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Simulation of modern signal processing strategies in cochlear implants

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With current coding strategies (ACE, CIS, SPEAK etc.) cochlear implant (CI) users achieve already good speech intelligibility in quiet. However, music perception and speech intelligibility in noise are still poor [1, 2]. The strategies used in current devices are based on the envelope information in different frequency bands.
Here, a new approach using not only the envelope information but also the fine structure information of a signal is evaluated. In previous studies it was shown that this new strategy leads to a better pitch discrimination [3]. The aim is to investigate, whether the additional transmission of fine structure information could have positive effects on speech intelligibility in noise and on music perception.
Based on the Gammatone filter bank [4] a CI-simulation was developed that translates the electrical stimulation into an acoustic signal. The signal processing of the simulation is based on the CIS+-strategy (Continuos Interleaved Sampling) and the FSP- strategy (Fine Structure Processing). For lower frequency bands FSP transmits the fine structure of a signal in addition to the envelope using the channel-specific sequences strategy.
Different sound signals were processed using our simulation and several audiological tests were carried out with normal hearing listeners. Subjective ratings and paired comparison tests were conducted in which subjects rated the sound quality and speech intelligibility with and without fine structure information.
As a result music signals with additional fine structure information were preferred to music signals with envelope information only. Preliminary results also indicate a positive effect of the transmitted fine structure on speech intelligibility in noise.

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