Insect communication

Communication may be defined as any exchange of information between individuals. We communicate through speech, written language, sign language, body language, and many other cultural and technological inventions. There is even some evidence that we use body odor in communication.

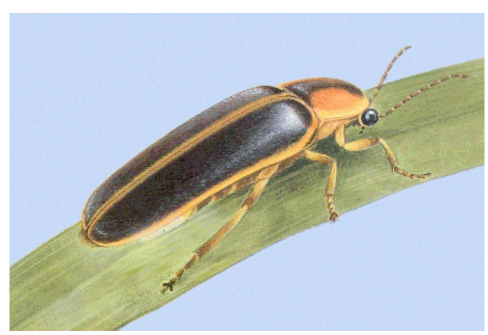
Insects also have many ways to communicate but, unlike humans, their "language" is almost entirely innate. Each individual is born with a distinctive "vocabulary" that is shared only with other members of its own species. Learning plays little or no role in the ability to produce these signals or to understand them.

An act of communication is not always overt or obvious. No physical entity passes from one individual to another, so it is not always possible to know when exchange of information occurs. The situation is analogous to an alien from another planet who comes to Earth and observes human behavior. Without knowing our language and customs, the alien would be unlikely to recognize a black arm band, or a "yellow ribbon 'round the old oak tree" as forms of human communication. We are in much the same difficult situation when we study insect communication. The only way to distinguish communicative behavior from non-communicative behavior is by looking for evidence of a change in the behavior of another individual.

For experimental purposes, ethologists (scientists who study animal behavior) often define communication as:

An action or condition on the part of one organism that alters the behavior of another organism in an adaptive way.

Thus, an insect may send a communication signal by doing something (e.g. make a noise, release a chemical, or flash a light) or the signal may simply be an inherent part of the insect's physical makeup (e.g. wing pattern, body color, or surface chemistry). In either case, the signal must elicit some behavioral change in order for a human observer to recognize its existence.



Why do insects communicate?

Some form of intraspecific communication is a prerequisite for any behavior that involves the participation or cooperation of two or more individuals. Intentionally or not, insects may also communicate with members of other species (interspecific communication). The adaptive value of these communication signals may include:

1. Recognition of kin or nest-mates

2. Locating or identifying a member of the opposite sex
3. Facilitation of courtship and mating
4. Giving directions for location of food or other resources
5. Regulating spatial distribution of individuals -- aggregation or dispersal; establishing and maintaining a territory
6. Warning of danger; setting off an alarm
7. Advertising one's presence or location
8. Expressing threat or submission (agonistic behaviors)
9. Deception / mimicry

How do insects communicate?

Like all other animals, insects use their five senses to acquire information about their environment; any of these sensory modalities may serve as a pathway for the exchange of information. Taste and touch are both contact senses, therefore, exchange of information can occur only when two individuals are touching one another. Vision, olfaction (smell), and hearing are remote senses -- information signals may propagate through the air (or water) over considerable distances.

1. Tactile

2. Chemical

3. Acoustic

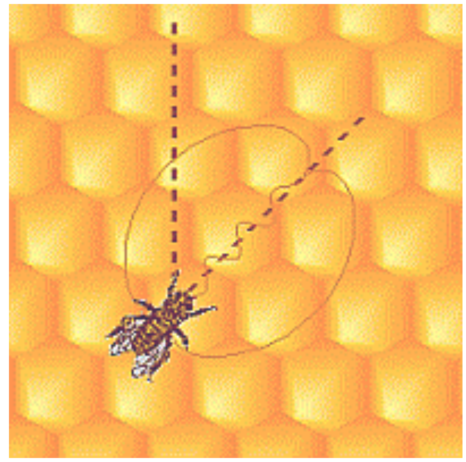
4. Visual

Tactile communication

"Keep in touch!" for some insects it's really a channel of communication. Since many insects have poor vision and sound perception, physical contact provides an important avenue of communication. In blister beetles (family Meloidae), courtship begins with a series of antennal taps by the male on each side of the female's body. She signals her receptivity by lifting her wing covers (elytra) and allowing him to climb on her back. But to complete his quest, the male must continue tapping, alternating from side to side at just the right frequency until the female is stimulated to extend her genitalia and begin mating.

Antennal tapping is also an essential component of communication in both ants and termites. It's not clear exactly what information may be exchanged, but it certainly involves nest-mate recognition and leads to exchange of food through trophallaxis. In some cases, instantaneous feedback allows the sender to monitor the receiver's response and alter the signal if necessary. Antennal tapping on the hind legs is used

during **tandem running** in both ants and termites. This is a "follow-the-leader" behavior in which the tapping informs the leader that she has not lost her disciple. If tapping stops, the leader instinctively turns around and searches in ever-widening circles until she re-establishes contact with the follower.



The "dance" language of honeybees is largely a tactile communication system, performed in total darkness on the vertical surface of the honeycomb. A "round dance" signals to nestmates the presence of a nectar source in close proximity to the hive (usually less than 80 feet). It consists of a series of circular runs with more or less frequent changes in direction. The greater the frequency of direction changes, the better the quality of the nectar source. The "waggle dance" is used for longer distances. It involves a figure eight pattern with a series of abdominal waggles on a straight run after each half-circle turn (see figure). Distance is indicated by the duration of the straight run and the frequency of the waggles. Direction is indicated by the angle of the straight run (relative to vertical) and corresponds to the horizontal angle between the sun and the direction of the food source.

Tactile cues generated by ripples on the water surface allow whirligig beetles (family Gyrinidae) to constantly monitor the location of dozens of other nearby whirligigs. Thanks to this tactile communication system, the whirligigs can swim rapidly in circles, avoid bumping into other members of their own species, and still detect the presence of nearby predators or prey.

Certain treehoppers (order Hemiptera: family Membracidae) produce vibrations in the tissue of their host plant that can be felt by all other treehoppers on the same plant. The signal travels throughout the plant in much the same way that banging on water pipes in your apartment creates noise throughout the whole building. The signals apparently work as an alarm system, and in some species, they may be used by nymphs to elicit protective maternal behavior. Pros and Cons of Tactile Communication

Advantages:
Instantaneous feedback
localized area
Individual recipient
Effective in the dark (*e. g.* caves, wood galleries)
Disadvantages:
Not effective over distance
Organisms must stay in direct contact
Message must be repeated to each recipient
Vibration signals can be intercepted by predators