

## TEMPORAL INTEGRATION OF PULSATILE STIMULI DISTRIBUTED ACROSS MULTIPLE ELECTRODES

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Several speech processing strategies in current use present pulsatile stimulation non-simultaneously on multiple intracochlear electrodes. In most cases the rate of stimulation is constant, and variations in the pulse amplitudes are presumed to contribute to the overall delivery of information to the implant user. However, it is not known whether such amplitude modulations are combined across nearby electrode positions, or whether they produce separable percepts when presented on multiple electrodes. This question, addressing the issue of channel interactions in multiple-electrode implants, is important to the development of advanced sound processing strategies. It was investigated in a psychophysical experiment using amplitude-modulated pulse trains presented at an overall carrier rate of 1000 Hz, with pulses being delivered alternately to two electrodes. The modulation had a period of 10 ms, within which two pulses (one on each electrode) had a high amplitude, while the remaining eight had a low amplitude. The time was varied between the two high pulses in each period (which can be regarded as a phase shift). The smallest time delay (1 ms) produced an overall 100 Hz modulation pattern, whereas the largest delay (5 ms) produced a 200 Hz modulation pattern. All of the stimuli produced identical 100 Hz patterns on each of the component electrodes, and so would be distinguishable only if the combined pattern were being perceived. The hypothesis was that this combined pattern would be perceived only for small electrode separations. This hypothesis was confirmed experimentally in five subjects by using a four-interval forced-choice task where the subject was asked to identify the one stimulus which was different. Phase differences of 1 - 2 ms could be detected provided that the electrode separation was within about 3 - 4 mm. A subsequent experiment using single-interval pitch estimation tasks showed that the differences in the temporal patterns were perceived in the same way as rate pitch differences. In conclusion, our experiments showed that, when modulated pulsatile stimuli are delivered to nearby electrode positions, implantees may perceive the modulations of the combined stimuli and not just the modulations on the separate electrodes.



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