Week 4: Animal Communication

Study Guide

This week, we considered the answer to three major questions:

(1) What sorts of communicative capacities do animals display in nature?
(2) How do these capacities compare to the linguistic capacities of humans?
(3) Do any animals exhibit abilities to learn a human language (or anything close to it)?

To attempt to answer these questions, we looked at three kinds of case studies:

(1) Complex communication systems in relatively simple organisms (honey bees, birds)
(2) Natural communication of primates (vervet monkeys)
(3) Attempts to teach them language (chimpanzees, gorillas, orangutans, bonobos)

Communication in Other Species

Corresponds to the first lecture and sections 14.1 & 14.2 of reading

In order to compare animal communication to human language, we first asked: **what are some key properties of communication systems in general?**

- We learned that **all** communication systems have some way in which a message is transmitted (sound, visual cues, touch, smell, etc) — the **mode** — and all serve some useful purpose — have **meaning** — usually related to survival (eat, mate, fight, flee).
- We learned that some communication systems:
    - Are **arbitrary**, in that the form of the symbol is not directly related to its meaning.
    - Are **discrete**, in that they are able to construct complex messages build up from smaller discrete parts
    - Are **interchangeable**, in that one can both send and receive messages
    - And are **culturally transmitted**, in that at least some parts are learned through interactions with others.

Then we considered the **key properties of human language**

- Grammatical systems are **unbounded discrete combinatorial systems**:
    - **discrete** parts (sounds, morphemes)
    - **rules for combining** those parts are **unbounded (productive)** — no limits on application of rules; there are always more new/longer words, sentences, etc.
- This means humans have a communicative tool of essentially unlimited expressive power
- And we can communicate about things not present in space or time (**displacement**)

How does this compare to communication in relatively simple animals?

(1) **Case study 1: Honey bees** communicate via two kinds of dance
    - By doing the **round dance** honey bees communicate (1) ‘I’ve found some food’ and based on the **vigor** of the dance (2) ‘There’s X much of it’; This alerts other bees that they should go outside to find the food source (which they do by smell).

- For food at longer distances (50+ meters), honeybees have to do the **waggle (or sickle) dance**. With it, they communicate the quality (more food, more vigorous dance), distance (fast flight to food, faster dance), and direction (angle of food from sun, angle of dance from vertical) of the food source.
- Bee 'language' is much more instinctual than human language; they don't transmit this culturally: orphan bees are immediately understood, they don't have to learn. And bees cannot learn other bee dialects (italian bees introduced to Austrian hives aren't understood).

(2) **Case study 2: Song birds** make two types of vocalizations:
- **Calls**: a set of short, simple sounds associated with particular events and activities (alarm calls, flight calls when flying in a group). Song bird calls have a limited, closed inventory of discrete messages; there is no creativity and no combinatorial system. Calls themselves are **innate** — **whistle** for hide and **mobbing** for defend — but the birds have to learn what species are dangerous by observing when they hear these calls.
- **Songs (often partially learned)**: ranging from a simple series of a few notes through long arias that may last 10 seconds or more (often longer and louder than calls); Song bird songs serve as an expression of territoriality and to attract a mate.
  - **Song dialects are learned**: Species of birds have a broad range of possible sounds, but birds of different regions can have different "dialects" that are learned; baby birds moved to a new area learn the new dialect.
  - **Songs are also partially innate**: at two weeks old they can react to a few notes of their own species' song; and birds raised in isolation will produce a song similar to their own species.
- Birdsong has a critical period during which input must be available, there is a specific range of patterns it is capable of learning, and they can produce songs that are not exactly the same as what they hear, but fall within the range of their species. But, there is no discrete combinatorial structure, there is a limited communicative role, and there is no expressiveness.

How does this compare to communication in other primates?

(3) **Case study 3: Vervet monkeys** (primates in the wild) have three alarm calls: Leopard, snake, and eagle.
- Vervet monkey calls and the general categories they represent are **innate**, but: young vervets **learn** by observation which species of each predator class is dangerous. An infant might deliver an aerial alarm because of a vulture, stork, or falling leaf (similar to birdsong in this way).
- The calls are **used to affect the behavior of others**: they don't call when they are alone and they call more in the presence of kin or offspring. But, there is not evidence that they call to affect the knowledge state of the other vervets — they call just as much even if everyone else has already seen the leopard.

Teaching Human Language to Animals

Corresponds to the second lecture and section 14.3 of reading

We've seen that lots of animals can communicate in the wild, but none appear to be equivalent to human language. Next we'll consider what happens if we try to teach language to animals.

The Hayes family tried to teach Viki, a chimp speech, but that didn't work so well.

- **Viki (1950s) - chimp**: Psychologists Keith and Cathy Hayes raised Viki at home, much like a human child, and attempted to teach her language. However, after three years of intensive training (including shaping Viki's lips for her), Viki could only say three or four things: mama, papa, cup, and up.

Later studies attempted to teach either symbols or sign language, and that went OK in some ways, but not well in others.

- **Washo (1967) - chimp**: Psychologists Allen and Beatrice Gardner felt that ASL might work better than speech, since chimps are manually dexterous and use gestures to communicate already. Just like Viki, Washo underwent extensive training, including trainers molding Wahoe's hands into the shapes for the signs. By 5 years old, Washo had 132 signs and by the end of her life, over 250. She showed some signs of using ASL productively ('water bird') and even taught her adopted son Loulis around 40 signs!
- **Sarah (1966) - chimp**: Psychologists Anna and David Premack tried to train Sarah to communicate with chips that were arbitrarily associated with English words. Sarah would communicate with a "language" board, in which she's be asked to choose between two chips to respond or carry out a task a trainer indicated on her language board.
- **Koko (1972) - gorilla:** Patterson spent more than 30 years teaching ASL to a gorilla named Koko. Patterson claimed Koko knew hundreds of signs and could use ASL productively ("finger bracelet").
- **Nim Chimsky (1970s) - chimp**: Terrace wanted to show that chimps could learn grammar, not just a lot of vocabulary. By the time Nim was 3 or 4, he knew 125 ASL signs and could do some rudimentary combinations, so Terrace felt optimistic. But, after analyzing the recordings from Nim's training sessions, Terrace noticed that Nim almost never initiated signing (only 12%) and 40% of his signs were simply repetitions of what the trainer had just signed. Finally, Nim's spontaneous signs were invariably requests for food or other reward.
- **Kanzi (1980s) - bonobo**: Sue Savage-Rumbaugh wanted to know if apes knew what signs meant. Maybe Koko had just learned to associate certain behaviors with certain consequences. A bonobo Kanzi was taught lexigrams and eventually learned to associate the lexigram with their meaning.

In general, these projects were successful in teaching a lot of vocabulary items, but it required a lot of direct instruction and training, most used "language" to request food, and their "language" appears to be explained by some rote learning + randomness, not an unbounded discrete combinatorial system.

Nonhuman primates are apparently not capable of learning human language, but they have some remarkable abilities we didn't know about before! They can learn many symbolic, referential signs and to understand linear ordering to some extent.