Philosopher uses game theory to understand how words, actions acquire meaning

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The latest work from Elliott Wagner, Kansas State University assistant professor of philosophy, appears in the scientific journal *Proceedings of the National Academy of Sciences*, which is a rarity for philosophy research. Credit: Kansas State University

Why does the word "dog" have meaning? If you say "dog" to a friend,

why does your friend understand you?

Kansas State University philosopher Elliott Wagner aims to address these types of questions in his latest research, which focuses on long-standing philosophical questions about semantic meaning. Wagner, assistant professor of philosophy, and two other philosophers and a mathematician are collaborating to use game theory to analyze communication and how it acquires meaning.

"If I order a cappuccino at a coffee shop, I usually don't think about why it is that my language can help me communicate my desire for a cappuccino," Wagner said. "This sort of research allows us to understand a very basic aspect of the world."

The researchers' latest work appears in the scientific journal *Proceedings of the National Academy of Sciences*, or *PNAS*, in the article "Some dynamics of signaling games." It is rare for philosophy research to appear in the scientific journal, Wagner said. Collaborators include two other philosophers—Simon Hutteggar and Brian Skyrms—from the University of California, Irvine, as well as mathematician Pierre Tarres of the University of Toulouse in France.

The researchers are using evolutionary game theory models to understand how words and actions acquire meaning through natural processes, whether through biological evolution, social learning or other adaptive processes.

Game theory is a branch of mathematics that creates mathematical abstractions of social interactions and communication. Communication involves two agents—a sender and a receiver. The sender shares a message with the receiver through a sign or signal and the receiver uses the signal to act in the world. This interaction is called a signaling game.

The researchers used signaling games to study information flow in the natural world, which happens at all levels of biological organization, Wagner said. For example, bacteria such as those in the genus Pseudomonas communicate through chemical signals to attack the human immune system. Monkeys use vocalization to talk with each other. A peacock uses the size of his tail to signal his attractiveness to a female. People use gestures and language to communicate.

While these types of models have existed since the 1970s, Wagner and collaborators studied the dynamics of signaling games. The researchers incorporated evolution and individual learning to overturn other preconceived notions from previous models.

Through these models, the researchers start with a signaling game in which the sender's message does not have any prebuilt meaning. As the signaling system evolves, the sender's message may reflect the state of the world and the receiver may respond in a way that is appropriate for the state of the world.

"Through this process an arbitrary signal with no prebuilt meaning has come to mean something," Wagner said. "It appears that the meaning of a word has almost magically arisen out of this natural process."

If the researchers can show that this process occurs across a wide variety of models, then they may be able to explain how a word or action gains meaning.

"I think it's important for us to think carefully about features of our lives that we take for granted," Wagner said. "This research is one way for us to think carefully about why it is that words have meaning and how it is that words can acquire meaning through a natural process."

More information: Some dynamics of signaling games,

www.pnas.org/content/early/201 … /1400838111.abstract

Provided by Kansas State University