Neural mechanism for binaural pitch perception

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The perception and processing of complex signals is a nontrivial task for the nervous system. A classical example is the perception of the pitch of complex sounds by the auditory system, the mechanism of which remains controversial. Recently, a mechanism of pitch perception has been proposed on the basis of the so-called *ghost stochastic resonance*. Under this paradigm, an appropriate level of noise yields an optimal subharmonic neural response to a combination of two or more harmonic signals that lack the fundamental frequency, which is nevertheless perceived by the system [1]. The original proposal concentrated in the peripheral level of the perception process, by considering the case of a simple monoaural presentation of the complex signal. On the other hand, it is known that complex sounds are also perceived when its two constituent tones are presented binaurally [2], what corresponds to signal integration at a higher processing level. Thus, the question remains whether ghost stochastic resonance can explain the detection of the virtual dichotic pitch at this higher level of processing. In this communication we propose a plausible mechanism for the binaural perception of the pitch of complex signals via ghost stochastic resonance. The effect is studied via numerical simulations using a Morris-Lecar description [3] and experiments on electronic models. In the situation considered, each of the two input tones is applied to a different noisy neuron (representing separate detection in the left/right auditory pathways), and together they drive a third noisy neuron that perceives the missing fundamental. In this way, the same basic mechanism of ghost resonance can explain pitch perception occurring at both the peripheral and higher processing levels.

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