ACOUSTICS2008/1756
strategic listener movement in a model of auditory distance perception

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A mobile listener has the potential to exploit dynamic auditory cues to judge sound source distance. One such cue is motion parallax, which employs a sequence of azimuth estimates from interaural time differences to triangulate sound source location. However, distortions due to reverberation and competing sources complicate matters, so it is of interest to know what active strategies listeners might adopt to arrive at robust location estimates. One hypothesis is that not all listener motion trajectories are equally-beneficial for distance estimation. Trajectories designed via certain optimisation criteria might lead to faster and more robust estimates in a wider range of environments. Eight listener motion strategies were tested, from naive approaches such as random walks and head-rotation only to more sophisticated techniques based on sequential Monte Carlo methods. In the latter case, strategies included movement towards the expected source location, or in the most informative direction, or movement reducing overall uncertainty. Evaluation in a simulated acoustic environment with single sources under both anechoic and reverberant conditions demonstrated that moving towards the most likely source location led to the most accurate estimation of distance and subsequent tracking of a moving source. Significant problems remain in estimating distance in multi-source conditions.