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Neuronal representation of pitch ambiguity

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Iterated rippled noise (IRN) is produced by delaying a broadband noise by time d, multiplying by gain g, adding the delayed noise to the original, and repeating this process for n iterations. When g=+1 IRN has a well-defined pitch at $1/d$ Hz. If g=-1 the pitch can be ambiguous. A gain of -1 is equivalent to applying a frequency-independent phase shift ϕ of π rads to the delayed noise (g=+1 $\equiv$ ϕ=0). We recorded spike-trains from single units in the ventral cochlear nucleus in response to IRN with varying ϕ. Units with high best frequencies represented waveform envelope modulation (independent of ϕ), however, units in the phase-locking range of best frequencies represented stimulus fine structure (which varies with ϕ). Fine structure responders show a gradual transition from a well-defined peak in the interspike interval distribution at d when ϕ=0 to two equal-amplitude peaks flanking d when ϕ=π, and a gradual shift back to a well-defined peak at d as ϕ approaches 2π. Within the dominance region for pitch interspike interval distributions account for psychophysical pitch matches of $1.07/d$ and $0.94/d$ Hz for ϕ=$\pi/2$ and $3/2\pi$ respectively, as well as the ambiguous pitches of $0.88/d$, $1.14/d$, and $1/2d$ Hz heard when ϕ=π rads.