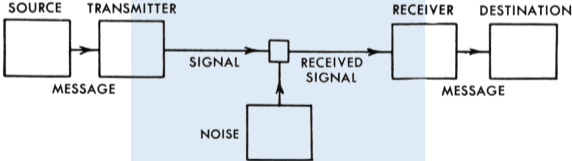
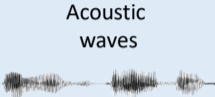
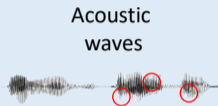


Objectives of the fastACI team



Objectives of the fastACI team



acoustic cues



mental representation
of a phoneme

Φ

physical

Ψ

perceptual

Reverse correlation (aka **revcorr**) is the perfect tool to reveal perceptual cues used in a psychophysical task, based on purely behavioral data... in particular for auditory categorization tasks. [Varnet et al. 2013, 2015; Varnet & Lorenzi, 2022; Osses & Varnet, 2023]

Core idea: adding **random fluctuations** to the stimulus and measure how they affect the participant's responses on a trial-by-trial basis.

[Introduction](#)[ACI method](#)[Group results](#)[Interindividual variability](#)[HI listeners](#)[Conclusions](#)

Original Article

High-Frequency Sensorineural Hearing Loss Alters Cue-Weighting Strategies for Discriminating Stop Consonants in Noise

Léo Varnet¹, Chloé Langlet¹, Christian Lorenzi¹, Diane S. Lazard², and Christophe Michey³

Abstract

There is increasing evidence that (NH) individuals, even when we perceptual strategies is an important two complementary approaches: noise and (b) measuring the recordings altered by the spectrotemporal locations of The cue-weighting strategies with frequency loss, and 15 HI list amplification to compensate for than on the low-frequency differences in internal noise. In

Trends in Hearing
Volume 23: 1–18
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DOI: 10.1177/2331214519886707
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SAGE

JASA ARTICLE

Probing temporal modulation detection in white noise intrinsic envelope fluctuations: A reverse-correlation study

Léo Varnet¹ and Christian Lorenzi²

Laboratoire des Systèmes Perceptifs, Département d'Études Cognitives, École Normale Supérieure, Université Paris Sciences & Lettres, Centre National de la Recherche Scientifique, 75005 Paris, France

frontiers in
HUMAN NEUROSCIENCE

Using auditory classification images for the identification of fine acoustic cues used in speech perception

Léo Varnet^{1,2*}, Kenneth Knoblauch³, Fanny Meunier^{1,2,4} and Michel Hoen^{1,2}

¹ Neuroscience Research Centre, Brain Dynamics and Cognition Team, INSERM U1028, CNRS UMR5292, Lyon, France

² Ecole Doctorale Neurosciences et Cognition, Université de Lyon, Université Lyon 1, Lyon, France

³ Integrative Neuroscience Department, Stem Cell and Brain Research Institute, INSERM U846, Bron, France

METHODS ARTICLE

published: 16 December 2013
doi: 10.3389/fnhum.2013.00865



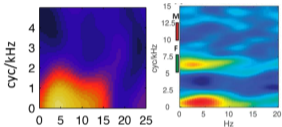
White noise on sound perception results from the mask random intrinsic envelope fluctuations arising from the effects on this phenomenon to probe AM detection through a normal-hearing listeners were asked to detect the carrier using a yes-no task with 3000 trials/participant. A reverse-correlation analysis was then carried on the effects of the stimulus' temporal envelope influences simulated with different implementations of a modulation. Normal listeners were able to track the position of AM and showed a marked temporal decay and a consistent pattern of related data, this was interpreted as an evidence for envelope fluctuations. © 2022 Acoustical Society of America

Auditory revcorr studies (full diagram on <https://dbao.leo-varnet.fr/>)

high level

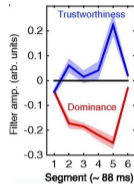
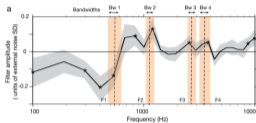
sentence recognition

[Venezia et al., 2016, 2019]



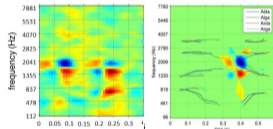
paralinguistics

[Ponsot et al., 2018a, 2018b]

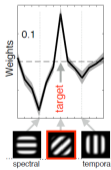
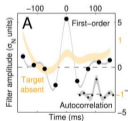
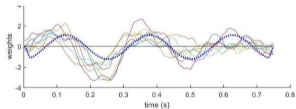


phoneme categorization

[Varnet et al., 2013, 2015]



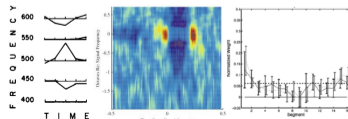
modulation perception



[Ponsot et al., 2020;
Joosten & Neri, 2012;
Varnet & Lorenzi, 2022]

pure-tone detection & loudness perception

[Ahumada & Lovell, 1971; Shub & Richards, 2009; Ponsot et al. 2013]



low level

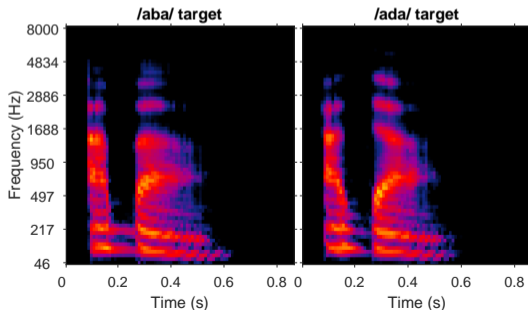
Aba/Ada experiment [Osses & Varnet, 2023]

Topic: perception of stop consonants /b/ and /d/.

Targets: 2 VCV sounds (t_0 =/aba/ and t_1 =/ada/) from the Oldenburg Logatome Corpus [Wesker et al., 2005], equalized in duration and rms.



Alejandro Osses



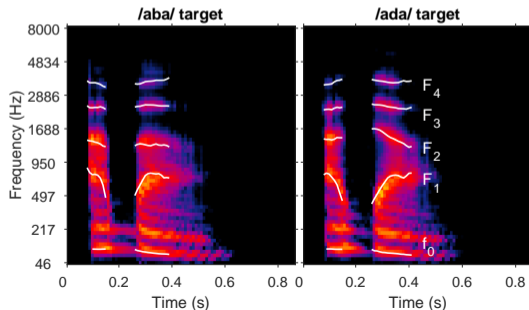
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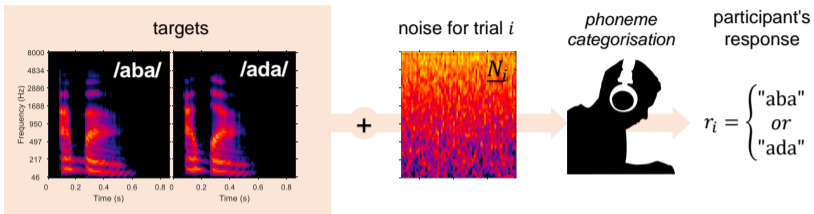
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Alejandro Osses



Aba/Ada experiment [Osses & Varnet, 2023]



[Introduction](#)

[ACI method](#)

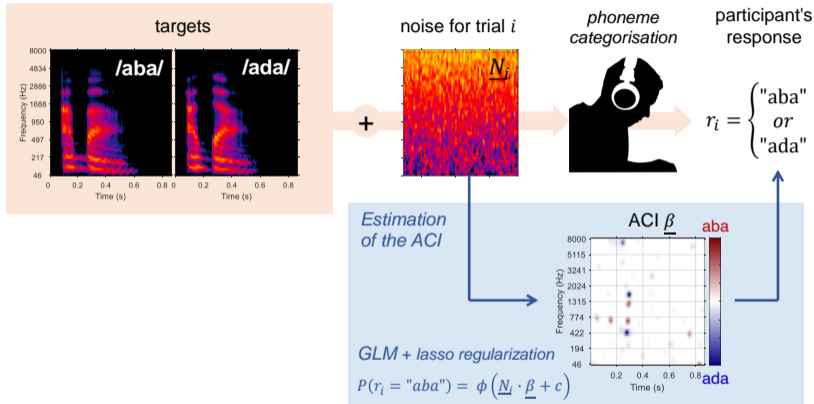
[Group results](#)

[Interindividual variability](#)

[HI listeners](#)

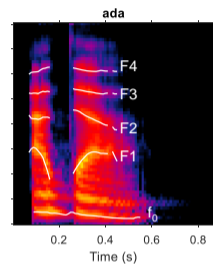
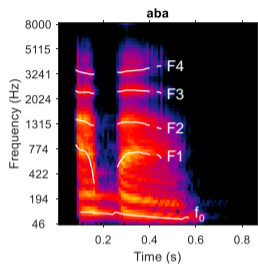
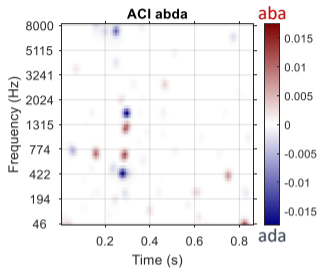
[Conclusions](#)

Aba/Ada experiment [Osses & Varnet, 2023]

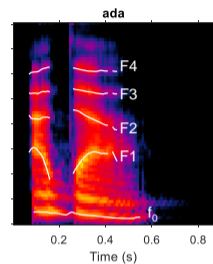
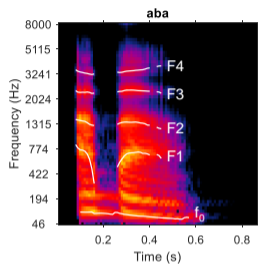
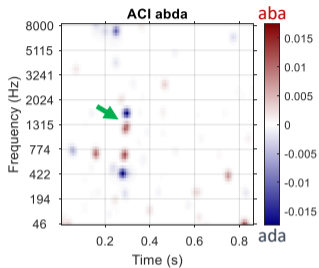


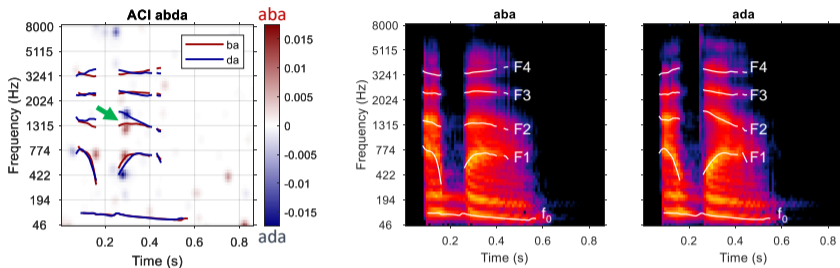
Auditory Classification Image (ACI): time-frequency matrix of decision weights. Shows how a specific noise configuration can mislead the participant.

Results [Osses & Varnet, 2023]

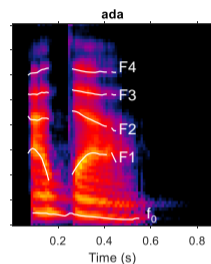
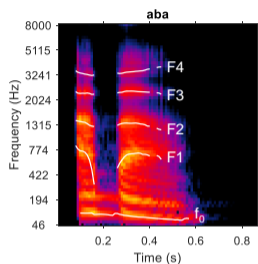
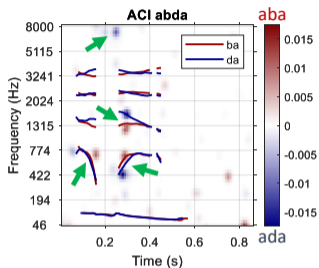


Results [Osses & Varnet, 2023]





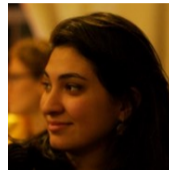
- The analysis successfully identified the **main cue** for the task (F2 onset), consistent with the phonetics literature [Lieberman et al., 1954]...



- The analysis successfully identified the **main cue** for the task (F2 onset), consistent with the phonetics literature [Lieberman et al., 1954]...
- ...as well as several **secondary cues** (e.g., F1 onset).

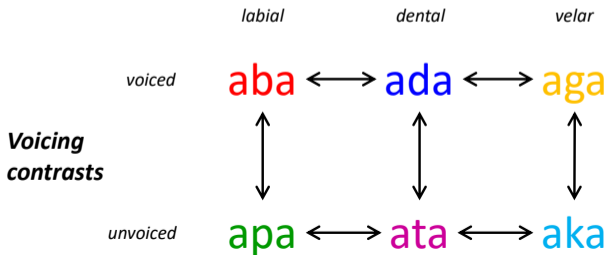
Plosive consonants experiment [Carranante et al., 2024]

- Discrimination task in noise
- 6 target sounds (plosive C in context /aCa/)
- 7 participants × 7 contrasts, 4.000 trials/condition



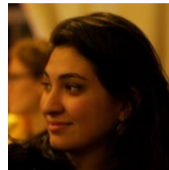
Géraldine Carranante

Place of articulation contrasts



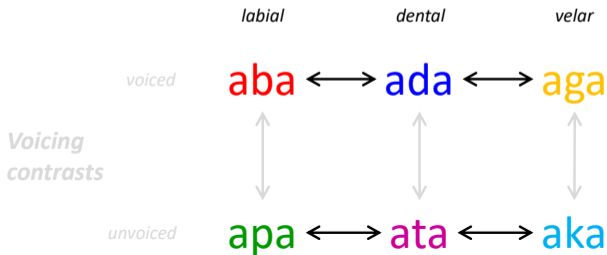
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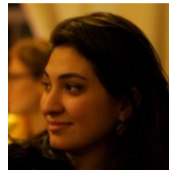
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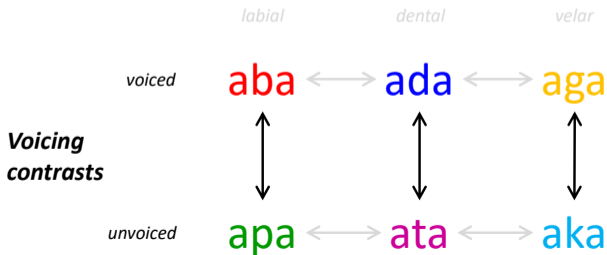
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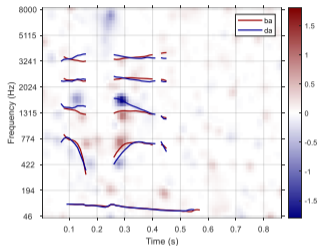


Group-averaged ACIs

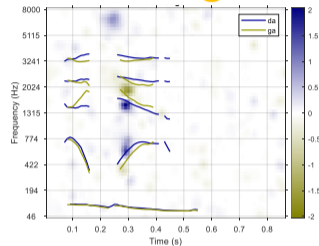
Place of articulation cues:

- F2 onset
- F1 onset
- release burst (/d/ and /t/)
- coarticulation on F1 and F2

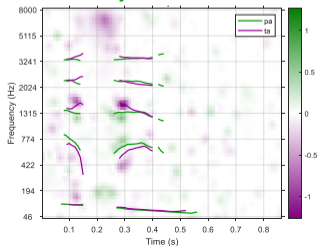
aba-ada



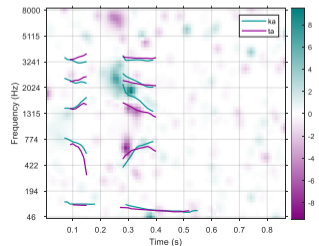
ada-aga



apa-ata



ata-aka

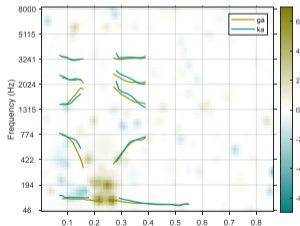


Group-averaged ACIs

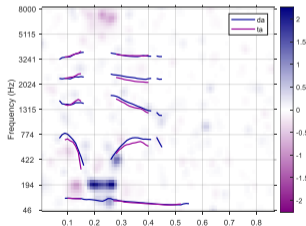
Voicing cues:

- voicing bar
- F1 onset
- release burst (only for /t/)

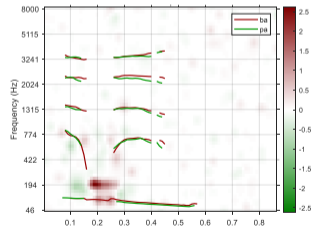
aga-aka



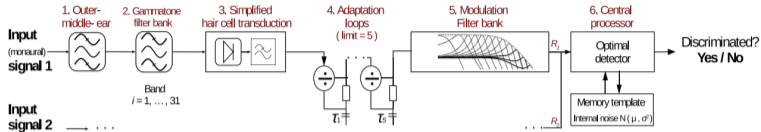
ada-ata



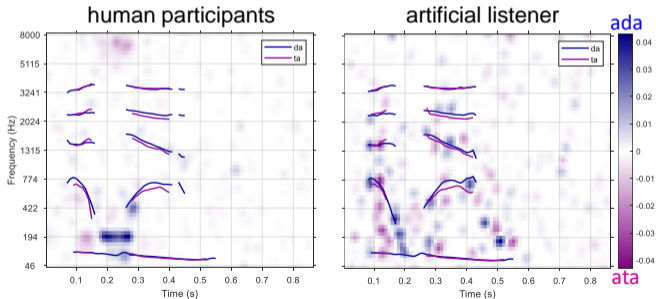
aba-apa



Artificial listener

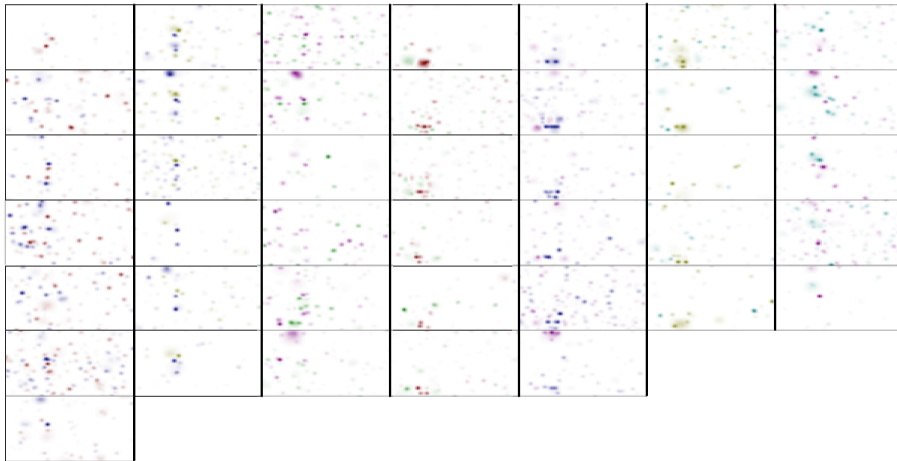


Artificial listener: updated PEMO [Osses & Kohlrausch, 2021]



Interindividual variability

aba-ada ada-aga apa-ata aba-apa ada-ata aga-aka aka-ata



Introduction

ACI method

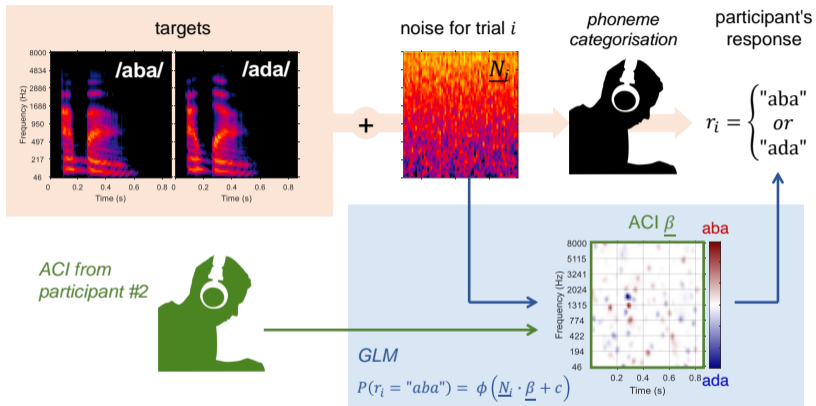
Group results

Interindividual variability

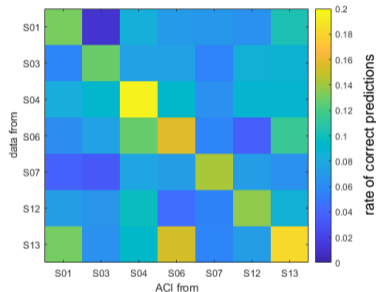
HI listeners

Conclusions

Interindividual variability



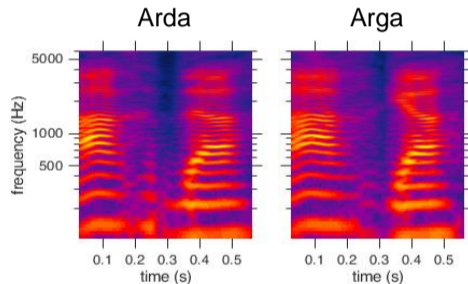
The similarity between listening strategies can be quantified by attempting to predict the responses of one participant using the ACI of another.



Our group of normal-hearing participants shows significant heterogeneity in their listening strategies: the ACI of one participant is better at predicting new data from this participant, rather than new data from another participant.

Comparing the strategies of NH and HI listeners [Varnet et al., 2019]

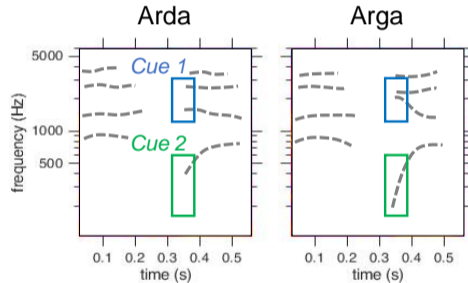
Cues for categorizing da/ga in noise:



Comparing the strategies of NH and HI listeners [Varnet et al., 2019]

Cues for categorizing da/ga in noise:

- Primary HF cue: F2/F3 onsets
- Secondary LF cue: F1 onset

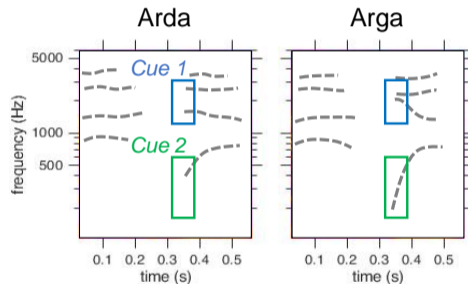


Comparing the strategies of NH and HI listeners [Varnet et al., 2019]

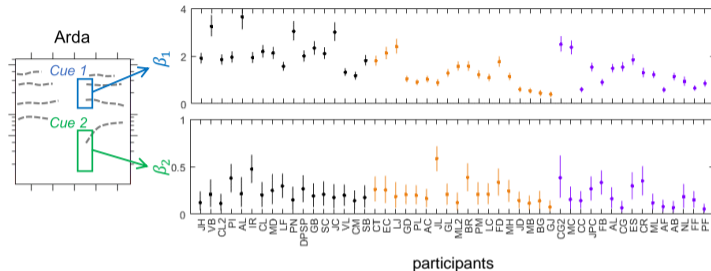
Cues for categorizing da/ga in noise:

- **Primary HF cue:** F2/F3 onsets
- **Secondary LF cue:** F1 onset

How is the relative importance of the high- and low-frequency cues impacted by hearing loss?



Comparing the strategies of NH and HI listeners [Varnet et al., 2019]



3 groups:

- NH
- HI (HF loss)
- HI (flat loss)

Audibility restored by amplification (NAL-R formula).

Introduction

ACI method

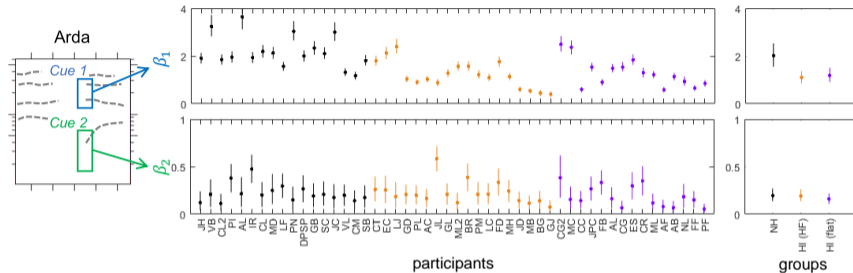
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Introduction

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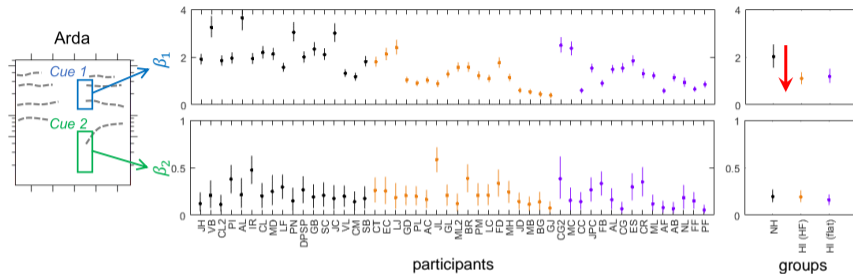
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Differences in the exact weights associated to each cue.

Introduction

ACI method

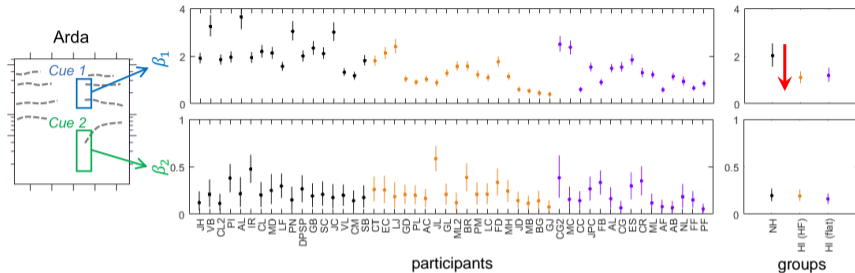
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Differences in the exact weights associated to each cue.

HI participants show **different cue-weighting strategies**, even though their hearing loss was corrected through amplification.

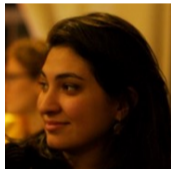


Sarah Attia

Collecting **ACIs for many auditory profiles** (PTT, age, experience with hearing aids...) to explore:

1. how listening strategies for phoneme comprehension depend on these characteristics
2. what is the interindividual variability within each group
3. whether there is a link between individual strategies and efficiency of hearing aids

Thanks for your attention!
And thanks to all my collaborators:



Alejandro **Osses**, Géraldine **Carranante**, Maria **Giavazzi**, Christian **Lorenzi**, Sarah **Attia**