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Modeling categorical perception with auditory neurons

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Abstract: It is well-known that the auditory perception of speech sounds is strongly influenced by the phonetic categories which divide up acoustic space. This paper approaches the problem of modeling categorical perception from the ground up, using a linear model of the tuning properties of auditory neurons – the spectro-temporal receptive field (STRF). An STRF which discriminates voiced from voiceless stops was derived from the TIMIT corpus, and two computer simulations were conducted to investigate its properties. In one simulation, this model neuron was found to exhibit a categorical response to a linear voice-onset-time continuum, closely tracking human behavior. In the second simulation, the STRF was found to exhibit a less categorical, more linear response to a stop-voicing continuum, also in line with human behavior. These two simulations show that perceptual responses to speech, whether non-linear or veridical, can be modeled by the action of auditory neurons.