

Abstract for ASA 2003 meeting (Nashville April 2003)

Biologically inspired robust onset detection (Leslie Smith)

Onsets are rapid increases in signal strength. Common onset time in different frequency bands provides an important cue for dynamically grouping sound energy, and hence for sound streaming. Onsets are important for segmenting sounds [Smith, J. New Music Res., 23(1) 11-23 (1994)] and for determining where to measure IIDs and ITDs for sound direction finding [Smith, J. Acoust. Soc. Amer. 111, 2467 (2002)]. Effective onset detection requires low latency and the capacity to cope with wide variation in dynamic range. Many neurons in the auditory brainstem are sensitive to onsets. The system filters sound into cochlea-like bands (using a Gammatone filterbank), then spike codes positive-going zero-crossings. Wide dynamic range is achieved by using multiple spike trains per filter band, each with different sensitivity. The spike trains from each band innervate a leaky integrate-and-fire neuron. The excitatory synapses from the spike trains are fast and depressing; the shunting inhibitory synapses are facilitating and slower. The combined effect is that the neuron produces a single spike for each onset over a wide dynamic range with very low latency. The use of both inhibitory and excitatory synapses improves onset detection over purely excitatory synapses, leading to better sound direction finding than previously reported.

L.S. Smith, *Biologically inspired robust onset detection (abstract)*, Journal of the Acoustical Society of America, 113, 4 (Part 2), p2198, April 2003.