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Auditory awareness

Henry E. Heffner *

Department of Psychology, University of Toledo, Toledo, OH 43606, USA

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Abstract

This paper reviews seven lines of auditory research which bear upon the issue of awareness in animals. First, comparative studies of auditory sensitivity have found important differences in the [redacted]

'conscious intention', leaving one writer to comment that "... the still befuddled state of definitions and descriptions of human awareness ... should give us pause about resolving terminology regarding animals!" (Burghardt, 1985).

Although the minds of animals, not to mention those of humans, are completely unobservable, the view taken here is that the topic of awareness in animals is one that can be productively studied. Indeed, a major source of information regarding animal [redacted] radical behaviourist who rejects the study of animal minds, have indicated that animals often show an unexpected degree of awareness (e.g., Epstein, 1996; Wasserman, 1993). This paper will not attempt a comprehensive review, but will illustrate both the types of studies that can be conducted as well as what is generally known about auditory awareness in animals. Reference is made where possible to studies of domesticated animals, with other species mentioned when necessary in order to illustrate major points.

2. Auditory awareness

That there are different levels of auditory awareness is demonstrated by brain-damage in humans that results in an inability to recognize sounds, i.e., auditory agnosia (e.g., Bauer, 1993). In this disorder, a patient is able to hear a sound, but is unable to identify the object that made it. For example, the sound of a violin or of a finger being run across [redacted] of studies in the literature that attempted to train animals to respond to sounds they could barely hear. The fact that the auditory sensitivity of animals varies is illustrated in Table 1, which lists the hearing ranges and sensitivities of various domestic animals with humans shown for comparison.

There are three points that can be made regarding the hearing parameters shown in Table 1. First, high-frequency hearing among this sample varies from 6000 Hz in the mallard duck to 79,000 Hz in the laboratory mouse, a range of over four octaves. In mammals, high-frequency hearing evolved as a means of localizing sound and the smaller the animal (or, more precisely, the smaller its head), the higher it must hear in order to use high-frequency locus cues (Heffner and Heffner, 1992b). Thus, most mammals hear high-frequency sounds that are inaudible to humans because most mammals have smaller heads than humans (the Indian elephant, on the other hand, with its large head has a high-frequency limit of 10,500 Hz, almost an octave less than the

Here, humans, along with cattle, excel and low-frequency sounds easily audible to us may be less audible to other animals. Low-frequency hearing in birds is less well studied and there is some indication that pigeons may be sensitive to very low-frequency sounds (Kreithen and Quine, 1979).

Finally, animals vary in their absolute sensitivity to sound. As shown in Table 1, mammals, especially humans, cattle and goats, tend to be extremely sensitive at their frequency of best hearing whereas birds are usually less sensitive (see the works of Fay, 1988; Heffner and Heffner, 1992a). Just why this variation in best sensitivity occurs is currently unknown.

A knowledge of the auditory sensitivity of domestic animals is of obvious use in stimulus to the response and the novelty of the stimulus. For example, rats rapidly learned to discriminate location using a go/no-go procedure when they were required to press a lever located next to one of the sound sources (Neill and Harrison, 1987). Similarly, horses easily learned to discriminate location using a go/no-go procedure

Not all studies have been so successful. Researchers using an auditory same/different task involving tones were able to train only four of eight monkeys (D'Amato and Colombo, 1985). Similarly, it was reported that a it took budgerigars months to learn a same/different task involving four different sounds (Downing et al., 1988). (Although these two studies stated that they used a matching task, strictly speaking, it was a same/different task.)

Overall, it has proven difficult to demonstrate auditory relational concepts in animals, although there are several factors which may facilitate training on relational tasks (Wright et al., 1990). These include requiring the animal to approach the sound source, employing a large sample of different sounds, and using 'natural' sounds—that is, sounds produced by other animals as opposed to pure tones and noise bursts.

2.4. Auditory memory

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the time span was very short. Either the auditory memories of animals are quite limited or else more appropriate tests need to be devised.

2.5. Auditory perception

Sounds are most useful when they provide information about the object that made the sound, i.e., the sound source. The perception of sound sources can be studied in the laboratory by training animals to classify sounds into natural categories. For example, dogs were trained to classify sounds into two categories (Heffner, 1975): sounds produced by dogs (barks, whines, whimpers, growls, and pants) and 'non-dog' sounds (various mechanical sounds as well as the sounds of other animals). The dogs were trained to touch one panel when a dog sound was presented and a different panel when a respond differentially to them. 'Leopard' alarm calls were more likely to cause the monkeys to run to trees, 'eagle' alarm calls caused them to look up and/or run into cover, and 'snake' alarm calls caused them to look down. Thus, some animals can use vocalizations to signal different events as well as to recognize individuals of their species.

2.7. Using human speech to communicate with animals

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