

Contextual effect influencing perceptual certainty but not the trading hypothesis: the interplay of frequency proximity and spatial grouping cues.

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When there is a spectro-temporal element that logically could belong to more than one object, the correct grouping of sound can be ambiguous. To be veridical, estimates of the amount of energy that an ambiguous element contributes to each perceptual object must sum to equal the physical energy in that element in the physical stimulus. In previous experiment when the frequency proximity cue was manipulated, this energy trading hypothesis was observed. However, the apparent perceptual organization of a scene containing two simultaneous streams may depend on which stream is being attended. With appropriate manipulation of the spatial cues, a clearly detectable “target” was “orphaned,” in that it was never perceived as part of the foreground stream, regardless of which stream was attended.

We used a previously established paradigm to measure directly the contribution of an ambiguous “target” to each of two ongoing streams. The stimuli were repetitions of a three-tone sequence, consisting of a pair of pure tones followed by a harmonic complex. The harmonic complex was spectrally shaped by a synthetic vowel formant, producing the percept of a repeating vowel that occurred at a rate one-third that of a separate, ongoing stream of pure tones. The identity of the vowel and the rhythm of the stream depend on whether the “target” was grouped with the object attended. In one block of the experiment, the relative frequency between the tones and the “target” and their spatial cues were co-varied. In another block of the experiment, either the relative frequency disparity or the spatial cues were manipulated alone.

Results support previous findings that there is, in general, a trading relationship in the allocation of the ambiguous “target” between the two objects, but it does not follow a strict energy conservation prediction. However, when more than one grouping cues were manipulated in a block, the perceptual certainty between the vowel prototypes was diminished.

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