

Phase-locked onset detectors for monaural sound grouping and binaural direction finding.

Locating sound sources is an important task for animals. IIDs and ITDs are normally used to provide information about the instantaneous direction of sound received at the ears. In a reverberating environment, this may differ from the direction of the sound source. However the IID and ITD always provide information about sound source direction at onset, since onsets always arrive from the shortest, direct path. Binaural recordings were filtered using a gammatone filterbank, converted to a phase-locked spike code, and passed to a leaky integrate-and-fire neuron through a rapidly depressing synapse. This provides a phase-locked onset detector in each bandpassed channel. Nearly coincident onsets from different channels in each ear were grouped. IIDs and ITDs were computed when grouped onsets in both ears occur at almost the same time. ITDs were converted to azimuth geometrically: IIDs were converted using the impulse response at each ear. The results show that even in a reverberating environment, sound direction can be found from a single onset. Wideband and long sounds provide better results. Multiple sound sources can be accommodated. The system exhibits the precedence effect since a second onset (without intermediate offset) will be ignored because the depressing synapses will not have recovered.

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