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On Communication

AS I WRITE this, summer is upon us in the Northern Hemisphere. I have just attended an online lecture about non-human species communication, sponsored by the Interspecies Internet project (interspecies.io). While the primary objective of the project is to determine experimentally whether it is possible to demonstrate communication between non-human species, there is also considerable interest in understanding the nature of intraspecies communication. The lecturer, Ofer Tchernichovski, explored years of experience with zebra finches. Of particular interest were their songs and how they propagated through generations of “tutors” and “pupils” among families of finches. Among the interesting observations he made was a concern that we sometimes bring preconceived but unwarranted notions to science. For example, consider the way in which we might analyze bird songs. We make audio recordings and spectral Fourier diagrams of the songs. We segment these vocalizations as if they might represent phonemes, but our segmentation could be inappropriately influenced by what we know of human speech.

Linguists have learned a great deal about human speech, how it is produced, and how the phonemes give structure to utterances. Whether we can apply such structural assumptions to bird songs is a matter for research. Tchernichovski points out that an alien arriving on planet Earth, even if it is capable of sensing human speech, might not have any idea how to segment sounds into phonemes and words. Language is a concept that organizes sound into phonemes, words, and sentences representing structures that follow grammatical

rules and from which semantic content can be derived. The alien might not have any a priori clue as to how human languages are expressed, parsed, and give rise to semantic meaning. If the alien itself has language, it might adopt a protocol for human language discovery, starting, for example, with self-identification.

This made me wonder whether some of our unsupervised pattern-detection mechanisms used in machine learning could be used to discover plausible phonemes in bird songs without making arbitrary judgments as to how to segment the patterns by pitch, duration, and repetition. In another lecture by Con Slobodchikoff, the warning signals of prairie dogs were analyzed and correlated with the arrival of identifiable predators. Evidence was offered from which we could infer the signals had sufficient descriptive capacity to distinguish among various predators, their size, location (for example, ground direction or airborne), and possibly other characteristics.

Other efforts analyzing gray parrots

(Irene Pepperberg), dolphins (Diana Reiss), and whale songs, (Roger Payne), among others, are also seeking to discover the structure and semantics of these species' signals. What is particularly interesting to me is whether any of these vocalizations or other signals (gestures, postures) can bridge the species gap and be understood by unlike species. That it is possible seems not to be in doubt. One has only to speak with a happy dog owner to be convinced the owner is fairly certain the dog has a significant ability to respond to a vocabulary of commands or queries. I was certain our beagle knew what “walk” and “ice cream” meant.

At the heart of the interspecies Internet effort lies the question: “Can we discover language in the vocalizations and/or gestures of non-human species?” And within that question lies another question: whether rich machine learning methods can demonstrate that interspecies communication is possible. Of course, this presupposes there is a sharable semantics between two or more species. There is some evidence that the warning calls of one species may be understood and even propagated to others. To go between species, the information might have to be transduced into new vocalizations, gestures, or visible displays. What I find most exciting about this exploration is the power and diversity that computing brings to the problem. We can imagine using a wide range of computational tools, statistics, machine learning, and perhaps newer methods to analyze intraspecies signals and to use them to facilitate interspecies communication.

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