# Acoustic Signals in Domestic Chicken *(Gallus gallus)*: A Tool for Teaching Veterinary Ethology and Implication for language learning

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**Abstract**

In this study chicken were able to express about 30 sounds (Words/ syllables) of which 19 were distinctly identified as : warning , alarm , contact, territorial, laying, nesting, mating, threat, submissive, distress, fear , contentment, food, dust bathing, perching, battle cries, privacy, dominance and time calls. And short sentences (A combination of two and three syllables/ cackle). There were also some sounds that were not deciphered. Local chicken have had a good sense of hearing to these sounds as observed from postural, visual and auditory displays. It was found that baby chicks from broody and non broody breeds responded to the acoustic stimulus. While the adults of the commercial breed, did not respond to the acoustic stimulus, showed less motor reactions, postural and vocal displays. Also they produced less syllables. It was concluded that they do not know the language. The songram indicate that chicken produced sound frequency ranging from 50Hz to 10 kHz, this hearing range is within the hearing realm of humans which is 20-20,000Hz. Thus, Birdsong can be used as a biological model of human language, and acoustic communication in chicken can be demonstrated to students without the requirement of special apparatus. The results showed the usefulness of the chicken model in teaching acoustic communication, animal behavior and the importance of imprinting in language learning.

**Keywords**: Animal behavior, bio-acoustic, bird-song, Imprinting, language-learning, poultry- welfare.

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## Introduction

Bioacoustics is the study of acoustic characteristics and biological significance of sounds emitted by living organisms. Birds are one of the few groups of animals known to exhibit vocal learning, and use acoustic communication for territoriality, mate choice, offspring recognition, alarm signaling, and individual recognition birds make their presence and known to each other

(Waldvogel, 2000). Communication between chicks takes place via visual and auditory signals. Several territorial songbirds have been shown to be very good at identifying vocalizations that serve as a species-specific acoustic signature that readily announces their presence (Burgeois, et al. 2007; Catchpole and Slater, 1995). However, most birds produce infrasonic sounds that a human ear may not listen (Brandes, 2008) necessitating special recording, analyzing and replaying equipment. Studies confirm that domestic chicks can hear 60-11950 Hz (Broitman, 2007). This hearing range is within the hearing realm of humans which is 20-20,000Hz. Thus humans can hear sounds produced by domestic chicken. This similarity of sound if recorded can serve as a readymade source of information that can be used to explore the acoustic behavior of birds.

In the wild, survival of chicks depends on rapid bonding between the hen and chicks. Newly hatched chicks need a special care in helping them to find food and water (Hafez, 1975). Maternal behavior or broodiness has been selected out of commercial laying strains so it is not important in intensive poultry husbandry systems. Chicks are reared artificially, kept on 24 hours light. Glitter tapes and marbles are placed on feed troughs in order to learn the chicks to drink and feed (Tannenbaum, 1995). These problems might be reduced if reared by broody hen. A broody hen with chicks, a bond is formed and the chicks learn to respond to the maternal feeding call, distress call and to the hen's 'purring' sound as she settles down. Repeated exposure to her, accompanied by food, guidance and protection, strengthen the filial bond.

The objective of this study was to examine the vocal interactions of domestic chicken through effect of maternal acoustic stimuli on the behavior response of chicks in broody (Indigenous and non broody (commercial) poultry variety. And to introduce students to acoustic lab and explore some aspects of chicken sound structure.

## Materials and Methods

### Animals

One broody hen with 10 newly hatched baby chicks plus three cocks of landrace breed. And 2 hens, 10 baby chicks and 2 cockerels of White leghorn breed were used in this experiment.

## Recording procedures

Recording and testing apparatus was constructed as shown in Figure 1A and B. The setups consisted of cage (80 cm×60 cm×60 cm) lined with sound-absorbent foam the front elevation was made of wire mesh. A broody hen was placed inside a cage a hanging microphone, the baby chicks were placed outside the cage and the hen was stimulated by different stimulus feed, fear by exposing to cat. The sound was recorded with Kenny wood 900 recorders, in cassette tapes. Then this was converted in to MP3 and copied in to CD.

## Acoustic analysis

Frequency response and acoustic structure of the recorded sound were analyzed using an acoustic software (Spectra PLUS®, 2011. Professional Edition FFT Spectral Analysis System Version 5.0.26.33 copyright 1993-2011). For proper understanding of the intended message each song was be divided into distinct sections called *phrases*, which in turn are composed of smaller acoustic units known as *syllables* and *elements* The sounds were played back to the baby chicks using a portable radio cassette by covering the cage to conceal the hen, with a card board and removing the hen from the cage. And the peep calls of the baby chicks to the hen. as shown in Figure 1 C and D.

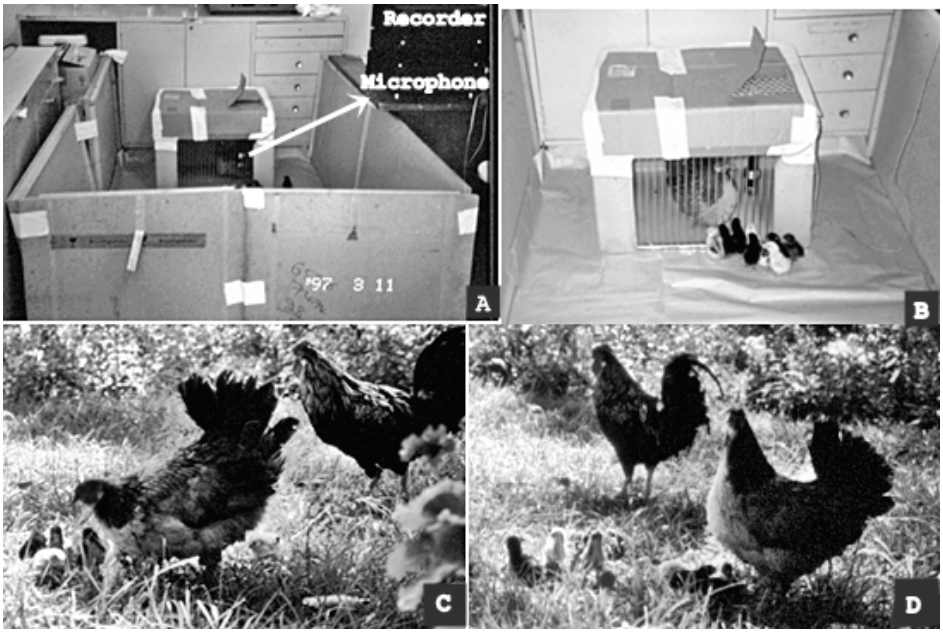


Figure 1. Sound recording and playing apparatus (A-B) and field experiment (C-D)

### Playback and observation of chick behavior

The reaction of baby chicks and adults were observed by playing warning calls, alarm cackle, feeding calls and resting calls. And behavior of chicks in the field with broody-hen was photographed and recorded and matching a specific inductive sound with behaviors was done. The reactions were reported as vocal, visual, postural, motor and tactile responses.

## Results

The frequency range of the sound produced was 50Hz to 10 kHz as shown on Figure 2. The sonagram revealed that, songs from different stimuli have different acoustic substructures various syllabi and phrases were identified as shown on Figure 3. Some 19 calls were deciphered. While some of the sounds were not characterized.

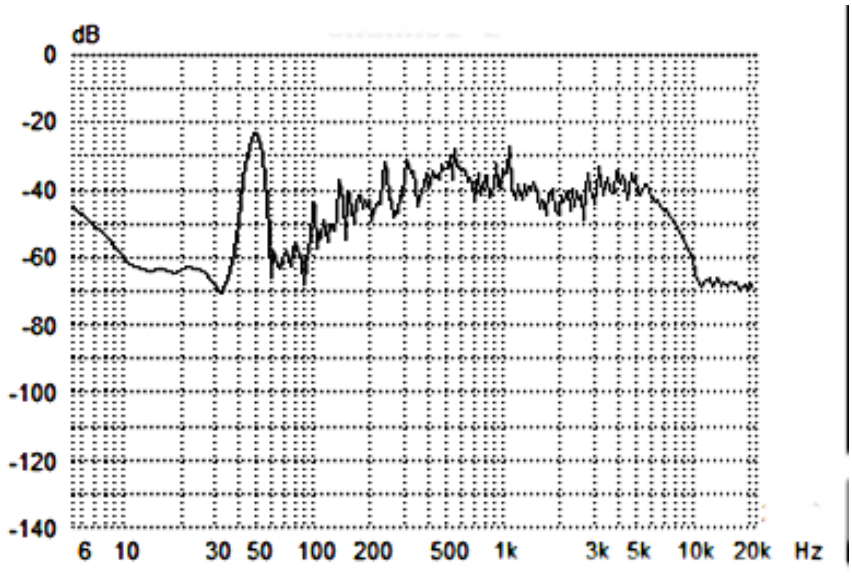


Figure 2. Frequency response curve of chicken vocalization 100Hz-10kH

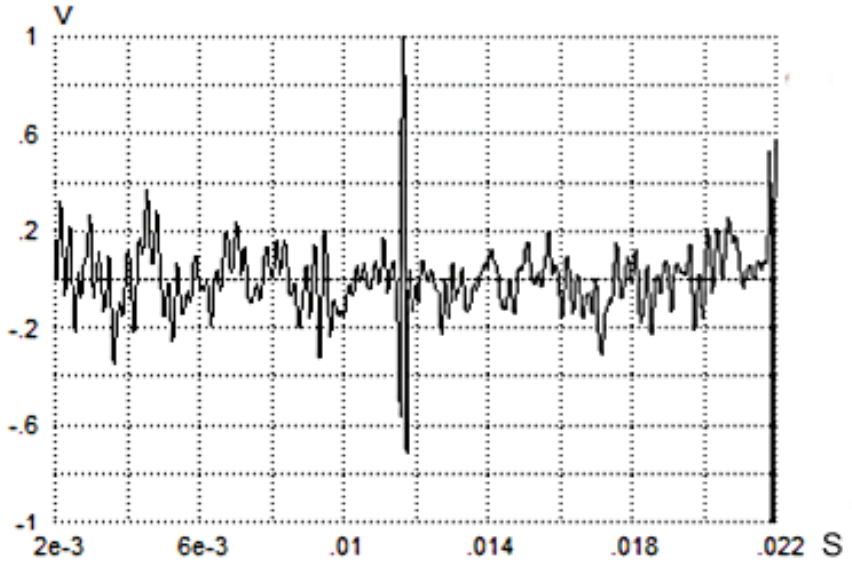


Figure 3. Spectral analysis of syllabic and phrases

Both breeds of baby chicks responded to the chrome recorded maternal acoustic stimulus with motor, visual and tactile responses similar to responses to maternal voice as depicted from analysis of photographs of specific actions related to the sound. The hen responded to baby chick peeps by moving toward the direction of the sound and communication is reciprocal. Similarly both male and female of the local broody breeds responded to recorded maternal acoustic stimulus. While the commercial breeds, responded none to the acoustic stimuli.

Two students were able to decipher the recorded sound without sonogram. They were able to make template matching sound and reactions; this was done by selecting an example sound as a template with which to find other instances of this sound. Complicated phrases were analysis using the sonogram method.

## Discussion

Based on this observation chicken song can be used in the study of animal communication with little equipment as it is audible to human ear. Chicken song can also be illustrated using the sonagram method (Colliar, 1953). Vocal communication mediates social relationships in many animal species

and can be particularly important in hen–chick interactions. Avian species in general and chicken in particular exhibit a strong mother –offspring bond that is frequently expressed through vocal exchanges among hens and their chicks (Alcock, 1989). Several species produce calls that are exclusively used to induce nursing behavior. We therefore predicted that chick calls would affect the behavior and biology underlying baby chick growth. And a recorded sound could be used to promote growth and feeding in commercial farms and improve animal welfare (Huntingford, 1984). The results of this study showed that there is little difference between the baby chicks of the two breeds, this is ultimate due to ability to being precocial, birds are self-sufficient after hatching, but parents serve an important protective function while also teaching the chicks about edible and inedible foods (Mench, 2009). Precocial chicks imprint on their parents in the first few days of life (Fisher, 1967). Imprinted chicks remain close to the imprinted object, which is normally a parent, but under laboratory conditions may be a variety of different objects (Mench and Keeling, 2001). In psychobiology, imprinting is a form of learning in which a very young animal fixes its attention on the first object with which it has visual, auditory, or tactile experience and thereafter follows that object. In nature the object is almost invariably a parent; in experiments, other animals and inanimate objects have been used.

The developmental physiological factors underlying imprinting are still not well understood (Fiscer, 1967). Two factors found to affect imprinting are age imprinting at I2 hours in a broiler chick can yield strong following and subsequent discrimination between the parental and a different model imprinting at I2 hours in a broiler chick can yield strong following and subsequent discrimination between the parental and a different model (Colwell et al, 2007).However, the adults of the two breeds differed in acoustic responses. The commercial breeds responded non to the stimulus and were able to produce fewer sounds. Probably they do not know the language. The modern breeds are selected against broodiness because it is unwanted character and this genetic trait has completely disappeared (knocked out) in the flock. Now in the world about 10 billion chicken are produced (Ensminger, 1992), annually by highly specialized industries, which are practically hatched and reared artificially. Consquently Poultry has attracted more welfare concern than any other farm animal. (Kligour and Dalton, 1984). Caged hens are deprived of an environment suited to their nature as foraging animals with wings, legs, horny toes for scratching the earth, full-spectrum color vision, and other evolved characteristics that distinguish them as gallinaceous birds with

well-defined, characterized patterns of, behavior and activity. Caged hens are unable to forage (to peck and scratch at the earth with their claws and beaks), to dust bathe, to sunbathe, to perch, to stretch their wings, to walk or to run. Male chicks reared separately as in commercial production lack the ability to undergo courtship and mating. The sound structure of chicken is somewhat analogous to a human language sentence, where Individual words combine to make up identifiable parts of grammar that give the sentence. There are significant acoustic similarities between bird sounds and speech particularly in the second formant frequency range only minimal modifications are required to transform species specific sound into speech-like sounds (Broitman, 2007). Thus the chicken model in school language suggests that early imprinting help learn a language. This can be extrapolated for children language study audio lessons incorporated into the school curriculum.

Equipment needs for demonstration of communication in chicken are relatively minor, but do require some computer program Windows with graphics capability for acoustic analysis computer software (Brandes, 2008).There is a need for of background knowledge needed to understand the role of song in bird communication. If the chicken acoustic lab is to demonstrate animal behavior, then the topics of physiology, development, genetics, territoriality, or communication should be studied in detail.

In conclusion our results showed the usefulness of the chicken model in teaching acoustic communication, animal behavior and the importance of imprinting in language learning.

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