Abstract Submitted
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How to generate a sound-localization map in fish[1] J. LEO VAN HEMMEN, Physik Department, TU Munich — How sound localization is represented in the fish brain is a research field largely unbiased by theoretical analysis and computational modeling. Yet, there is experimental evidence that the axes of particle acceleration due to underwater sound are represented through a map in the midbrain of fish, e.g., in the *torus semicircularis* of the rainbow trout (Wubbels et al. 1997). How does such a map arise? Fish perceive pressure gradients by their three otolithic organs, each of which comprises a dense, calcareous, stone that is bathed in endolymph and attached to a sensory epithelium. In rainbow trout, the sensory epithelia of left and right utricle lie in the horizontal plane and consist of hair cells with equally distributed preferred orientations. We model the neuronal response of this system on the basis of Schuijf's vector detection hypothesis (Schuijf et al. 1975) and introduce a temporal spike code of sound direction, where optimality of hair cell orientation θ_j with respect to the acceleration direction θ_s is mapped onto spike phases via a von-Mises distribution. By learning to tune in to the earliest synchronized activity, nerve cells in the midbrain generate a map under the supervision of a locally excitatory, yet globally inhibitory visual teacher.

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