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Towards a comprehensive assessment of unilateral hearing loss

Joaquin T. Valderrama[1,2,3,4,*] (jvalderrama@ugr.es), Colin Barbier[5,6,3] (cquba@dtu.dk), Paola Incerti[3,4] (paola.incerti@nal.gov.au), Jorge Mejia[3,7] (jorge.mejia@nal.gov.au), Melanie Ferguson[8] (melanie.ferguson@curtin.edu.au)

[1] Department of Signal Theory, Telematics and Communications, University of Granada, Granada, Spain
[2] Research Centre for Information and Communications Technologies, University of Granada, Granada, Spain
[3] National Acoustic Laboratories, Sydney, Australia
[4] Department of Linguistics, Macquarie University, Sydney, Australia
[5] Hearing Systems, Department of Health Technology, Denmark Technical University, Copenhagen, Denmark
[6] Copenhagen Hearing and Balance Center, Rigshospitalet, Copenhagen, Denmark
[7] School of Computing, Macquarie University, Sydney, Australia
[8] Curtin enAble Institute, Faculty of Health Sciences, Curtin University, Perth Australia
* Presenting author

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ABSTRACT

Aims: To design, implement and evaluate the sensitivity of a novel test battery to the unique hearing challenges experienced by people with unilateral hearing loss (UHL) in real-life environments.

Population: Sixteen normal-hearing (NH: 18–70 years, 6 females) and 16 UHL (25–75 years, 12 females) native-English individuals participated in the study. In the UHL group, 14 participants had severe-to-profound hearing loss and 2 participants had moderate hearing loss in the poorer ear.

Methods: The hearing profile of the participants was characterised in terms of (1) *listening effort*—determined by the participants' reaction time to a single task; (2) *speech-in-noise comprehension*—for this we used the 'Dynamic Comprehension Test' developed by the National Acoustic Laboratories (NAL-DCT); (3) *head movement* while listening in noise, measured by a head-tracking device; and (4) their *self-perceived hearing difficulties*, assessed both via standardised questionnaires, and in real environments where participants tend to experience hearing difficulties (e.g., noisy cafés, restaurants) using Ecological Momentary Assessment (EMA) methodologies.

Results: Relative to NH, UHL participants presented (1) longer reaction times (850 vs 752 ms, p-value = 0.049); (2) worse speech-in-noise comprehension performance—68.2% vs 73.7% accuracy, which due to the high inter-subject variability, the group difference was close to statistical significance (p-value = 0.07); (3) more frequent and more lateralised head movements while listening in noise; and (4) overall increased self-perceived hearing difficulties, including worse understanding in noise, higher frustration, higher mental effort, and worse localisation ability. Importantly, speech-in-noise comprehension performance could be predicted from a combined measure of EMA and reaction time (Pearson-r = 0.796, p-value = 0.0082).

Interpretation: Results show that the hearing difficulties experienced by individuals with UHL are multidimensional. UHL participants not only presented poorer understanding-in-noise levels than their NH counterparts, but also had to develop coping strategies such as making more prominent head movements to take advantage of the limited spatial cues provided by their monaural hearing, and had to dedicate more cognitive resources to segregate the speech stream from other noise distractors. Further, the large variability observed in UHL data could indicate the existence of different categories within the study group, each of them with their unique needs and challenges.

Conclusion: The proposed test battery is sensitive to different dimensions of hearing difficulties experienced by individuals with UHL. This result supports the need for a comprehensive assessment beyond pure-tone audiometric thresholds, aimed at segmenting the UHL population into different categories of similar hearing profiles. This segmentation may inspire new research leading to optimal interventions and individualised therapies.