HealthRecSys '19 – September 20th, 2019

Rethinking Hearing Aids as Recommender Systems

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oticon PEOPLE FIRST

Hearing Loss

In 2019

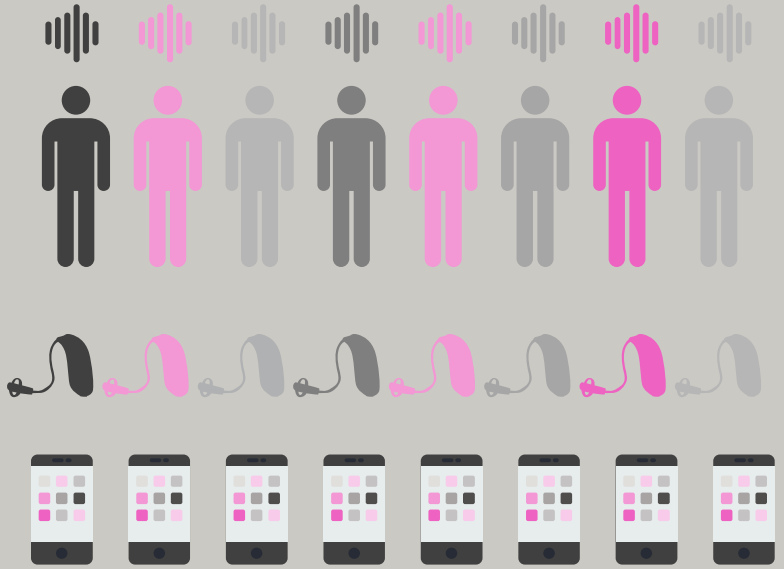
33% of people over 65 have disabling hearing loss[1]

By 2050

10% of the world's population will have disabling hearing loss[1]

[1] WHO (https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss)

Treating Hearing Loss



Rethinking Hearing Aids as Recommender Systems

Item

Complex device configuration

Multiple parameters influence the experience of hearing-impaired users

User

Hearing is a subjective sense

Users perceive the sounds differently and might

benefit from a fully personalized hearing aid configuration

Context

Constantly changing sound environment

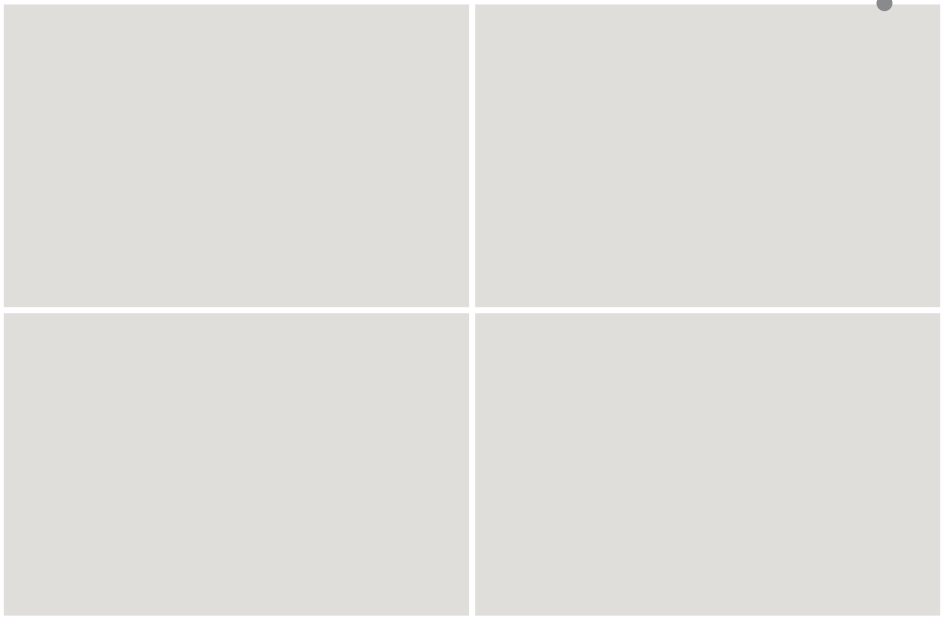
Users might have different preferences in different situations

Rating

Learning user preferences

How to effectively gather them in multiple real-world situations?

Rethinking Hearing Aids as Recommender Systems



1. **Fitting Space**
   It’s the space defined by the different possible combinations of settings that can be applied to a hearing aid, based on the audiogram of the user.

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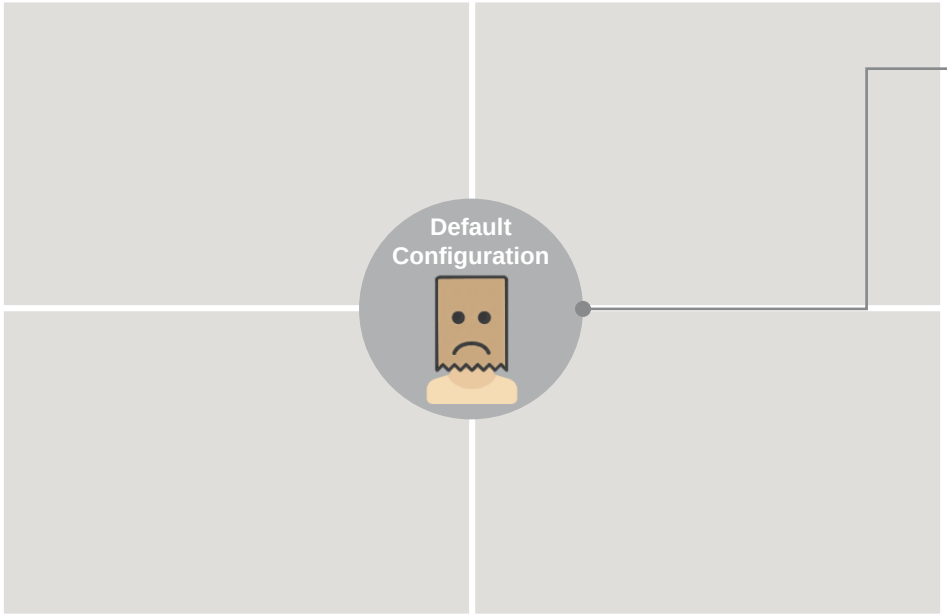

1. **Fitting Space**
   It's the space defined by the different possible combinations of settings that can be applied to a hearing aid.

2. **Default Configuration**
   The default configuration is a combination of medium settings, adopted when user preferences are not known. Previous research showed that people have different characteristics and hearing preferences. [5,6]

[5] Mead C Killion. (2002). "New thinking on hearing in noise: a generalized articulation index", Seminars in Hearing, vol. 23 no. 1
[6] Marozeau, J., and Florentine, M. (2007), "Loudness growth in individual listeners with hearing losses: A review", Journal of the Acoustical Society of America: JASA express letters, vol. 122, pages EL81-EL87

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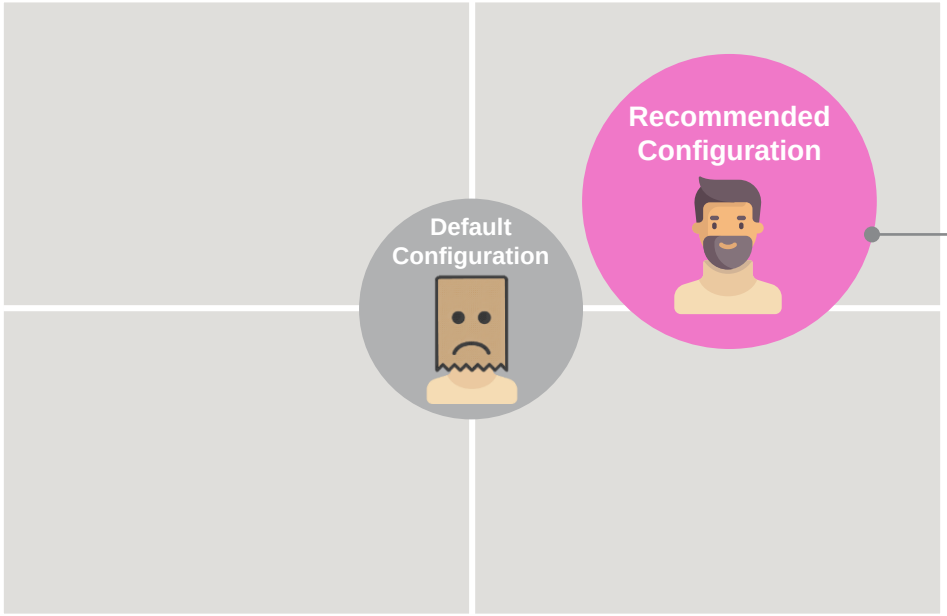


1. **Fitting Space**
   It's the space defined by the different possible combinations of settings that can be applied to a hearing aid.

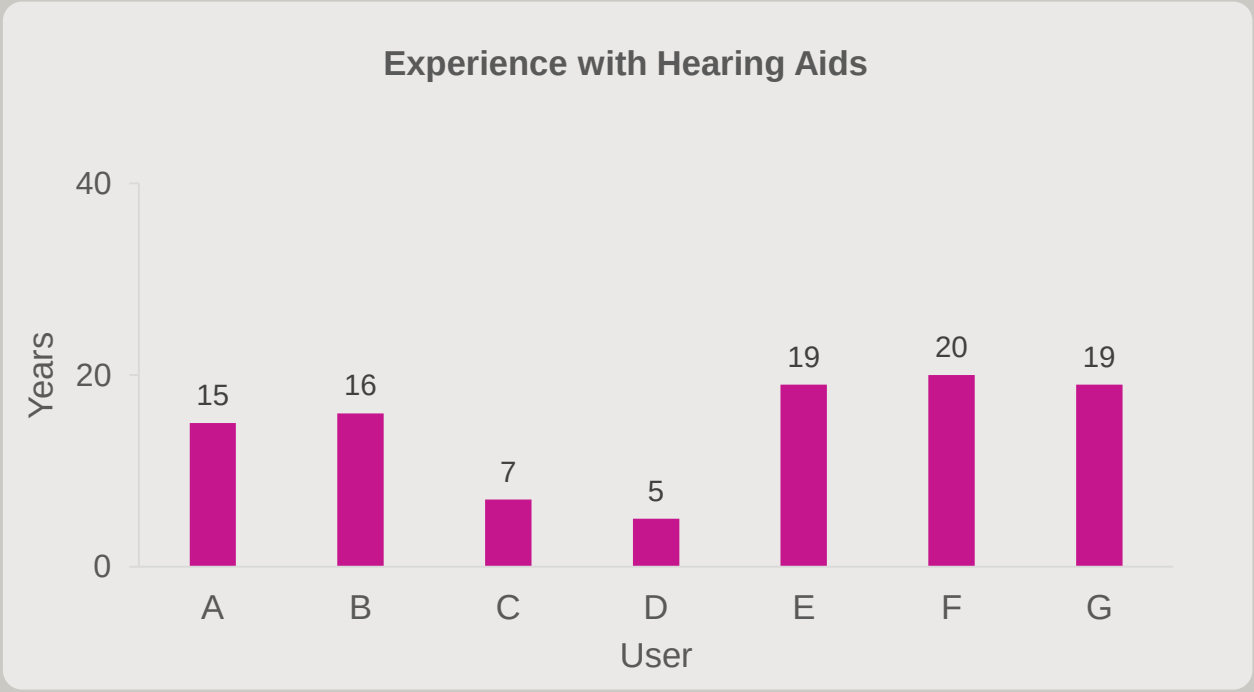
2. **Default Configuration**
   The default configuration is a combination of medium settings, adopted when user preferences are not known.

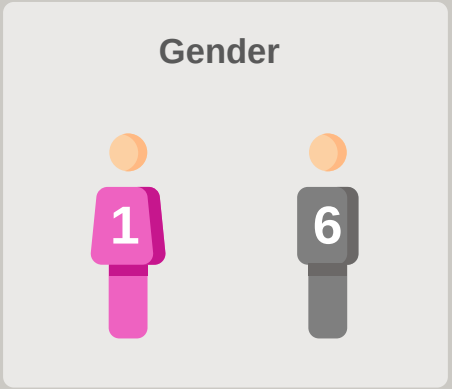
3. **Recommended Configuration**
   A personalised configuration can be recommended, based on some specific characteristics and preferences of the single user.

HOW TO RECOMMEND A PERSONALISED CONFIGURATION?

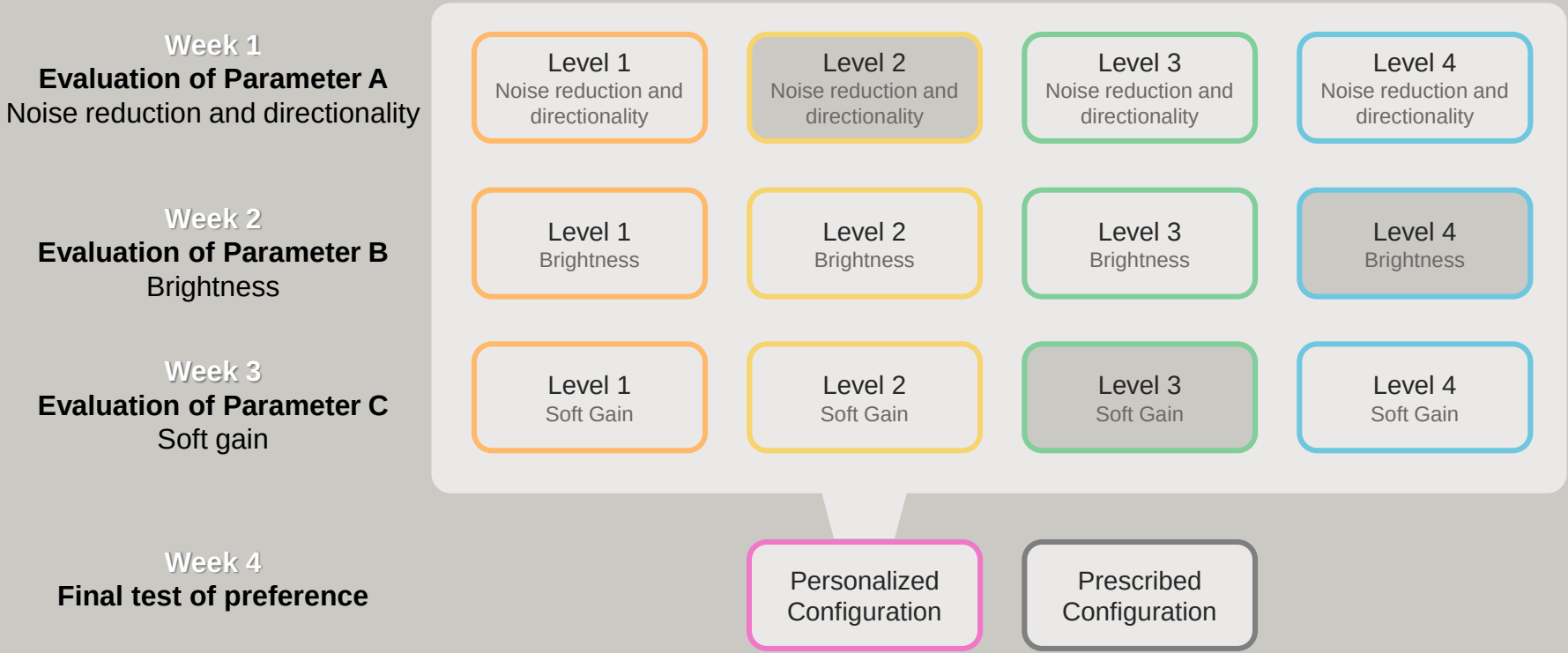
- ✓ Simplifying the complex **audiological space**
- ✓ Gathering user preferences in **real-world** situations

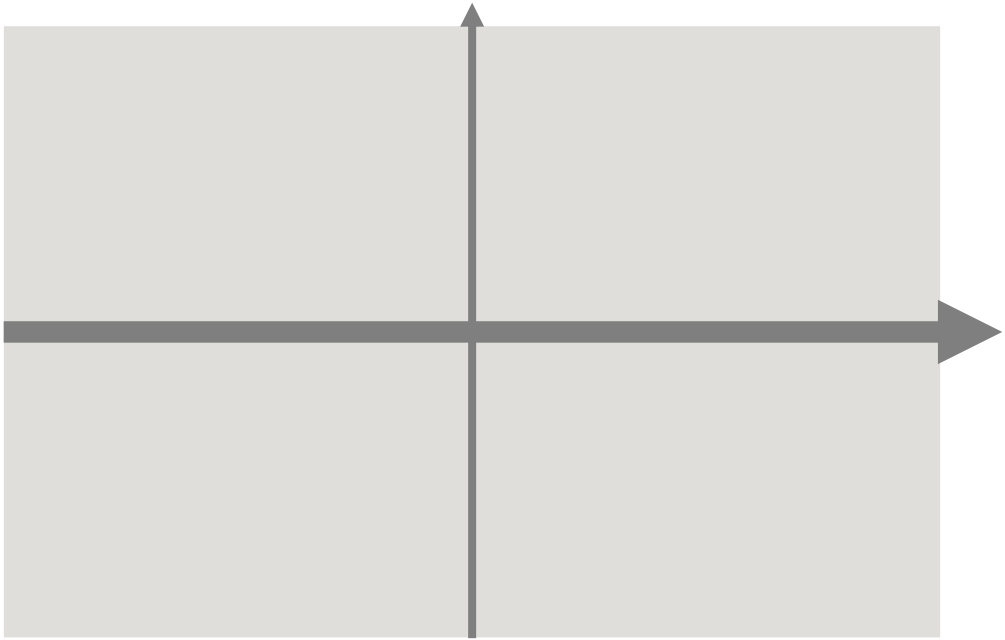
The Study Participants





The Study Timeline

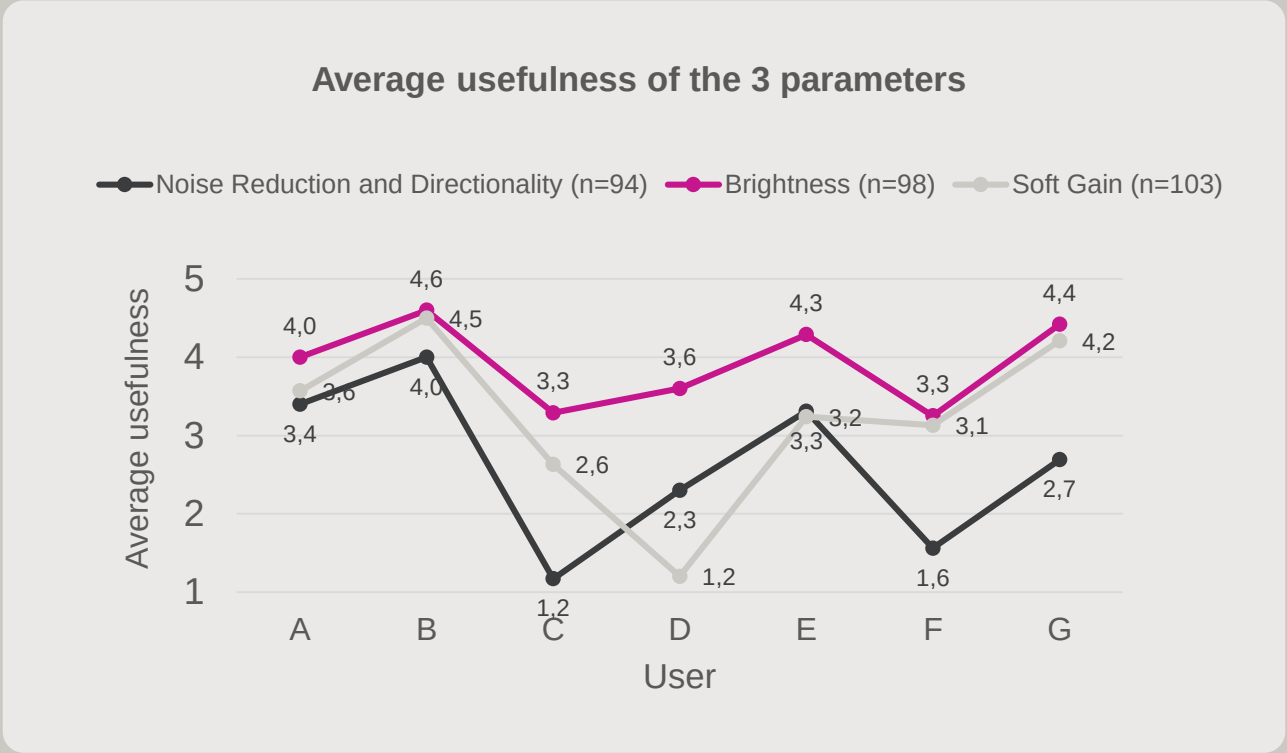


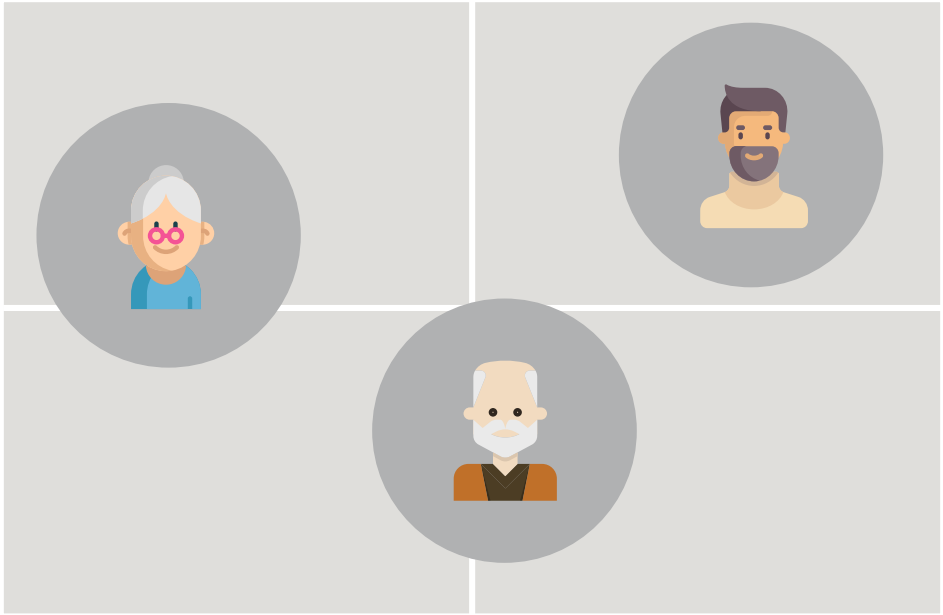


1

What is the perceived usefulness of the parameters?

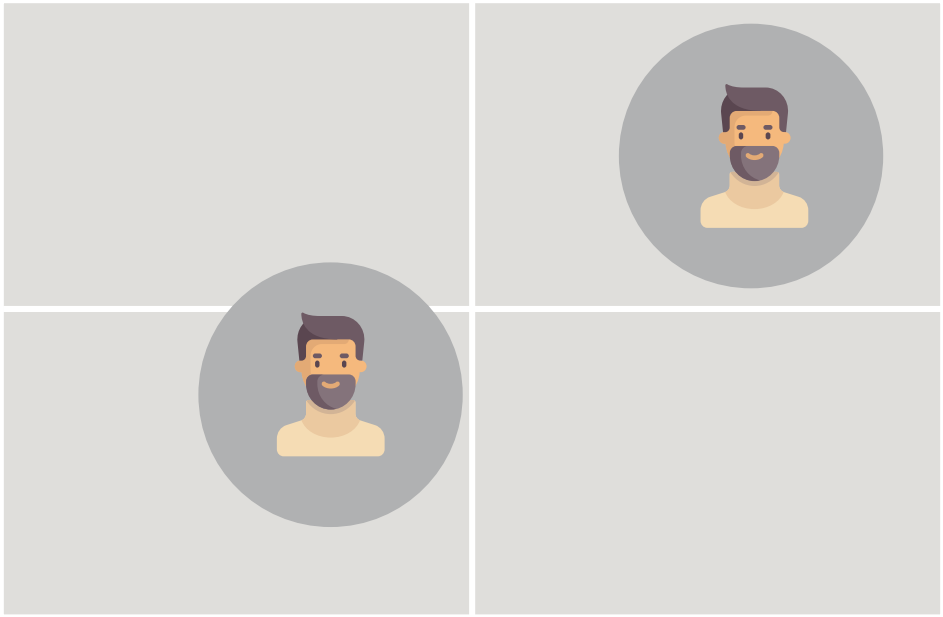
Usefulness of the 3 Parameters





2

Do people have different preferences?

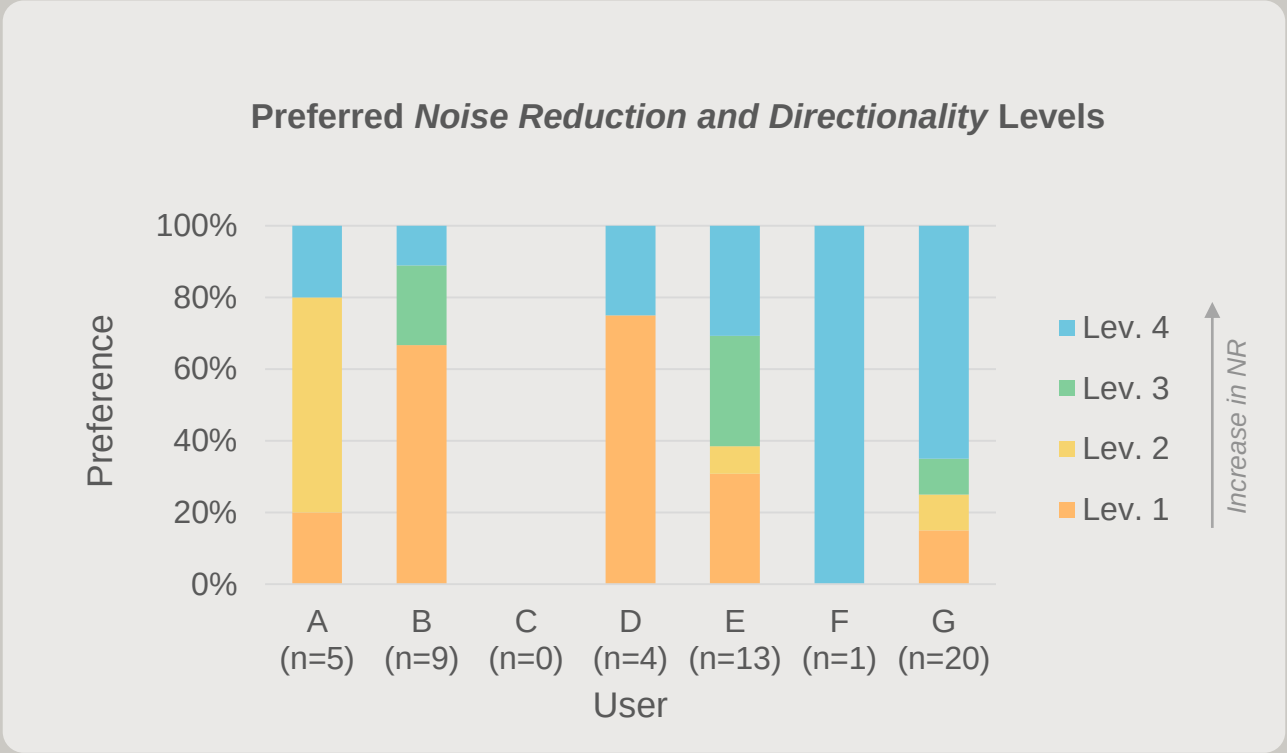


3

Does the same person have different preferences?

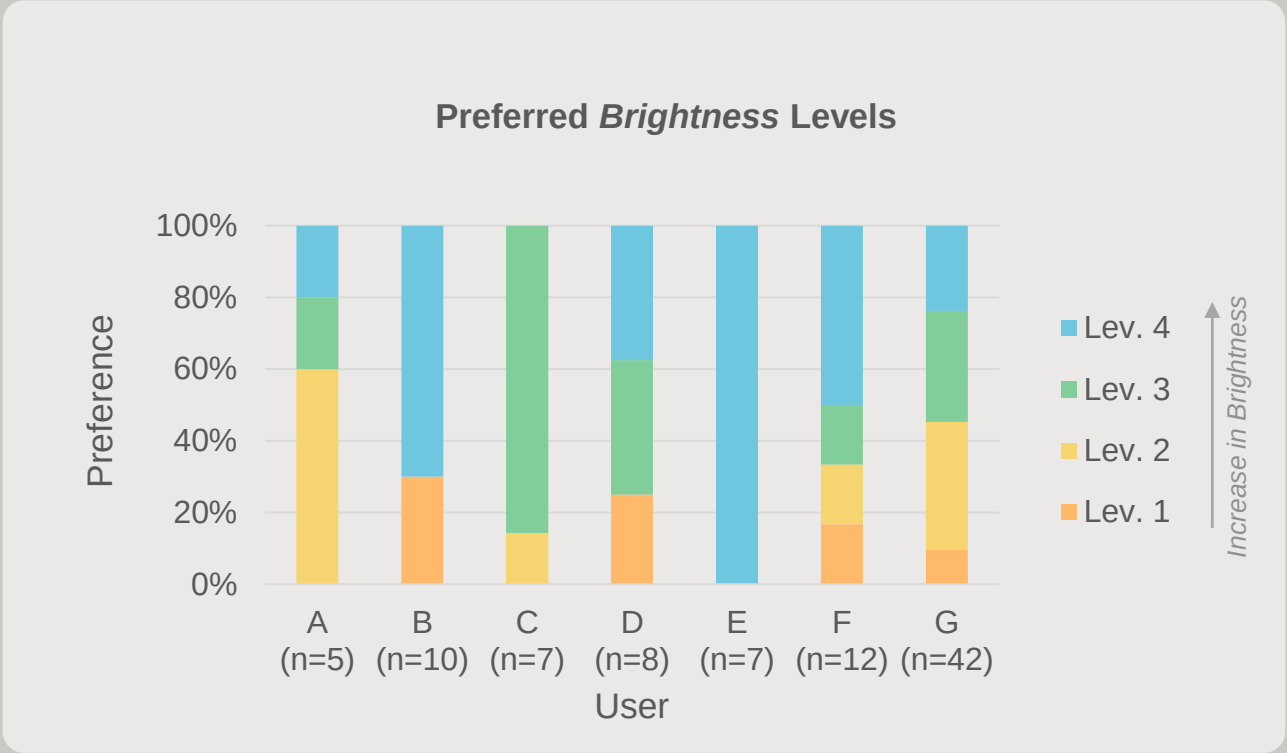
Noise Reduction and Directionality

User preferences when the parameter is considered to be useful (Usefulness > 2 out of 5)



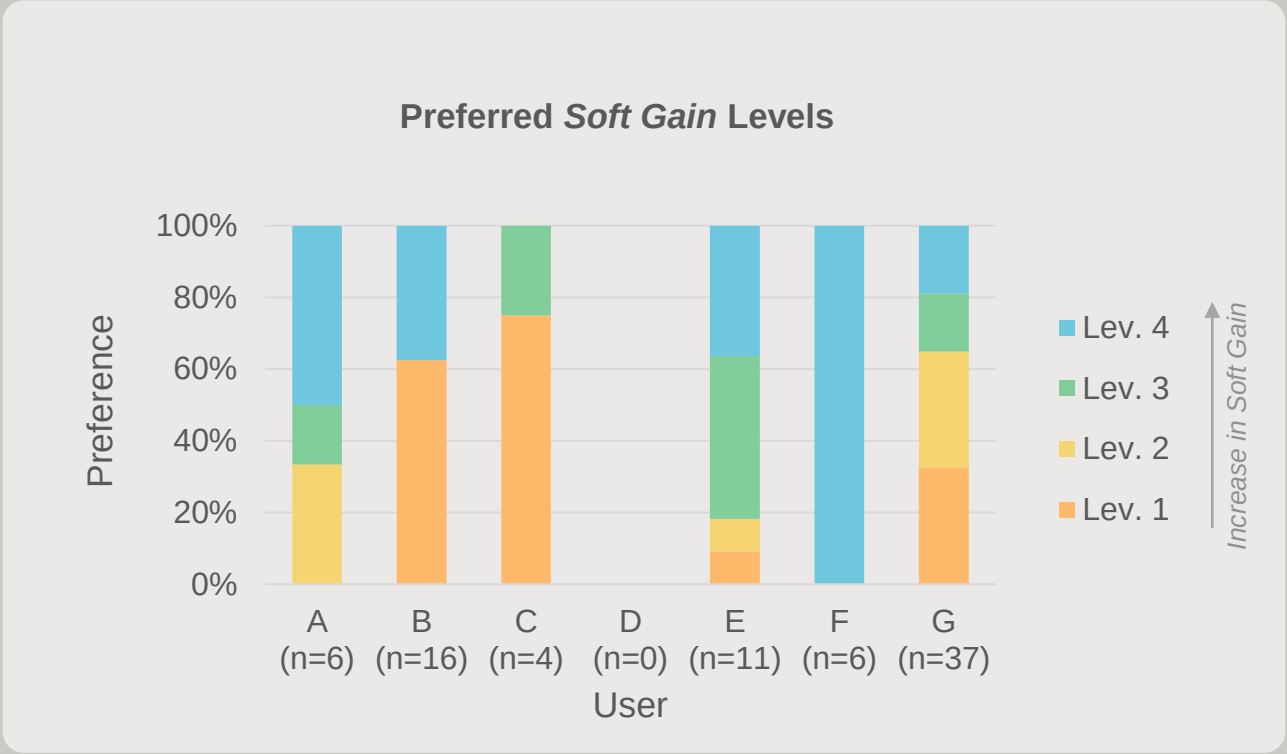
Brightness

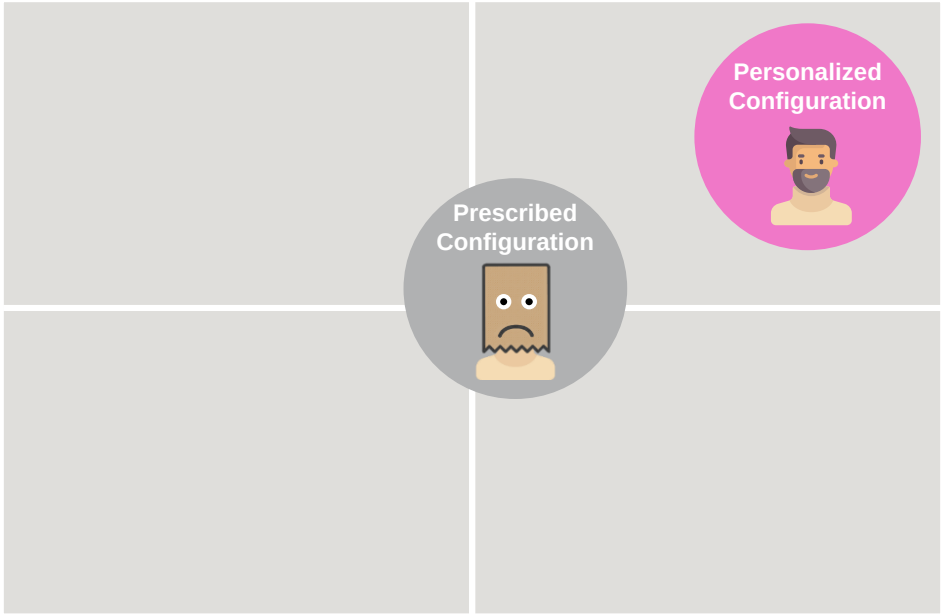
User preferences when the parameter is considered to be useful (Usefulness > 2 out of 5)



Soft Gain

User preferences when the parameter is considered to be useful (Usefulness > 2 out of 5)





4

Is real-world personalization preferred to how hearing aids are fitted in a standard clinical workflow?

Test of Preference

- ✓ 6 out of 7 users preferred the Personalized Configuration
- ✓ Some users fine-tuned the hearing aids for speech situations
- ✓ Participants liked to have more than one configuration

Conclusions

Item

We simplified the audiological design space and isolated the most important parameters.

User

Users exhibited different audiological preferences.

Context

The same user exhibited different preferences in different contexts.

Rating

The device configuration learned in multiple real-world environments was preferred to a traditional configuration.

Th  nk you

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