

Self-determined hearing through artificial intelligence

Peggy Sylopp,
CEO sincEARE UG, Berlin, Germany

Tobias Bruns,
Fraunhofer IDMT, Oldenburg, Germany

22.08.2022, inter.noise Glasgow



Agenda

Introduction to artificial intelligence in hearing aids

Example applications

Discussion

Outlook

Introduction to Artificial Intelligence (AI) in Hearing Aids

- Processing auditory scene and user data
 - perform complex tasks autonomously and/or adaptively
 - learning from accrued experience to improve results

Application Areas of AI in Hearing Aids

- Auditory environment classification (AEC)
- Signal enhancement
- Personalized hearing aid adjustment
- Speech Recognition
- Health Monitoring / Tracking

Example Applications

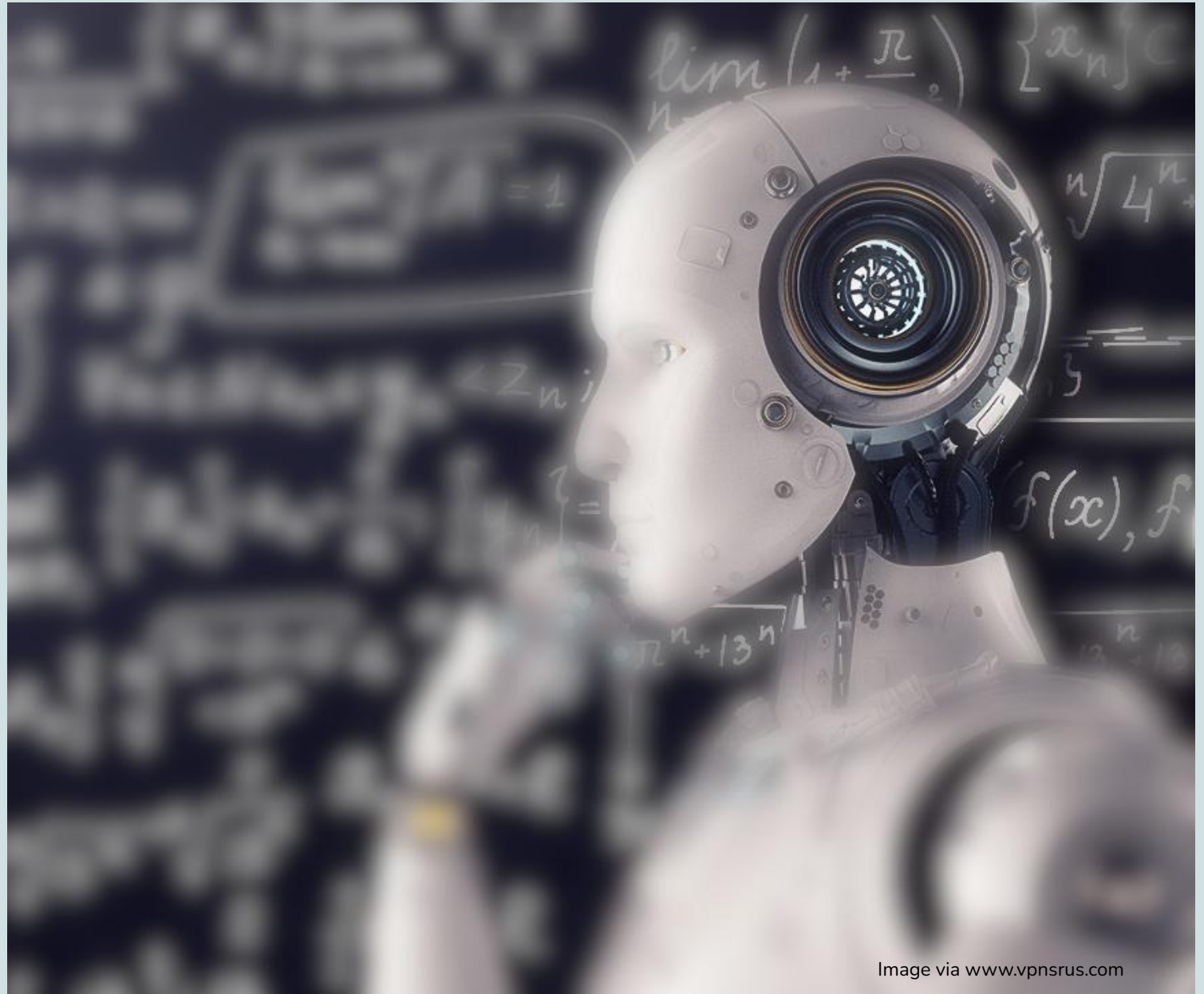


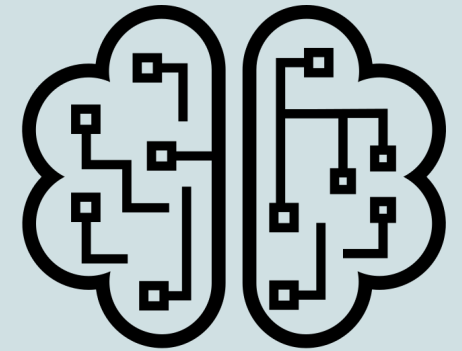
Image via www.vpnsrus.com

Rise of AI in the hearing aid industry

Oticon	Widex	Starkey	Signia	Phonak
More Sound	Sound Sense Learn	IntelliVoice	Signia Assistant	AutoSense OS / Speech Enhance
2021	2018	2020	2020	2021
Sound enhancement by ratings of processed 3D sound scenes	Individualized sound by A/B comparison and degree of preference	Speech enhancement by AEC for controlling noise reduction, directionality and gain settings	Individualized sound by recommendation system	Sound optimization by blending between environments settings

The More Sound Intelligence Approach (Oticon)

- Balances sound relationship by mimicking brain activity
 - subsystem **orient**: foreground / background
 - subsystem **focus**: focus on specific sounds
- Preserves access to sound sources and all directions



Brain symbol: Oksana Latysheva from the Noun Project

The More Sound Intelligence Approach (Oticon)

Sound enhancer for dynamic sound details for noise suppression

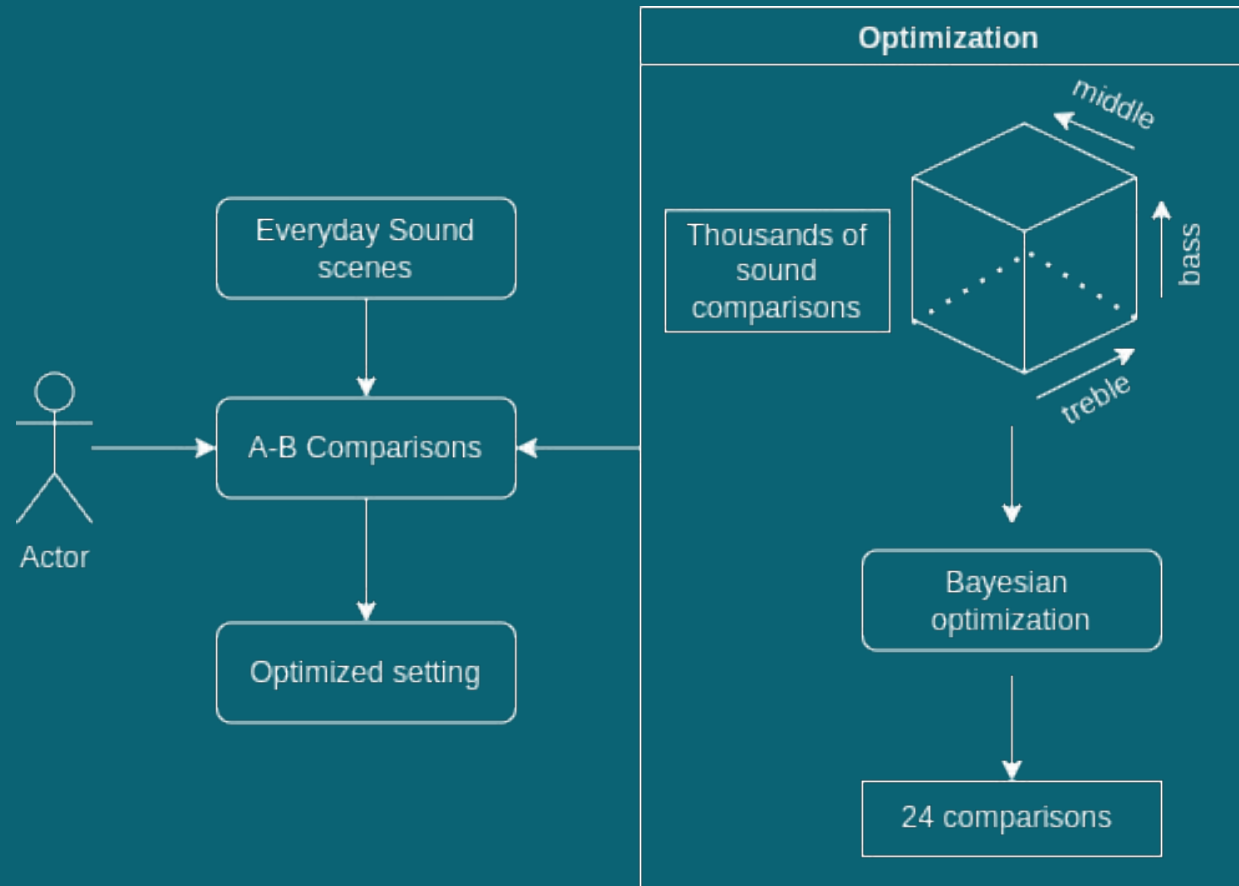
- **Spatial Clarity Processing (orient)**
 - easy sound environments:
 - Simulation by a Virtual Outer Ear (VOE).
 - difficult listening environments:
 - spatial balancer, with omnidirectional microphones signal and beamformer
- **Neural Clarity processing (focus)**
 - DNN trained by millions of real life sound scenes
 - creates "average user in average listening environment" standards

Source: Santurette & Behrens (2020) and Brændgaard & Loong (2020)

Sound Sense Learn Approach (Widex)

- Adjustment of sound in challenging everyday listening situations by hearing aid wearers, using
- A-B comparisons
- Stimuli are sampled from clusters for the activities
- Active learning approach

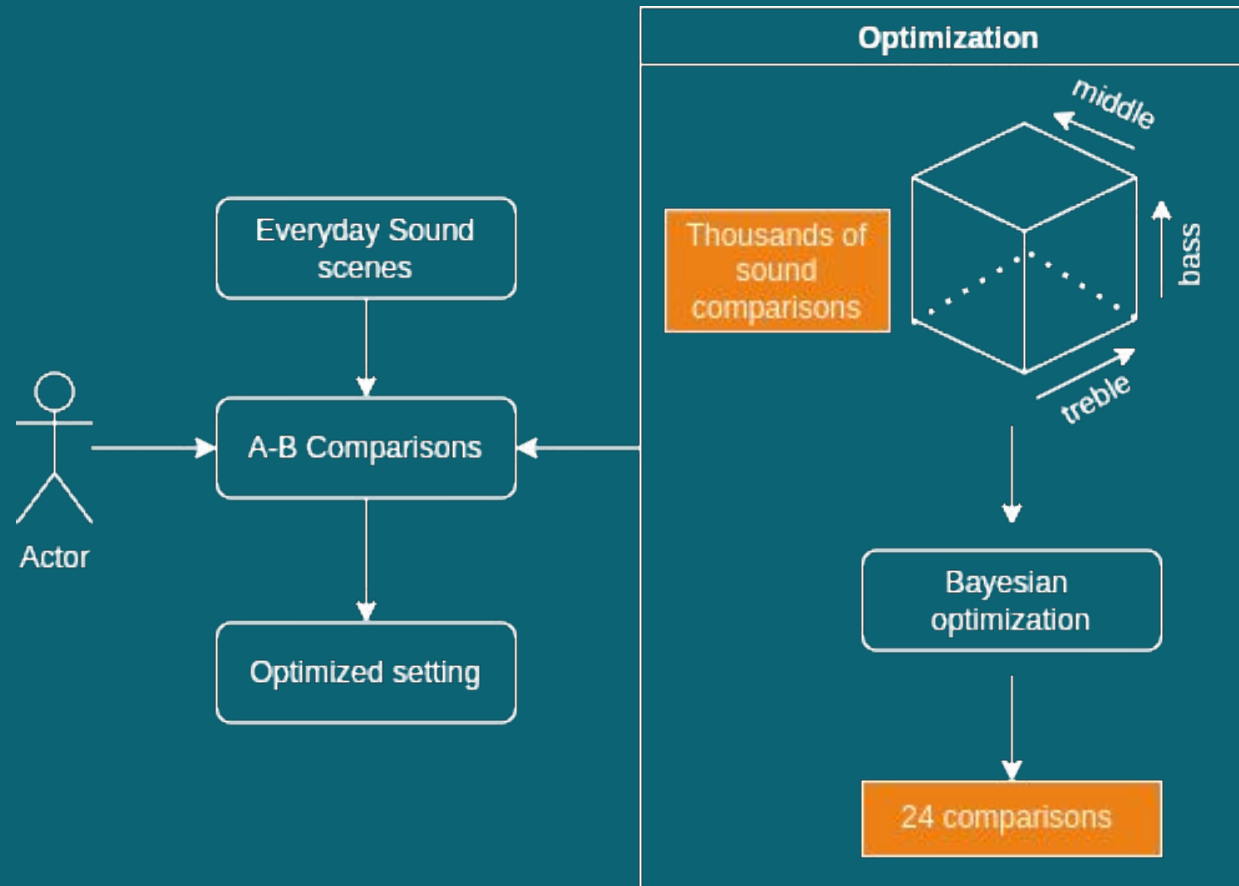
Sound Sense Learn Approach (Widex)



Source: Sylopp & Bruns 2022

Figure: Sylopp & Bruns (2022)
based on Balling et al. (2021)

Sound Sense Learn Approach (Widex)



Sound Sense Learn Findings (Widex)

Daily live survey

- 53 experienced hearing aid users (out of a group of 118)
- 20,000 user settings (year 2020) were almost evenly distributed

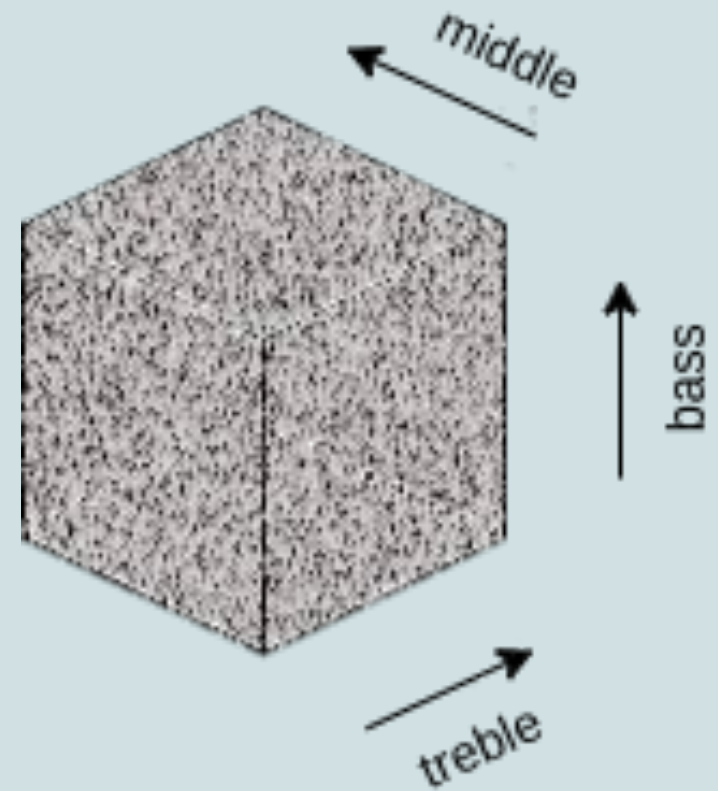


Figure: Sylopp & Bruns (2022)
based on Balling et al. (2021)

Sound Sense Learn Findings (Widex)

- 10,000 adjustment setting programs activity “watching TV” has outweighed

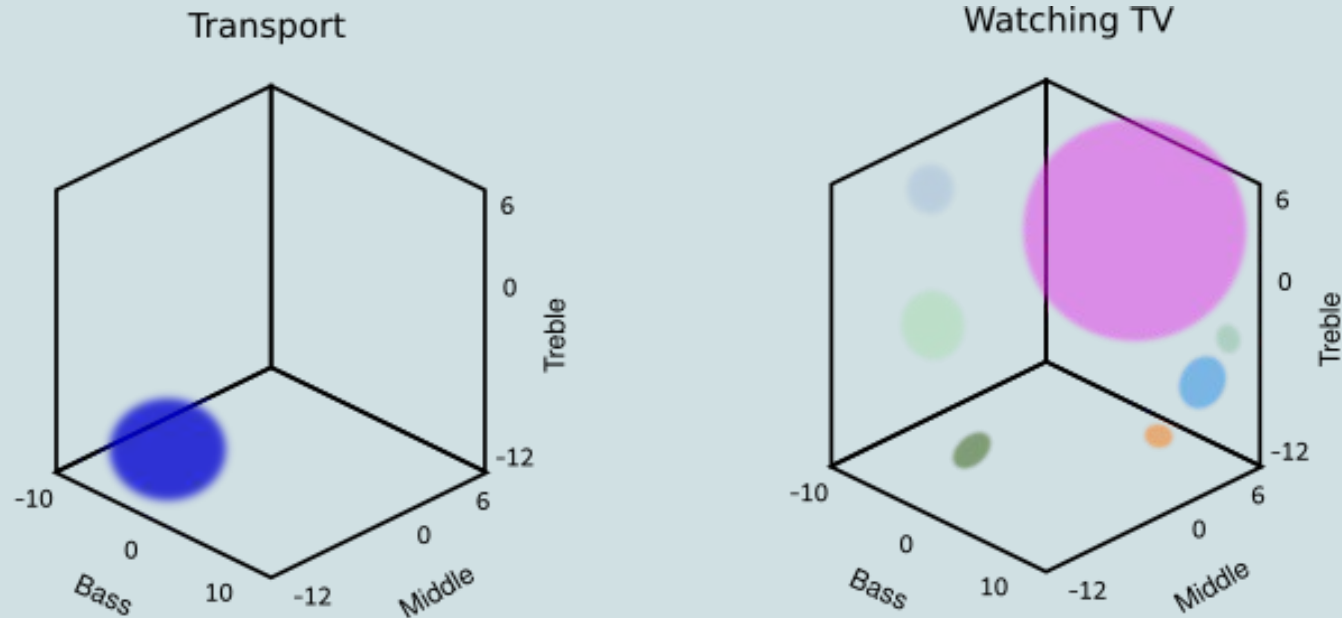


Figure: Sylopp & Bruns (2022)
based on Balling et al. (2021)

Discussion AI Approaches

- | | | |
|--|---|-----------------------------------|
| ● no user-specific settings | ⇒ | unoptimized setting |
| ● static baseline settings | ⇒ | long repeated fitting sessions |
| ● user adjustment effort | ⇒ | bias of application |
| ● biased assumptions about user motivation | ⇒ | user satisfaction remains unclear |

...

...

Outlook

The future of AI developments for self-determined hearing can be groundbreaking for

- Sound individualization
- User-specific listening environments
- Optimized self-fitting

Thank you for listening!

Self-determined hearing through artificial
intelligence

Peggy Sylopp, CEO sincEARe UG, Berlin, Germany
Tobias Bruns, Fraunhofer IDMT, Oldenburg, Germany

