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Auditory Reachability: An Affordance Approach to the Perception of Sound Source Distance

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The literature on perception of sound source distance reveals a wide range of listener accuracy. Most experiments have listeners perform unintuitive tasks, using unnatural sounds presented in impoverished acoustic environments. The present experiments implement an affordance paradigm for which listeners judge the "reachability" of a natural, live sound source in a familiar acoustic environment. Results reveal that listeners are quite accurate in judging whether the source is reachable and are sensitive to the advantage afforded by two vs. one degree of freedom reaches. Further analyses reveal that when scaled to an intrinsic bodily dimension, judgment differences between listeners disappear, implicating intrinsically scaled specificational information. A follow-up experiment explores the potential informational support for these judgments testing the usefulness of head movements and binaural hearing. Results reveal that whereas head movements had no bearing on either judgment accuracy or consistency, binaural information did enhance listener consistency. This could suggest that the allometric relation between interaural distance and arm length might provide a basis for auditory reachability judgments.

Although there is a vast literature on localization of sound sources in the horizontal plane (see Middlebrooks & Green, 1991, for a review), relatively little research has addressed perception of sound source distance. This is surprising because it is critical for animals to know the location of objects in both planes. For example, a bat uses distance information in timing its interceptive approach to a moth. The same is true of a visually impaired individual guiding his approach to switch off a radio. Sound source distance information is also used in guiding vision. For example, Guski (1992) proposed that knowing the changing distance of a looming object

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