SAMPLE 2

Context-Dependent Modification of the Sequential Order of Elements in a Complex Learned Behavior

Many adaptive behaviors require modification of a basic set of movement elements into context appropriate sequences. For example, to open a door, we ‘grasp’, ‘turn’ and ‘pull’ the doorknob, but to open a drawer, we only ‘grasp’ and ‘pull’ the drawer handle. In each case, the sequence of appropriate movement elements is modified to fit the ‘context’ - an abstract understanding of task demands. We were interested in whether songbirds share this capacity to modify movement elements based on abstract contextual rules. We studied Bengalese finches, a species that produces a song consisting of elements termed ‘syllables’ that occur in variable sequences with distinct relative probabilities (e.g. E-C sung 60% and B-C sung 40%). Previous work has shown that if aversive white noise (WN) feedback is delivered when one sequence is sung (e.g. E-C), birds will learn to shift its relative probability in favor of alternative sequences (e.g. E-C reduces to 30% while B-C increases to 70%). We used this paradigm to ask whether birds could learn to modify their syllable sequencing based on abstract rules provided by colored light cues: in green, birds received WN when they sang one sequence (e.g. E-C), but in orange light, they received WN for the alternate sequence (e.g. B-C). The birds learned to switch the relative syllable probability in response to alternating lights in order to minimize aversive feedback. These data indicate that birds, like humans, can associate arbitrary and abstract contextual cues with modifications of movement sequences.