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Vocal Communication

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Synonyms

Animal signaling; Nonverbal communication; Speech; Voice acoustics

Definition

Vocal communication is the transfer of information through the auditory channel via voice production mechanisms.

Introduction

Vocal communication is ubiquitous in mammal species. As a mode of signaling, vocalizations often manifest in alarm call systems, territorial displays, and courtship rituals and are particularly well-suited for functions requiring wide broadcast. But vocal signals are used in an incredible variety of communicative contexts, many of which are extremely quiet, and between small groups of animals. Here I will describe two fundamental issues important for the study of evolution of vocal communication in humans and nonhuman animals: the distinction between adaptive signals and byproduct cues, and the concept of form and function in the structure of animal signals. I will then apply these principles to current evolutionary research on vocal behavior in humans specifically.

In mammals, the underlying brain mechanisms driving emotional vocal behavior are highly conserved and involve neural circuitry integrating the anterior cingulate to laryngeal musculature (Ackermann et al. 2014). But humans have evolved speech production that is partially distinct both proximately (i.e., mechanistically and developmentally) and ultimately (functionally and phylogenetically). Direct connections between motor areas of the brain and laryngeal systems allow for the generation of complex speech sounds, and this production organization interfaces with many cognitive systems involved with language in a broad sense (Fitch 2000). But exactly how this dual pathway arrangement operates in real time remains to be described. Conversational turn taking, the primary context in which linguistic action occurs, is partly regulated by evolutionarily older vocal patterning, including suprasegmental prosodic variations, rhythmic coordination, and other vocal phenomena.

The study of vocal communication from an evolutionary perspective requires us to distinguish between signals and cues (Maynard-Smith and Harper 2003). Signals are behaviors or structures designed to affect the behavior of another

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organism, and the responses of the receiving organism are shaped by selection to be affected by the signal. That is, by design, signals typically benefit both senders and receivers. Examples of vocal signals in humans include a variety of evolutionarily conserved, nonverbal affective vocalizations, such as laughter, crying, pain shrieks, copulation calls, and emotional screaming. Language also constitutes a signaling system, transmitted primarily through speech production and working in tandem with the vocal emotional system through the integration of linguistic constituents (i.e., phonological, morphological, and syntactic) and suprasegmental prosodic features. All of the above signaling phenomena coevolved in the context of sophisticated social cognitive abilities including theory of mind, providing a platform for specialized ostensive communicative behavior (Scott-Phillips 2014). That is, because humans are able to reliably detect and signal about others' mental states and intentions, vocal signaling systems coevolved with pragmatic reasoning.

Conversely, cues are any actions or structures that were not designed to affect the behavior of other organisms but reveal information to receivers incidentally. Organisms can evolve perceptual sensitivity to cues and exploit individuals who reveal predictive information. When costly to those revealing information inadvertently, a coevolutionary arms race can ensue where selection for reducing cues coevolves with enhanced perception of relevant cue properties. This type of scenario applies to a variety of vocal communication phenomena in humans including detecting volitional signals with deceptive intent (e.g., so-called fake laughter and crying), intentional deception in speech, fertility in female voices, and formidability in male voices, among others.

As a general principle across mammalian vocal communication, the structural forms of signals are directly tied to communicative functions. In most nonhuman vocalization systems, the sound itself is doing the majority of the communicative work, as acoustic signals are designed to have either direct effects on receivers' behaviors, or they are paired with other events to achieve eventual indirect effects (Owren and Rendall 2001). This is true for a great deal of human communication as well. For example, in the case of infant-directed speech, a caregiver might produce a loud, nonverbal utterance with an abrupt onset and perhaps even nonlinear phenomena indicating high arousal, in an effort to prevent (or interrupt) a particular behavior in a target infant. Acoustic features capture the infant's attention and cause her to reorient, thus altering her behavior. The direct impact of the prohibitive yell on the infant's physiology achieves the goal of the caregiver. The form and function relationship apparent in ID speech suggests a fair amount of universality in the sound of a variety of infant-directed utterance types, which indeed has been found across cultures (Fernald 1992).

This principle underlies the affective aspect of any kind of human vocalization. Emotional vocal signals are generated as the products of particular combinations of physiological states characteristic of different emotions, and their sound can be understood in these terms. The downregulation typical of sadness lowers arousal-linked vocal features such as loudness, pitch, and speech rate, and the high arousal of intense fear has opposing effects on screams. Besides these basic acoustic dimensions of voice such as pitch, loudness, and rhythm, spectral features also are directly tied to affective states. Again, during high arousal, the effect of pushing air excessively through the vocal tract can be quite audible as nonlinear spectral features such as deterministic chaos and subharmonics that give vocalizations a harsh, noisy sound quality (Bryant 2013).

Many researchers examining human vocalizations from an evolutionary perspective have focused on the production and perception of sexually dimorphic vocal features. Vocal pitch in particular has been examined extensively. Pitch is the perceptual correlate of the fundamental frequency of vocal fold vibration regimes. Pubertal androgen exposure triggers growth of the vocal folds in young males resulting in lengthening and thickening that impacts vibration rates. According to the immunocompetence hypothesis, secondary sexual traits such as lowered pitch in male voices result from the effects of testosterone that simultaneously suppresses immune function. Only higher quality males, therefore, can afford to express the signal, thus making the trait attractive to females. Indeed, while immunosuppression effects of testosterone are not well established, it is fairly well documented that lower pitch in male voices has a variety of positive effects on judgments of attractiveness, dominance, body size, competence, strength, and other dimensions. Conversely, higher pitch in female voices increases men's judgments of attractiveness and is associated with judgments of greater femininity, youth, reduced body size, and higher fertility. Resonating properties of the vocal tract manifesting acoustically as formant structure also has been shown to have a variety of effects on these same dimensions, with relatively greater validity for body size in particular (for a review see Pisanski and Bryant 2018).

While sexually selected features of the voice have received considerable attention, the role of social context has been explored much less (Pisanski et al. 2016). Studies have shown that speakers often change their voices (e.g., pitch, loudness, and rhythmic properties) according to the demands of particular social contexts. For example, men have been shown to enhance masculinized features (e.g., use lower pitch) when speaking to a potential mate, and women will accentuate feminine features (e.g., raising their pitch and speaking slower) when told that their voices will be judged by men for attractiveness. Social context also plays an important role in how a variety of nonlinguistic vocalizations manifest themselves. For instance, friends in conversation tend to laugh more spontaneously, and the resulting arousal in their laughter affords the rapid detection of their relationship across widely disparate societies, as does the generally low-arousal volitional laughter more common between strangers or newly acquainted people (Bryant et al. 2016). Arousal is not only detected in human voices—recent work has shown that judges are quite effective in detecting arousal in species quite distant from humans, including in vocal signals of birds and tree frogs (Filippi et al. 2017). This research illustrates well the power of form and function in understanding the communicative effectiveness of vocal signals, and how evolutionary processes conserve signal features that are inherently connected to signaling production and shape perceptual systems to attend to them.

Conclusion

An evolutionary adaptationist approach to communication requires theorists to distinguish between vocal signals and cues. Our understanding of specific physical features of the human voice, and how they are deployed in social interaction, is clarified by recognizing the design features shaped by selection processes on communicative behaviors. Consequently, this approach profitably connects research between humans and nonhuman animals in a way not especially common in other areas of the evolutionary behavioral sciences. The study of vocal communication is among the fastest developing areas of evolutionary psychological research. Recent advances in acoustic analysis technology, which are freely available thanks to the developers of software such as Praat, have helped facilitate new and exciting work. The current trend of conducting large-scale cross-cultural studies is also affording tremendous opportunities for understanding universals and cultural variation in vocal signaling. It is an exciting time to be studying what is one of the most pervasive and fundamental aspects of human life.

Cross-References

▶ Biosemiotics
▶ Broca's and Wernicke's Areas
▶ Echolalia
▶ Field of Linguistics, The
▶ Gossip and Grooming Hypothesis
▶ Human Deception
▶ Imitation and Mimicry
▶ Language Modularity
▶ Laryngeal Descent
▶ Linguistic Evolution
▶ Modeling Language Transmission
▶ Modern Theories of Language
▶ Mother Tongue Hypothesis
▶ Motherese
▶ Neurobiology of Language
▶ Phonemes and Symbols
▶ Ritual and Speech Coevolution
▶ Stereotyped Vocalizations

► Stuttering
► Vocal Grooming

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