From Comparison to Classification: A Cortical Tool for Boosting Perception

Abstract:
Humans are much better in relative than in absolute judgments. This common assertion is based on findings that discrimination thresholds are much lower when measured with methods that allow interstimuli comparisons than when measured with methods that require classification of one stimulus at a time and are hence sensitive to memory load. We now challenged this notion by measuring discrimination thresholds and evoked potentials while listeners performed a two-tone frequency discrimination task. We tested various protocols that differed in the pattern of cross-trial tone repetition. We found that best performance was achieved only when listeners effectively used cross-trial repetition to avoid interstimulus comparisons with the repeated reference tone. Instead, they classified one tone, the nonreference tone, as either high or low by comparing it with a recently formed internal reference. Listeners were not aware of the switch from interstimulus comparison to classification. Its successful use was revealed by the conjunction of improved behavioral performance and an event-related potential component (P3), indicating an implicit perceptual decision, which followed the nonreference tone in each trial. Interestingly, tone repetition itself did not suffice for the switch, implying that the bottleneck to discrimination does not reside at the lower, sensory stage. Rather, the temporal consistency of repetition was important, suggesting the involvement of higher-level mechanisms with longer time constants. These findings suggest that classification is based on more automatic and accurate mechanisms than interstimulus comparisons and that the ability to effectively use them depends on a dynamic interplay between higher- and lower-level cortical mechanisms.

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