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# Laboratory studies of imitation/field studies of tradition: Towards a synthesis in animal social learning

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ABSTRACT

Here I discuss: (1) historical precedents that have resulted in comparative psychologists accepting the two-action method as the "gold standard" in laboratory investigations of imitation learning, (2) evidence suggesting that the two-action procedure may not be adequate to answer questions concerning the role of imitation in the development of traditional behaviors of animals living in natural habitat, and (3) an alternative approach to the laboratory study of imitation that might increase the relevance of laboratory studies of imitation to the work of behavioral ecologists/primatologists interested in animal traditions and their relationship to human cumulative culture.

This article is part of a Special Issue entitled: Tribute to Tom Zentall.



## 1. Introduction

In 1988 Lawrence Erlbaum Associates published *Social Learning: Psychological and Biological Perspective*, a multi-authored text that Tom Zentall and I co-edited. The book, developed from a symposium that Tom had organized for the meetings of the Midwestern Psychological Association in Chicago in 1985, was the first of several edited volumes and special issues of journals focussed on animal social learning that were to appear in the following 25 years.

Periodic publication of collections of papers on social learning was useful because those interested in the role of socially acquired information in the development of adaptive patterns of behavior had backgrounds in fields ranging from anthropology to zoology. Consequently, relevant literature was widely scattered and difficult to follow in the primary literature.

The diversity of background of those interested in understanding social learning led Zentall and Galef (1988, p. ix) to suggest that "The process of creating a coherent field of social learning out of the diversity of current social learning research is likely to be both long and difficult." Juxtaposition in edited volumes of work sampling broadly from the diverse social learning literature provided a potential antidote to intellectual provincialism.

As the subtitle to Zentall and Galef's (1988) volume indicates, divergence of interests between those approaching the study of animal social learning from biological and psychological perspectives was particularly obvious. Investigators working in paradigms associated with experimental/comparative psychology were concerned almost entirely with social influences on animals' acquisition of behaviors that are not seen outside the laboratory: bar pressing, key pecking, chain pulling, etc. More biologically oriented contributions focussed on the possible role of socially acquired information in the development of presumably adaptive patterns of behavior seen in natural circumstances: predator avoidance, food handling, mate choice, etc.

Further, and as will come as no surprise to those with even a passing familiarity with the social-learning literature, the chapters in Zentall and Galef (1988) discussing the role of social information in the acquisition of arbitrary responses were preoccupied with the question of whether animals could imitate, whether in Edward Thorndike's (1911, p. 79) words, an animal "from an act witnessed, could learn to perform that act." For example, Zentall (1988) entitled his chapter in the Zentall and Galef (1988) volume "Experimentally manipulated imitative behavior in rats and pigeons" and David Hogan (1988) entitled his "Learned imitation by pigeons." To the contrary, chapters focussed on the role of social learning in the acquisition of patterns of behavior seen in natural circumstances never mentioned imitation in either title or text.

The field of social learning has changed dramatically over the last quarter century. In Laland and Galef (2009) edited volume "*The Question of Animal Culture*" comprising chapters by both psychologists and biologists interested in the role of social learning in development of local traditions in free-living animals, imitation is discussed in every contribution, whether its author was trained in psychology, ecology, primatology, or philosophy.

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The present manuscript has four goals: first, to explore the historical context that led those with a background in experimental/comparative psychology and an interest in animal social learning to focus almost exclusively on studies of imitation as first defined by Thorndike in 1898 rather than on other forms of social learning: e.g. local and stimulus enhancement, emulation, second, to ask whether concentration on learning to perform an act from seeing it done was really such a good idea (I am going to suggest that it was not), and third, to explore the adequacy of Thorndikian imitation and the two-action method to which it led for analysis of the development of traditions in free-living animals. Last, I shall offer a suggestion as to where those interested in mechanisms of social learning that support development of local traditions in animals might focus attention in future.

My purpose in reviewing the historical material is to take a tentative, and I hope heuristic step towards integrating the work of those (primarily experimental psychologists) conducting laboratory experiments examining animal imitation with the contributions of those (primarily primatologists) providing information on the regional distribution (e.g. Whiten et al., 1999) and development (e.g. Lonsdorf, 2005, 2006) of traditional patterns of behavior in populations of free-living animals.

## 2. Edward Thorndike and the study of animal imitation

Edward Thorndike published two immensely influential monographs, both entitled *Animal Intelligence*, and both describing and interpreting the results of his dissertation research on animal learning. The title of both monographs poked not- so-subtle fun at similarly titled earlier monographs by such pioneers in the interpretation of animal behavior as Lloyd-Morgan (1891) and George Romanes (1892). Indeed, the conclusion Thorndike reached in both his publications was that animals are not nearly as cognitively sophisticated (i.e. intelligent) as they had been portrayed by his contemporaries.

In the social-learning literature, Thorndike's classic papers are usually treated as describing the methods and results of a series of failed experimental investigations undertaken to determine whether, as a plethora of earlier anecdotal reports of animals (e.g. Romanes, 1884) suggested, non-human animals (henceforth animals) could "from an act witnessed, learn to produce that act."(Thorndike, 1911, p. 79), or alternatively "whether the idea of an act *or the result of an act* [emphasis added]. . .tends in itself to produce that act" (Thorndike, 1911, p. 250).

Perhaps surprisingly, for decades, only the first of the two definitions of imitation Thorndike (1911) proposed captured the attention of those studying animal imitation. Not until 1996, when Tomasello introduced the term "emulation" (learning about the results of actions rather than about actions themselves) into the social-learning literature, did researchers and theoreticians begin to consider the possibility that observation of the result of an act, rather than of an act itself, might increase the probability that an observer would perform an act that it had observed.

Thorndike's repeated failure to find evidence consistent with the hypothesis that cats, dogs, chickens or monkeys could learn by imitation proved an irresistible challenge to subsequent generations of comparative psychologists motivating myriad studies in apparatus, similar to (if more sophisticated than) Thorndike's famous puzzle boxes. Discovery of convincing experimental evidence that any animal could learn to produce an act simply from observing another engage in that act became something of a Holy Grail in laboratory research on animal social learning.

However, as the second of the two quotations above from *Animal Intelligence* (1911, p. 250) suggests, Thorndike did not undertake his ground-breaking thesis research to determine whether animals could imitate. The issue that interested Thorndike was both broader and of greater general interest than that. Thorndike wanted to know whether, as his contemporaries largely believed, animals other than humans could use representations to initiate actions. In Thorndike's view, evidence of imitation in animals would be consistent with interpretations of animal learning that included human-like cognitive capabilities; if animals could imitate, then the idea of an act (in the case of imitation, an idea formed by watching another behave) must be able to initiate and direct behavior.

Evidence of the breath of Thorndike's interest in undertaking his dissertation research is apparent in a second (perhaps wisely forgotten) paradigm that he used to investigate the ability of animals to use representations to organize their behavior. Thorndike argued that, if the idea of an act were sufficient to produce that act, then an inexperienced animal repeatedly "put through" (Thorndike, 1911, p. 103) some action leading to reward should subsequently show a reduced latency to learn to perform that action. "Putting through" involved manually moving an animal's limb to produce a desired action (e.g. a foot pulling on a string or stepping on a treadle). Thorndike considered his failure to find any evidence of an effect of "putting through" on latency to acquire behaviors as consistent with his failure to find evidence of imitation. Both suggested that in animals, the idea of an act did not lead to its production.

Thorndike's thesis data and his interpretation of them had tremendous impact on the study of behavior and resulted in a near-total rejection of cognitive interpretations of animal behavior during the decades when radical behaviorism dominated study of both animal and human learning. Second, and equally relevant to the present discussion, all researchers interested in animal learning adopted Thorndike's general method for studying imitation; naïve observers were allowed to watch demonstrations of a motor act leading to reward, and the latencies of such subjects to acquire the observed behavior was compared with that of control animals that had not seen demonstrations.

In the late-20th century, Thorndike's method of studying imitation as well as his perspective on animal intelligence more generally (Shettleworth, 2010), were to fall from favor. Critics of Thorndike's experimental paradigm for studies of imitation (e.g. Galef, 1988) argued that his methods could not provide convincing evidence of imitation learning. It was simply impractical to exclude all alternative explanations to imitation of any effect of watching a demonstrator perform a behavior on the latency of an observer subsequently to acquire that behavior. In particular, local or stimulus enhancement, the effects of increased attention paid to a portion of the environment following observation of activity of another there (e.g. Galef, 1988; Whiten and Ham, 1992; Zentall, 1996) proved impossible to exclude in traditional imitation experiments.

Credible evidence of imitation by an animal that had seen another engage in some activity was not available until some decades after Dawson and Foss (1965) first reported that naïve 'observer' budgerigars that had watched a trained conspecific demonstrator use either its foot or beak to depress a lever for a food reward tended to use the same appendage as had their respective demonstrators. A partially successful attempt to replicate the Dawson and Foss "two-action method" (Galef et al., 1986) led, over subsequent decades, to a dramatic change in the procedures used to seek evidence of animal imitation. The two-action method became standard in experimental studies of imitation; naive rats watched trained demonstrators push joy sticks to left or right (Heyes and Dawson, 1990; Heyes et al., 1992), observer pigeons and quail watched conspecifics either step on or peck at treadles (e.g. Zentall et al., 1996; Atkins et al., 2002), and apes and children watched others push or pull at artificial fruit, (for review, see Whiten and Custance, 1996), then tended to act as had their respective demonstrators. Other potential methods for studying imitation [e.g. examining social transmission of novel sequences of