Ambiguous sound elements contribute differently to auditory object identity and object location

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We investigated how spatial cues influence object formation and perceived object location. Results show that perceived object location can be 1) directly affected by sound elements not part of an object and 2) indirectly affected by other objects in the mixture.

All experiments used a sound mixture containing an ambiguous sound element (target) that logically could belong to either of two objects: a slowly repeating vowel and a concurrent, rapidly repeating tone stream. Stimuli consisted of repetitions of two 500-Hz pure tones followed by a harmonic complex of fundamental frequency 125 Hz. The harmonic complex was spectrally shaped so that it was heard as a vowel. The “target”, a 500-Hz tone presented simultaneously with the vowel complex, logically was a third tone in the tone stream as well as the fourth harmonic of the vowel.

Perceptual grouping was measured by asking listeners the perceived vowel identity and the perceived tone-stream rhythm (in separate experimental blocks). Spatial cues in the sound elements affect both the vowel identity and tone-stream rhythm.

Subjects also matched the perceived intracranial position of the vowel and the tone stream (in separate blocks) by setting the interaural level difference of a pointer (a 200-Hz narrowband noise). Spatial cues in the target pulled the perceived vowel location even when the target was not perceived as part of the vowel, presumably because of limited spectral resolution in spatial computations. In addition, the perceived location of one object consistently was pushed away from that of the other object.

These results show that localization of sound objects is influenced by sound elements that are not perceived as part of the object, both directly (because spatial cue computations depend on the interaural signals covering a range of frequencies) and indirectly (because of inter-object interactions in sound localization).

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