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Use of simultaneous stimulation to represent fine structure in cochlear implant processors

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In cochlear implants, simultaneous stimulation of adjacent electrodes, can be used to shape the electric fields generated within the cochlea. For example, simultaneous in-phase stimulation of nearby electrodes can be used to create activation patterns which may have maxima at locations that are intermediate to the locations of the stimulated electrodes. Psychophysically, such "virtual channels" give rise to intermediate pitch sensations. Simultaneous out-of-phase stimulation of two flanking electrodes in addition to the center electrode can be used to presumably produce more focused activation at the cost of larger overall stimulation currents. Forward masking patterns indicate that for sufficiently large compensation currents, such "focused" stimulation can lead to a more spatially contained excitation. In some cases, current focusing also could lead to sensations that are more tonal relative to monopolar. This presentation will review recent results obtained in our laboratories with both "virtual channel" and "focused" configurations. We will also address how both techniques can be used to better represent the within-channel fine structure in a wearable sound processing strategy.