Assessments and real-life acoustical properties

8, Jun, 17:00- 22:00




The **fingerprint** figures provide data values for

- RMS
- PSDs
- Assessments by situations
- Coherence spectrogram
- Averaged coherence (400 Hz -1 kHz)
- Chunks (60s) containing the study participants own voice x x

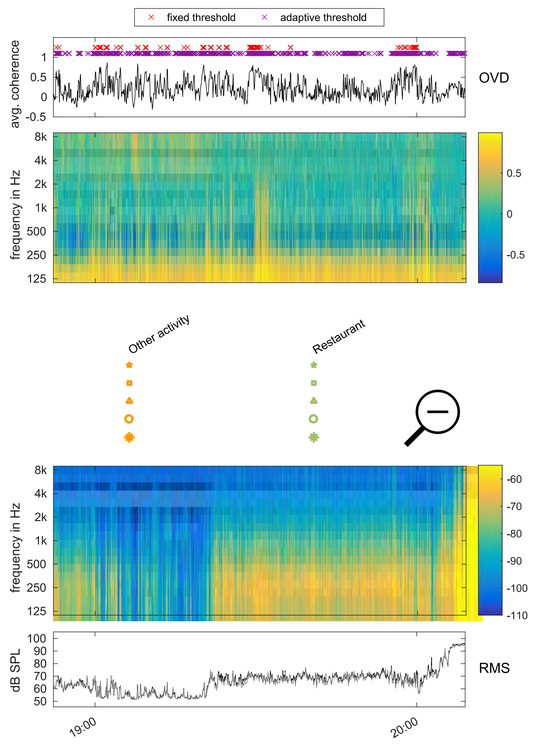
→ for selected time periods

Scaled display of subjective assessments


very important, no speech understanding, extremely disabled, extreme effort, too loud

## Data browser / Zoom

8, Jun, 18:00-20:00




The **zoom function** allows for enlarging the display and detailed inspection of the acoustical feature data and the corresponding assessments.

**Own voice detection (OVD)** is critical for level- and SNR estimations and is based either on a

- Fixed threshold[3]
  avg. coherence > 0.6
- Adaptive threshold[4]
  adjusted to min/max values of the avg. coherence in a given and well-defined time frame (60s) – *work in progress* –

**Future work**

- Optimization of competing OVD algorithms
- Analysis of the relationship between objective and subjective data

## References

[1] Holube I, von Gablenz P, Kowalk U, Meis M, Bitzer J. *What's going on? Individualized evaluation in the real world.* **IHCON 2018;** [2] Kowalk U, Holube I, Franz S, Groenewold H, von Gablenz P, Kissner S, Bitzer J. *An open source toolkit for privacy-preserving real-world EMA data collection*. **IHCON 2018;** [3] Bitzer J, Kissner S. *Two-channel Coherence-Based Own Voice Detection for Privacy-aware Longterm Acoustic Measurements*. Speech Communication. **ITG 2016;** [4] Bitzer J, Bilert S, Holube I. *Evaluation of Own Voice Detection (OVD) algorithms*. **ITG 2018**

## Acknowledgements

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