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Perceptual asymmetries induced by category learning

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This paper takes an information-theoretic approach to study the perceptual consequences of the neural encoding of categories (e.g. vowels). We focus on two well-known psychophysical phenomena: *categorical perception*, characterized by greater cross-category than within-category discrimination, and *perceptual magnet effect*, stating that perceptual space is wrapped around prototypical instances of a given category, leading to a better ability to discriminate stimuli near non-prototypical exemplars of a category than near prototypical ones. Introducing a perceptual distance based on the Kullback-Leibler distance between the patterns of activity evoked by two stimuli, we show that both categorical perception and prototypical effects emerge from maximizing information contained in the neural representation about a set of categories. We discuss the relations between these two psychophysical phenomena and show that they go in hand with another kind of asymmetric effect. The discriminability between a category prototype and a non-prototype is not symmetric, depending on which stimuli serves as a referent. Non-prototypical stimuli are judged closer to prototypical exemplars than the reverse. Quantitative and qualitative comparisons with experimental data and previous theoretical work are presented and discussed.