“Virtues of (co)variance for perceptual learning”

Objects and events in the sensory environment are generally predictable, making most of the energy impinging upon sensory transducers redundant. Given this fact, efficient sensory systems should detect, extract, and exploit predictability in order to optimize sensitivity to less predictable inputs that are, by definition, more informative. Not only are perceptual systems sensitive to changes in physical stimulus properties, but growing evidence reveals sensitivity both to relative predictability of stimuli and to co-occurrence of stimulus attributes within stimuli. Speech signals are notoriously redundant, and our experiments are revealing that auditory perception rapidly reorganizes to efficiently capture covariance among stimulus attributes. Acoustic properties per se are perceptually abandoned, and sounds are instead processed respecting patterns of co-occurrence. Listeners’ ability to distinguish sounds from one another is driven primarily by the extent to which they are consistent or inconsistent with patterns of covariation among stimulus attributes and, to a lesser extent, whether they are heard frequently or infrequently. These findings have implications for perceptual learning most broadly, for experience-dependent auditory development and plasticity, for learning of speech sound contrasts, and for learning to talk.