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Explicit and Implicit Access to Ambiguity in Frequency Shifts

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In order to succeed in everyday auditory environments, listeners must often distinguish between multiple plausible interpretations of an ambiguous signal. Generally, listeners are aware of this ambiguity, but certain classes of ambiguous stimuli seem to inhibit conscious access to ambiguity. We used a well-known ambiguous stimulus consisting of two Shepard tones containing octave-spaced components presented one after the other. We measured listeners' ability to access ambiguity in this stimulus, both explicitly through behavioral responses and implicitly through pupil dilation. In two experiments, listeners judged the direction of the change between the two tones, while pupil diameter was continuously measured. In experiment 1, we varied the degree of ambiguity in the stimulus by varying the size of the interval between tones. In experiment 2, in order to ensure that the observed effects were not due to interval size itself, we compared Shepard tones to harmonic complex tones, presenting the same interval sizes for each tone type. In both experiments, the ambiguous 6-semitone case for the Shepard tones evoked first-order behavioral variability but high explicit confidence. Pupil dilation was elevated for this condition relative to other conditions in both experiments. More specifically, we could correlate trial-by-trial pupil dilation with subsequent response entropy, even when participants were not aware of producing variable responses. This suggests that implicit sensitivity to ambiguity, measured through pupil dilation, may occur without explicit awareness.

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