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Speech-in-noise enhancement and sound localization with
improved binaural hearing instruments

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Multi-microphone noise reduction schemes have become standard in commercial hearing aids and cochlear implants. Recent studies with bilateral hearing aids have shown that common adaptive directional microphone systems tend to distort localization cues, leading to inappropriate and reduced spatial awareness for bilateral hearing aid users. Here we show that binaural multi-microphone signal processing based on multi-channel Wiener filter (MWF) are capable of combining noise reduction with the preservation of directional hearing. Physical simulations and perceptual results from 10 listeners have been studied for different noise source scenarios, in different reverberant conditions, and for a number of signal processing schemes using up to 4 microphone inputs (2 each side). An overview is given of the localization performance and the speech reception benefits in these different listening conditions for the different noise reduction strategies. An adaptive directional microphone system (ADM) is used as a reference system. Signal processing based on MWF does, unlike ADM, provides a combination of noise reduction and preservation of spatial awareness. Moreover, in some conditions it even offers an improved spatial release from masking. The MWF outperforms the ADM in terms of localization and noise reduction if signals are not arriving from the most forward field of view.