The Neuroscience of Perceptual Categorization in Pigeons: A Mechanistic Hypothesis

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We are surrounded by an endless variation of objects. The ability to categorize these objects represents a core cognitive competence of humans and possibly all vertebrates. Research on category learning in non-human animals started with the seminal studies of Richard Herrnstein on the category “human” in pigeons. Since then, we have learned that pigeons are able to categorize a large number of stimulus sets, ranging from Cubist paintings to English orthography. Strangely, this prolific field has largely neglected to also study the avian neurobiology of categorization. I will present a hypothesis that combines experimental results and theories from categorization research in pigeons with neurobiological insights on visual processing and dopamine-mediated learning in primates. In short, I hypothesize that perceptual categorization is a two-component process in which stimulus features are first rapidly extracted in associative visual forebrain areas in a feedforward process, thereby enabling a fast subdivision along multiple category borders. The second process rests on dopaminergic error-prediction learning that enables prefrontal areas to connect in feedback manner the relevant visual category dimension to the appropriate action dimension.