



Likely Impacts of Anthropogenic Noise on Social Communication in Helmeted Guinea Fowl (*Numida meleagris*)



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Abstract

Ambient noise has the ability to mask important aspects of social communication. Often overlooked in agricultural, domestic, or conservation studies, the impacts of environmental noise can mask important features of social communication that enable species to engage each other. Here, I discuss the concerns of anthropogenic noise on social communication, and use the helmeted guinea fowl (*Numida meleagris*) as a model species in both popular and institutional purposes for understanding the effects of artificial noise on communication.

Keywords: Social communication; Helmeted guinea fowl; Sensory systems; Anthropogenic noise; Environmental noise

Perspective

In animal communication, signals are designed to stimulate the sensory systems of intended receivers [1-6]. It is assumed that signal structures reflect the action of selective forces and constraints that shape signal characteristics in a way to maximize signal efficiency in its ability to convey information to a receiver by drawing first its attention and by enhancing signal detection, discrimination and processing [5,7]. In order to convey information effectively through an ecologically complex environment, animals have to maximize the chance of being detected by social partners [8,9]. Since signals are used to mediate social interactions, it is important for receivers to perceive them in an accurate manner to further adopt appropriate behavioral responses [10]. Thus, detect ability appears to be a critical feature for signal efficiency, which is possibly affected by the properties of the natural background scene in which signals are displayed. When the environment becomes too noisy, it may be difficult to discriminate the signal among levels of interference. A reduction in signal transmission, due to environmental noise, has been described in different sensory capacities, such as vision, [11-13] auditory [14], seismic [15], chemosensory [16] and electrical modalities.

To overcome the masking effect of this type of environmental noise, signals must evolve a design component to compensate for complex noise; moreover, the receiver systems must then develop a mechanism to enhance the detection of these signals [17]. The effect of ambient noise on signal detection has recently been given much attention in the literature, especially in acoustic signals affected by

urban noise [18-20]. For example, great tits (*Parus major*) increase the frequency pitch of their songs to prevent masking from human-induced noise [21]. Similarly, house finches (*Carpodacus mexicanus*) increase singing rates to overcome ambient noise in urbanized areas [22]. Thus, the efficiency of auditory communication may face interference from the competition induced by ambient anthropogenic noise, such as traffic, construction, conversations, and the reverberation of these sounds against artificial and natural structures.

Helmeted guinea fowl (*Numida meleagris*) are a common species of the order Galliformes found in southern Sahara Africa, but has been widely introduced to places in South America, Europe, Asia, and North America. Many studies have focused on the guinea fowl in its native African range [23-26], resistance to certain parasites [27], and use as food for nutrition [28,29], little research has focused on the behavior of these social organisms. Commonly maintained on rural farms as a biological alarm system [30], the helmeted guinea produces alarm calls that tend to instigate the mimicked vocalizations in their conspecifics [31,32]). When threatened, one individual will begin the call, which will elicit the calls of all members of the social group [32]. As such, this species has become a popular domestic animal to maintain both commercial, to protect personal interests, and personally for collectors who are invested in their auditory attributes.

Although helmeted guinea fowl have sustained the success of popularity and sustainability through zoological institutions

and personal collections, they remain an exemplary model for understanding how species may adapt behavioral attributes to the onset of anthropogenic interferences. Few well-documented species have been able to thrive under both domestic and various captive conditions that favor maintaining a colony for permanence. Hence, *N. meleagris* maintains a status that allows them to be popular for collections, yet a model species for both captive and in situ species that need to negotiate anthropogenic noise in order to continue to communicate with conspecifics.

The masking of important aspects of social communication by environmental noise can be overlooked during both agricultural and conservation efforts. For example, in the application of domestic livestock welfare, Miranda-de la Lama & Mattiello [33] found that derailment of social behaviors interfere with vertical, horizontal, and oblique interactions with conspecifics, and thus alters the human-animal interaction responsiveness across the herd. In conservation efforts, Rabin et al. [34] found anthropogenic noise indeed influences the behavior of captive species, both in a positive and negative manner. However, their study noted that it is important to consider the impacts of the artifacts of ambient noise that may influence the perception of behavior to public patrons.

Patricelli et al. [18] make a strong point, particularly for the plethora of avian species found in urban environments, which they clearly must adjust to the constraints of signaling demands in order to continue social engagement. The inability to effectively communicate would surrender their ability to sociality is an important and dynamic feature of welfare and husbandry that must be considered for animals in captivity. So imagine, for example, that a social species was hampered from communicating with conspecifics that have been sympatrically isolated from their genetic cohort. Yet, this species faces a new challenge of maintaining physiological constraints to continue social communication where anthropogenic elements interfere with their transmission. There is good evidence to support that the evolution of cultural transmission surpasses the rate of natural selection [35]; thus species need to adapt and impart this physiologically able, yet socially plastic behavior to future offspring. There is clear evidence that social species in an urban environment has managed to adapt to the conditions, both as an r-selected species, yet maintain social communication. The house sparrow [36,37], for example, have championed the ability to be artificially translocated from their natural ecological envelope, and thrive in a new environment. Hence, these species maintain the known qualities of generalists physiologically and behaviorally [38-40].

Conclusion

It is important that caretakers of animals in captivity, for both domestic and conservation purposes, acknowledge that there are conditions like anthropogenic noise that may influence natural behaviors. The indicators may be subtle, yet important for guiding how an individual may engage conspecifics and any human caretakers on sustainability, and thus may influence how to progress with fruition. In maintaining captive populations for various purposes, it is important to understand how the subtle

aspects of a behavioral repertoire may greatly influence general behavior. Thus, studies on social behavior may enable caretakers of captive populations to consider how sociality is fundamentally important for generating social interactions.

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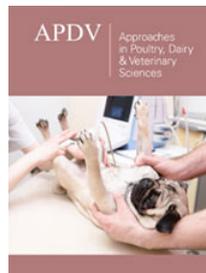
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