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A neural oscillator model of binaural auditory selective attention

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It has been proposed that listeners separate an acoustic mixture by auditory scene analysis (ASA) in which a perceptual description of each sound source is formed – a stream (Bregman, 1990). Typically, ASA is seen as a precursor to attentional mechanisms which simply select one stream as the attentional focus. However, recent work by Carlyon *et al.* (2001) has suggested that attention plays a key role in the formation of streams.

The work presented here incorporates this finding into a new model of ASA in which attentional factors play a role in both the grouping and stream selection stages.

Initial stages of the model consist of auditory peripheral processing followed by pitch and harmonicity analysis. The core of the model comprises a network of neural oscillators which perform stream segregation on the basis of oscillatory correlation (Wang, 1996). Individual segments (contiguous regions of acoustic energy) are created by forming local excitatory connections between oscillators. A group of segments which are deemed to be consistent with the F0 estimate have a further set of excitatory connections placed between them to achieve grouping by harmonicity.

Each oscillator is connected to an attentional leaky integrator (ALI) by excitatory links, the strengths of which are modulated by an attention interest vector. A segment or group of segments are said to be attended to if their oscillatory activity coincides temporally with a peak in the ALI activity.

The model accounts for a number of interesting phenomena including the subconscious re-direction of attention by the onset of a new, loud stimulus; the streaming effect of alternating tone sequences (van Noorden, 1975) and associated build-up effect (Anstis and Saida, 1985); the failure of streaming to occur when attending to a distractor task (Carlyon *et al.*, 2001); the grouping of a mistuned harmonic and complex (e.g. Darwin *et al.*, 1995); and the capture of tones from a complex which demonstrates the old-plus-new heuristic (Bregman, 1990).

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