Same/Different Concept Formation in Pigeons
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How other kinds of animals think about the world we share is one of the most interesting and difficult of scientific questions to answer. One longstanding approach to this question has focused on measuring and comparing the cognitive capacities of different animals (Darwin 1872; Morgan 1894; Romanes 1883; Thorndike 1911). This comparative approach to animal cognition and intelligence has represented one of the two or three most basic questions defining the field since its inception. Birds play an important role in such comparative cognitive studies because they offer a unique, non-mammalian perspective to our understanding of these issues. Like mammals, over the last 200 million years these endothermic animals have separately evolved to interface with the events and objects of the world by employing a highly dynamic and interactive mode of living. This has placed similar demands on the sensory and cognitive processes of both of these classes of vertebrates. It is no accident that these two groups are the most visually sophisticated animals on the planet, for instance. Unlike mammals, however, the concurrent demands of flight have required birds to keep their body weight to a minimum, limiting them to small, but apparently powerful, central nervous systems for processing this information. Understanding this paradox of how birds meet the perceptual and cognitive demands of their interactive lifestyle with such small and limited neural equipment is one of the objectives of my research.

My research is directed at understanding these various aspects of visual cognition in one kind of bird, the pigeon (*Columba livia*). During the past fifty years, pigeons have become a significant focus animal in the comparative study of perception and learning. This is because a great deal has been established about their basic behavioral processes and nervous system (Zeigler and Bischof 1993) and powerful and precise laboratory methods developed for experimentally investigating these processes. Possessing a sophisticated visual system with established capabilities for color vision, form perception, pattern recognition, these animals are capable of learning a wide variety of simple and complex visual discriminations (Cook 2000). This can be seen in our research over the last few years, which has explored perceptual segregation and the mechanisms of visual search (e.g., Cook 1992a, b), the discrimination and perception of objects and the contribution of motion to these processes (Cook and Katz 1999; Cook et al. in press), and the learning and use of abstract concepts (Cook et al. 1995; Cook, Katz, and Cavoto 1997; Cook, Katz, and Kelly 1999; Cook and Wixted 1997). Because of its direct implications for the overarching themes developed in this volume, the remainder of this article just focuses on the latter line of research.

The Comparative Psychology of Same/Different Concept Learning.

Human behavior is often rule-based. We can easily answer questions about things with which we have no direct experience, often using simplifying rules or general principles abstracted from the relations among a set of elements. The benefits of this cognitive ability are that it releases behavior from the direct control of the stimulus and its history of reinforcement, allows us to engage in behaviors unbounded by our experience with specific stimuli, and permits highly flexible and adaptive solutions to novel problems. Such relational rule-based concepts allow us to make accurate inductions about new events and their relations, form the basis for our use and appreciation of language, mathematics, analogical reasoning, social relations, and even fine arts such as music. As a species, we are expert at detecting and abstracting the general patterns present in the world's particulars.

While many animals often respond to specific stimulus situations with a fixed or limited repertoire of innate or learned behaviors, it has also become clear that some animals can detect and abstract the patterns present in the world. Understanding the distribution, mechanisms, and conditions of this conceptual behavior in animals is essential to unraveling its evolution and