

# **SOCIAL LEARNING**

**Psychological  
and Biological  
Perspectives**

**EDITED BY  
THOMAS R. ZENTALL  
BENNETT G. GALEF, JR.**

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# *Social Learning Psychological and Biological Perspectives*

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During the past decade there has been a marked increase in the number of North American and European laboratories engaged in the study of social learning. As a consequence, evidence is rapidly accumulating that in animals, as in humans, social interaction plays an important role in facilitating development of adaptive patterns of behavior.

In many cases, studies of social learning appear to have been initiated independently by researchers who began with an interest in individual acquisition of a particular behavioral capacity and only later recognized the importance of social learning in the development of that behavior. For example, research on the social basis of bird-song dialect learning grew out of a long tradition of research on the functions of bird vocalizations. Similarly, interest in the role of social cues in the development of feeding behavior arose from research on the involvement of individual learning in diet selection. Because investigations of social learning research have often started from very different research literatures and perspectives, it is not surprising that the study of social learning as a general phenomenon is highly segmented. Experimenters are isolated both by the phenomena they study and by the species with which they work. The process of creating a coherent field out of the diversity of current social learning research is likely to be both long and difficult. It is our hope, however, that the present volume may prove a useful first step in bringing order to a diverse field.

The idea for this book grew from the premise that researchers who study

the role of social learning in the acquisition of one behavior could benefit from exposure to the methods and theories developed by others in their studies of social influences on behavioral development. The purpose of the present volume is, thus, both to initiate a rapprochement among researchers working on diverse problems in the general area of social learning and to serve as an introduction to current research and thinking about problems in social learning for outsiders to the field.

To assess interest in an integrative volume of this type, the editors organized a symposium at the meeting of the Midwestern Psychological Association held in Chicago in 1985. In addition to the organizers, David Hogan, Russ Mason, Sue Mineka, and Irene Pepperberg presented papers. After the symposium, participants expressed unanimous interest in development of an edited book that would serve as a forum both for the research of participants and for the work of others concerned with psychological and biological aspects of social learning.

We wanted to include both discussion of some of the methodological and theoretical issues involved in social learning research and descriptions of a wide range of research programs concerned with the role of social learning in the development of a variety of different behaviors. Methodological issues are presented in historical perspective in Galef's opening chapter (see also Zentall's chapter). Boyd and Richerson follow with a discussion of social learning within an evolutionary perspective.

In an effort to avoid the parochialism that has tended to fractionate social learning research by species and by problem within species, we have organized the book by topic. The chapter groupings reflect research problems that we felt had most in common or would benefit most from a comparison of findings. Following the first section of theoretical and methodological issues, is a section on social influences on avoidance learning. The section deals with fear conditioning of monkeys (Mineka & Cook), mobbing by jackdaws (Curio), and poison avoidance by blackbirds (Mason).

In the third section social influences in foraging and feeding behavior are discussed. This section includes chapters on socially influenced food preferences in both rats (Galef) and humans (Rosin), as well as social modification of foraging strategies of pigeons (Lefebvre & Palameta).

Chapters in the fourth section are concerned with effects of social modeling on the acquisition of arbitrary responses by rats (Zentall and Denny, Clos, & Bell), mice (Mainardi & Mainardi), and pigeons (Zentall, & Hogan).

The last section deals with social influences on communication. Petrinovich's chapter concerns social factors in bird song acquisition, Pepperberg's discusses the allospecific communication by an African Grey parrot (the renowned Alex), and chapters by Meltzoff and Masur deal with nonverbal social modeling by human infants.



We intend this volume as an introduction to some of the many roles that social learning can play in the ontogeny of animal behavior. We hope that it will stimulate interest in social learning research in general and will lead to an increased appreciation of the importance of social factors in the development of behavior.

*Social Learning:  
Theoretical and  
Methodological Issues*



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# *Imitation in Animals: History, Definition, and Interpretation of Data from the Psychological Laboratory*

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## INTRODUCTION

Since the latter part of the 19th century, scientists have discussed the possibility that animals are capable of learning by imitation. Darwin (1871) explained difficulties in poisoning or trapping wild animals as the result of their ability "to learn caution by seeing their brethren trapped or poisoned" (p. 49). Wallace (1870) interpreted consistency from generation to generation in the structure of the nests of birds of the same species as the result of young observing and imitating the nest of their parents. Romanes (1884) treated imitation learning and subsequent biological inheritance of imitated behaviors as responsible for both continuity across generations in species-typical patterns of behavior and the perfection of instincts. During the early part of the present century, many of the major figures in the early history of experimental psychology (Hobhouse, 1901; Kohler, 1925; Lashley, 1913; McDougall, 1924; Morgan, 1900; Thorndike, 1911; Watson, 1908), as well as any number of less well remembered behavioral scientists, studied and speculated about the process of imitation learning (Berry, 1906, 1908; Cole, 1907; Davis, 1903; Haggarty, 1909; Kempf, 1916; Kinaman, 1902; Porter, 1910; Sheperd, 1910, 1911, 1923; Small, 1900, 1901; Witmer, 1910).

In consequence, in discussing imitative learning in animals, one has to

consider a long and venerable history that provides sources of both comfort and confusion: Comfort, in that study of learning by imitation in animals for more than a century suggests the topic of animal imitation is of intrinsic interest; confusion, in that historical diversity in approaches to study of imitative behavior has produced incompatible conceptual frameworks for analysis of imitative phenomena. One man's example of true learning by imitation is another's paradigmatic case of "pseudo-imitation" and each can cite historical precedent for treating phenomena of interest as he does.

Early work on imitation learning is not only of historical interest. The latter half of the 19th century saw the formulation of alternative approaches to the study of imitative phenomena that, even today, shape research in the area. The views of major figures in the behavioral biology and psychology of the last century, provide an important foundation for understanding the origins of much contemporary disagreement and confusion as well as a benchmark from which to measure a century's progress in the study of imitative behavior.

## EARLY PERSPECTIVES ON LEARNING BY IMITATION

The major impetus for 19th-century discussion of imitation arose out of disagreement among leading scientific figures of the period concerning the origins of the higher mental faculties of man. Darwin and Wallace, co-formulators of evolutionary theory, differed profoundly over the possibility of employing the principle of evolution, of descent with modification, to understand the development of the human mind. As a contemporary, George Romanes (1884), stated the issue:

. . . the great school of evolutionists is divided in two sects; according to one the mind of man has been slowly evolved from the lower types of psychical existence, and according to the other the mind of man, not having been thus evolved, stands apart, *sui generis* from all other types of existence. (p. 9)

The dispute was similar to modern debate over whether animals, like men, are capable of conscious thought, "for them to know, or think consciously about the eventual results of what they are doing" (Griffin, 1985, p. 480); the issue today, as in 1884, is the continuity of human and animal mind. In one way, the controversy at the end of the last century was more respectable than its modern counterpart; during the former debate, there was some consensus as to evidence that would decide the issue: indication that animals had humanlike emotions such as shame, remorse, jealousy, and benevolence, that they could use tools or act deceitfully, that they were able to solve complex problems or imitate complex acts.

## G. J. Romanes

For both George Romanes, a staunch advocate of the Darwinian view, and for his opponents, demonstrations of imitative learning in animals were seen as providing important evidence of an evolutionary origin of the higher mental faculties of man. The capacity for imitation in animals was viewed as ancestral to the unique human faculty for culture.

Because of the view of phylogeny held by Romanes and many of his contemporaries, failure to find evidence of gradually increasing complexity in imitative behavior as one ascended the great chain of being would have disconfirmed the continuity position. Romanes did not share Darwin's conception of phylogeny as a branching process (Galef, 1986). Rather, Romanes's discussions of evolution have implicit within them the older Spencerian (1855) view (now discredited; Hodos & Campbell, 1969) that it is possible to trace a historically meaningful, linear development of mind across extant species. In consequence, Romanes believed the Darwinian notion of continuity required the presence in living animals of a graded series of primitive precursors of human mental and moral faculties.

Imitation learning was a particularly important test case for Romanes (1884, 1889) because he believed that the imitative faculty reached its highest levels of perfection, not in rational, adult, European man, but in slightly inferior forms: monkeys, children, savages, and idiots (Romanes, 1884, p. 225). Hence, imitation was a faculty one would expect to find, in at least rudimentary form, in species standing yet lower on the psychological scale. Seeking evidences of primitive imitative capacities in animals, Romanes was quick to find them. Romanes's (1884, 1889) classic texts provide many examples.

The first instance of imitation, and the one described by Romanes (1884) at greatest length, is an example of imitation by honeybees of a behavior exhibited by bumblebees.

One morning for the first time, I<sup>1</sup> saw several humble-bees . . . visiting flowers [of the kidney bean], and I saw them in the act of cutting with their mandibles holes through the under side of the calyx, and thus sucking the nectar: all the flowers in the course of the day became perforated, and the humble-bees in their repeated visits of the flowers were thus saved much trouble in suckling. The very next day I found all the hive-bees, without exception, sucking through the holes which had been made by the humble-bees. How did the hive-bees find out that all the flowers were bored, and how did they so suddenly acquire the habit of using the holes? . . . I must think that the hive-bees either saw the humble-bees cutting the holes, and

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<sup>1</sup>The "I" in this case is actually Charles Darwin. Romanes's 1884 text contains several quotes from an unpublished Darwin manuscript, originally intended as part of *Origin of Species*.

understood what they were doing and immediately profited by their labour; or that they merely imitated the humble-bees after they had cut the holes, and when sucking at them. (p. 220–221)

Romanes then briefly mentions a number of additional cases of imitative learning reported by other correspondents: (1) dogs in the Falkland islands that learned from one another the best way of attacking cattle, (2) chickens learning to respond to “the danger cries and signals employed by other species,” (3) birds imitating the songs of different species, (4) birds of some species that “articulate words” or “songs having a proper musical notation,” (5) dogs foster-reared by cats acquiring feline patterns of behavior such as face-washing, avoidance of water, and stalking mice, (6) juvenile birds taught by their elders to fly, (7) hawks taught by their parents “to more perfectly swoop upon their prey,” and (8) newly hatched chicks learning to drink water by imitating their fellows.

Romanes (1884) justified treating this diverse collection of observations as exemplifying a single underlying process, imitation, by inferring that in each case “there must first be intelligent perception of the desirability of the modification on the part of certain individuals, who modify their actions accordingly” (p. 229).

In Romanes’s view, modification of behavior as the result of interaction with others implied both intelligence and intentionality in the imitator. These inferences of intelligence and intentionality from evidences of imitation were both crucial to Romanes’s main line of argument and a recurring problem in succeeding decades.

If imitation in animals results from psychological processes qualitatively different from those underlying imitation in man (presumed to be intentional and intelligent), then instances of apparent imitative learning in animals are not true precursors of the human faculty for culture; such examples of animal imitation would be, in modern terms, analogues rather than homologues of human imitation. In consequence, Romanes’s use of evidence of imitation in animals to provide a bridge between the minds of animals and the minds of men required interpretation of instances of animal imitation as examples of the exercise of rudimentary versions of humanlike capacities for intelligent, intentional action. J. T. Bonner’s (1980) recent tracing of the evolution of culture has a similar underlying philosophy.

### C. L. Morgan

The need to determine whether a given instance of animal imitation depended on faculties of mind similar to those assumed to be employed in imitation learning by humans was recognized early in the history of behavioral biology. C. L. Morgan (1900) proposed that imitation may be of two basic types, either “in-

stinctive," or "reflective"<sup>2</sup> and that it is only the latter type, "deliberate and intentional imitation . . . directed to a special end more or less clearly perceived as such" (p. 193), that should properly be considered imitation in the sense the term is used in describing the behavior of humans after infancy.

A chick sounds the danger note; this is the stimulus under which another chick sounds a similar note. . . . Such a procedure may be described as imitative in its effects, but not imitative in its purpose. Only from the observer's standpoint does such instinctive behaviour differ from other modes of congenital procedure. It may be termed biological but not psychological imitation. And if it be held [as Romanes asserted] that the essence of imitation lies in the purpose so to imitate, we must find some other term under which to describe the facts. This does not seem necessary, however, if we are careful to qualify the term "imitation" by the adjective "instinctive" or "biological". And the retention of the term [imitation] serves to indicate that this is the stock on which deliberate imitation is eventually grafted (p. 190).

Thus, Morgan departs from Romanes in suggesting that changes in behavior, which to an outside observer appear to be the result of deliberate, conscious imitation, may rest on a different psychological process, instinctive imitation.

In addition to distinguishing instinctive from reflective imitation, Morgan (1900) introduced a further important concept, that of *intelligent imitation*, into discussions of imitative behavior. "Instinctive imitation introduces into the conscious situation certain modes of behavior, and if the development of the situation as a whole is pleasurable, there will be a tendency to its redevelopment under the guidance of intelligence on subsequent occasions" (p. 121).

As William James has proposed in 1892, "every instinctive act, in an animal with memory, must cease to be 'blind' after being once repeated" (James, 1961, p. 262). Either instinct or instinctive imitation may introduce behavioral elements into an individual's repertoire, but its subsequent maintenance, frequency of occurrence, and conditions of expression will reflect nonimitative learning processes, the action of intelligence. The distinction between processes leading to introduction of a pattern of behavior into an individual's repertoire and those influencing its subsequent expression, first suggested by James and Morgan, is one to which I return later in the present chapter.

### E. L. Thorndike

Although both Romanes and Morgan were willing to infer occurrence of learning by imitation from observation of animals of unknown previous history in uncontrolled environments, Edward Thorndike (1911) was far more cautious in accept-

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<sup>2</sup>The same distinction appears in the essays of the Scottish philosopher Thomas Reid (1764), though I do not know whether Morgan was aware of Reid's analysis of imitation learning.



ing evidence that animals could "from an act witnessed learn to do an act" (p. 79). Thorndike's unwillingness to accept anecdotal evidence of imitation in animals arose from his more general position that "the idea of a response is in and of itself unable to produce that response" (p. 257). If animals could learn to do acts simply by seeing those acts performed, clearly the idea of an act is sufficient impulse for its performance.

Thorndike's attempts to experimentally demonstrate imitation learning in chickens, cats, dogs, and monkeys failed to provide evidence of a capacity for imitation learning. The problem remaining was to explain purported instances of learning by imitation described by his contemporaries. It is in that explanation that Thorndike (1911) provided the conceptual basis for much subsequent experimental investigation of imitative phenomena.

To the question, "Do animals imitate?" science has uniformly answered, "Yes." But so long as the question is left in this general form, no correct answer to it is possible. It will be seen, from the results of numerous experiments soon to be described, that imitation of a certain sort is not possible for animals, and before entering upon that description it will be helpful to differentiate this matter of imitation into several varieties or aspects. The presence of some sorts of imitation does not imply that of other sorts.

There are, to begin with, the well-known phenomena presented by the imitative birds. The power is extended widely, ranging from the parrot who knows a hundred or more articulate sounds to the sparrow whom a patient shoemaker taught to get through a tune. Now, if a bird really gets a sound in his mind from hearing it and sets out forthwith to imitate it, as mocking birds are said at times to do, it is a mystery and deserves closest study. If a bird, out of a lot of random noises that it makes, chooses those for repetition which are like sounds that he has heard, it is again a mystery why, though not as in the previous case a mystery how, he does it. The important fact for our purpose is that, though the imitation of sounds is so habitual, there does not appear to be any marked general imitative tendency in these birds. There is no proof that parrots do muscular acts from having seen other parrots do them. But this should be studied. At any rate, until we know what sort of sounds birds imitate, what circumstances or emotional attitudes these are connected with, how they learn them and, above all, whether there is in birds which repeat sounds any tendency to imitate in other lines, we cannot, it seems to me, connect these phenomena with anything found in the mammals or use them to advantage in a discussion of animal imitation as the forerunner of human. In what follows they will be left out of account, will be regarded as a specialization removed from the general course of mental development, just as the feathers or right aortic arch of birds are particular specializations of no consequence for the physical development of mammals. For us, henceforth, imitation will mean imitation minus the phenomena of imitative birds.

There are also certain pseudo-imitative or semi-imitative phenomena which ought to be considered by themselves. For example, the rapid loss of the fear of railroad trains or telegraph wires among birds, the rapid acquisition of arboreal habits among Australian rodents, the use of proper feeding grounds, etc., may be