MOSAICS - Minimised outcome spread and maximised participation in society

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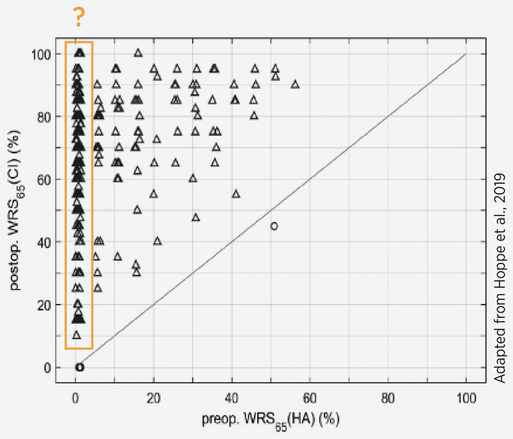
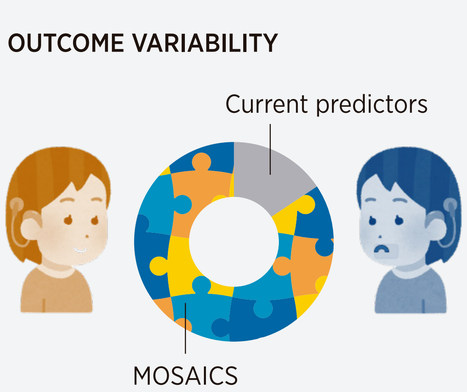
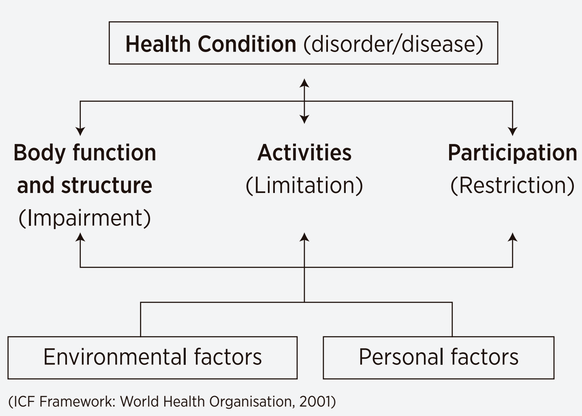
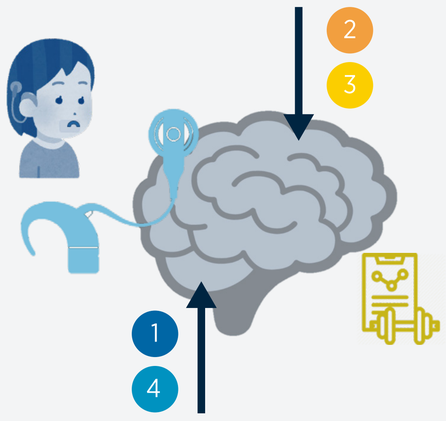
For individuals where hearing aids do not provide functional hearing, cochlear implantation is the intervention of choice. CIs provide significant improvements in speech understanding, hearing performance, and quality of life. However, **large individual differences** and **unexplained variability** are reported in auditory, speech, and language outcomes after CI[1,2].





Based on the ICF model[3], MOSAICS aims to understand this outcome variability in adult CI performance over the next four years by investigating four domains: (1) Objective measures, (2) Neurocognitive measures, (3) Societal impact, and (4) Fitting. Improved knowledge in these domains is expected to minimise outcome spread and maximise societal participation, with a specific focus on poorly performing adult CI users.



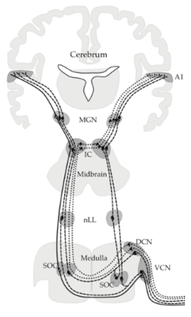


1. OBJECTIVE MEASURES

- **Degraded sensory information** is a potential cause for the **outcome spread and poor performance** observed in CI users. Combining behavioural methods with electrophysiology (EEG) and imaging techniques (fNIRS) can help **unravel bottlenecks** in signal transmission through the auditory pathway.
- Some **general questions** to be investigated:

1. What is the influence of neural health, at the level of the cochlea, on signal representations at higher levels?
2. How are spectral and temporal representations of a sound signal affected by CI processing and subject specific parameters?

Ψ-Physics
+
EEG/fNIRS



2. NEUROCOGNITIVE MEASURES

- It is hypothesised that **top-down modulation** influences speech perception outcomes in adult CI users. The current project will gain more insight into top-down cognitive factors predicting speech perception outcomes in adults CI users. (What predictors, when & how) → Studying underlying **neuronal mechanisms & cognitive behavioural measures.**
- Some of the **questions to be answered**:

1. What does **current literature** say about top-down influences?
2. What is the **global level** of cognition before and after implantation (RBANS-H) and its relationship to CI performance?
3. Is there a relationship between **specific cognitive functions** (e.g. inhibitory control, working memory) and speech outcome measures in good and poor performing adult CI users? And can this be explained by similarities in brain activation patterns?

3. SOCIETAL IMPACT

- It is hypothesised that **individualised auditory training programs** will yield better individual and societal outcomes for poor performers, compared to a standardised one-size-fits-all rehabilitation approach.
- To address this hypothesis, **the following questions will be explored**:

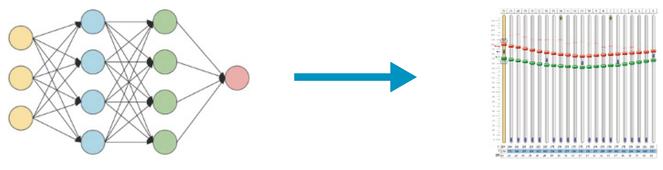
1. What does **current literature** say about individualised auditory training programs?
2. What is the **impact of timely intervention** with CI on outcomes?
3. How accurately are clinicians able to **predict poor performance**?
4. Using individualised auditory training programs, are poorly performing adult CI users able to achieve **improved outcomes**?
5. In poorly performing adult CI users, what is the **influence of patient factors** on rehabilitation progress and outcomes?

4. FITTING

- Not being able to identify the causes of poor performance means that we don't know how to properly fit patients experiencing poor performance. This makes fitting a **long trial-and-error process**.
- We want to find factors which correlate with poor performance and look at the best way to make use of these factors in order to develop **personalised maps, leading to optimised outcomes**.
- Steps of the project will include:

1. Data analysis on **MAPs and speech recognition tests**
2. Analysis of **phoneme confusion matrices** for frequency allocation
3. Investigation of **bone formation** as a predictive factor

- The final goal is to build an **AI-assisted fitting tool.**



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