



BEE DANCE

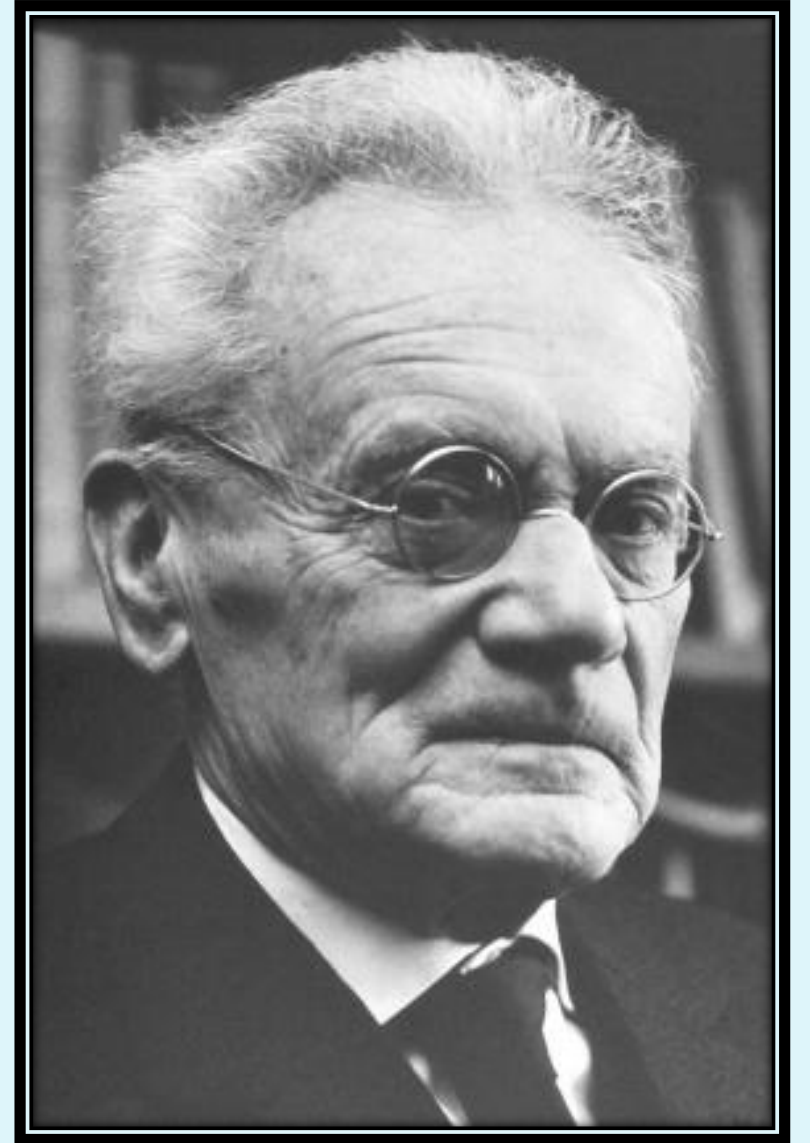
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Introduction

- ❏ Honey Bees are members belonging to **Phylum Arthropoda & class Insecta**.
- ❏ They are known for **producing and storing honey**, or liquefied sugar, as well as building impressively large nests using wax secreted by workers in a particular colony.
- ❏ Honey bees have three castes: **drones, workers, and queens**. **Drones are male, while workers and queens are female**.
- ❏ Worker bees do the main **job of foraging**. The forager bees can be classified into two groups - scout bee which is search for the food source and the reticent bees which wait in the beehive until scout bees return and give them information about the food source by dancing.

Discovery

- ➡ Karl von Frisch, 1886-1982
- ➡ Studied European honey bee, *Apis mellifera*
- ➡ Bees used flower scents or other odors to find food source - Karl von Frisch
- ➡ Decoded the dance language performed by returning foragers.
- ➡ Dance very precious with varying rhythm and direction.

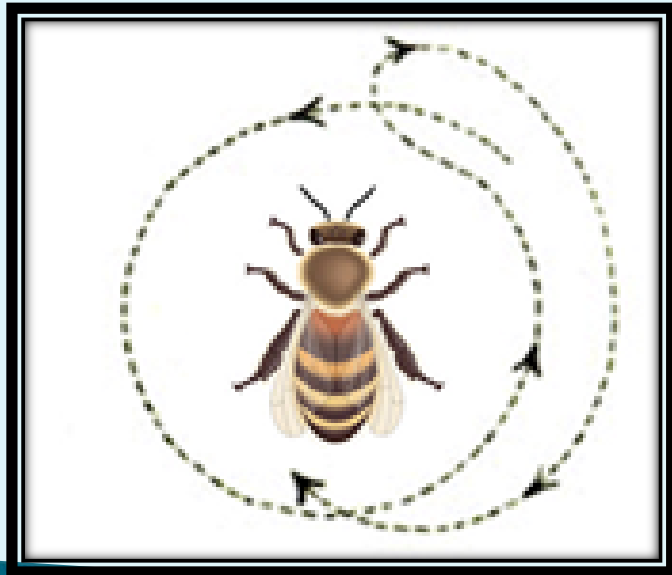


The Honey Bee Dance Language

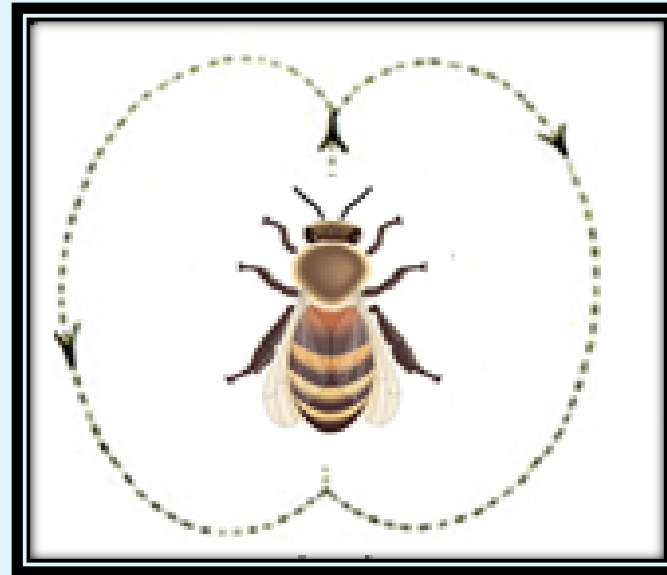
- ✚ Dance language is used by an individual worker to communicate two information to other workers: distance and direction to a location (usually a food source, such as a patch of flowers).
- ✚ It is most often used when an experienced forager returns to her colony with a load of food, either nectar or pollen. If the quality of the food is sufficiently high, she will often perform a “dance” on the surface of wax comb to recruit new foragers to the resource.
- ✚ The dance language is also used to recruit scout bees to a new nest site during the process of reproductive fission, or swarming. Recruits follow the dancing bee to obtain the information it contains, and then exit the hive to the location of interest.
- ✚ Distance and direction information contained in the dance are representations of the source's location, and thus is the only known abstract “language” in nature other than human language.

Types of Bee Dance :

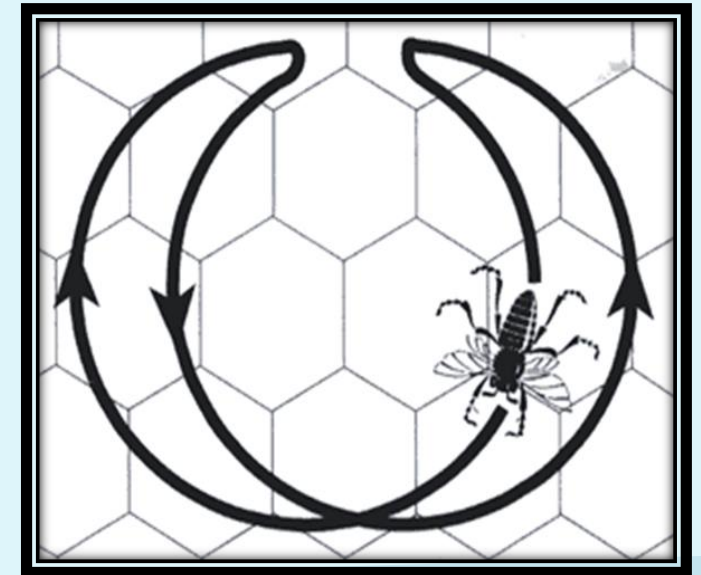
- ❏ Round Dance
- ❏ Waggle Dance or Wag-tail Dance
- ❏ Sickle Dance



Round Dance



Waggle Dance



Sickle Dance

Components of the Dance Language:

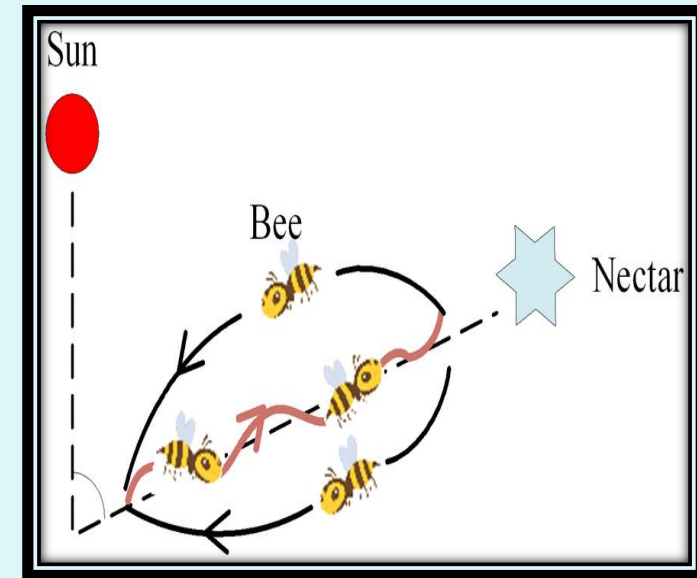
✓ For Round Dance

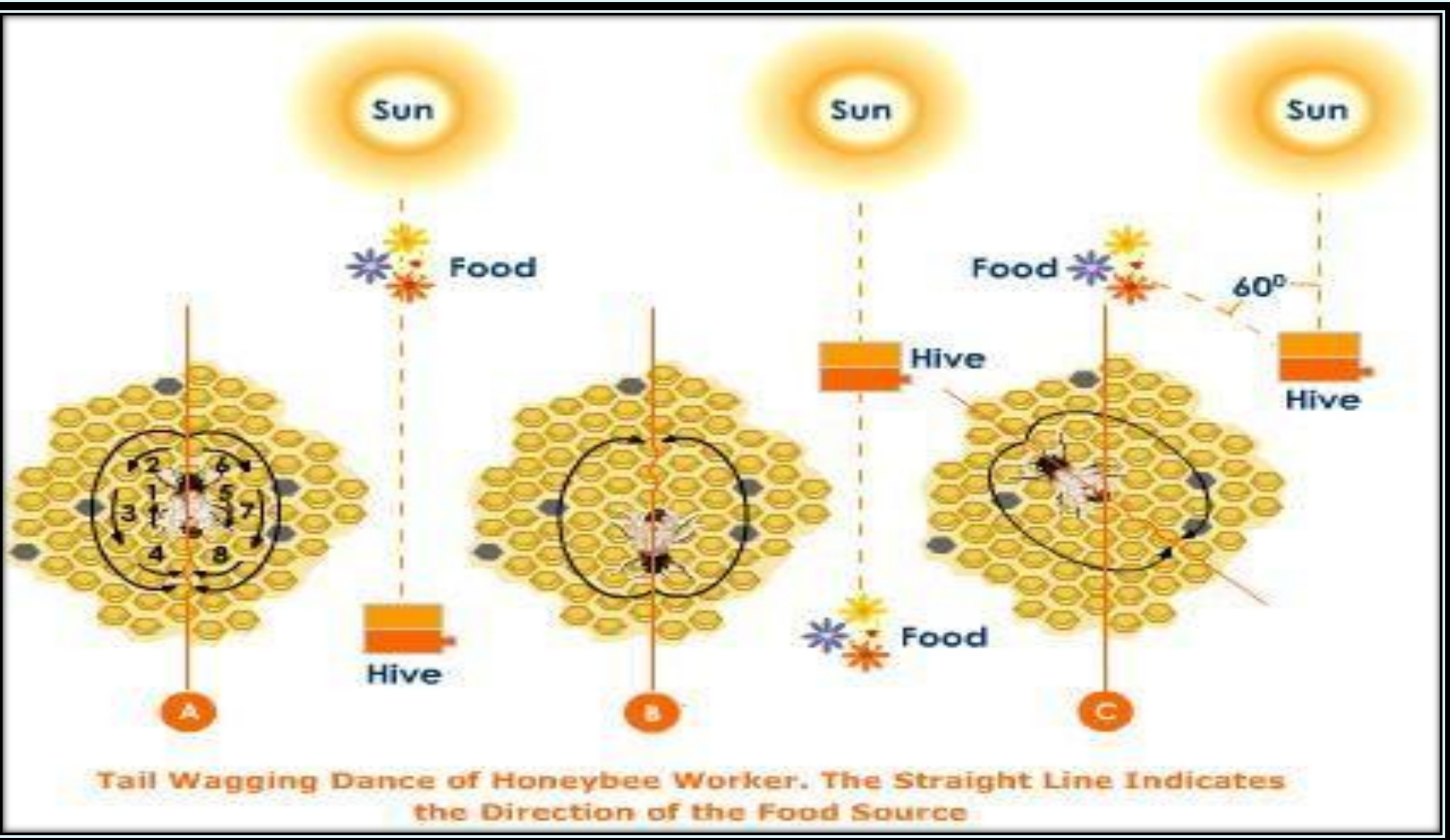
- ✿ When food source is very close to the hive forager performs a round dance.
- ✿ Less than 50 meters away
- ✿ Running around in narrow circles, suddenly reversing direction to her original course.
- ✿ Repeat the dance several times at the same or another location.
- ✿ After the round dance has ended, she often distributes food to the bees following her.
- ✿ A round dance, communicates distance, but no direction.

✓ For Sickle Dance

- ✿ Distances between 50 and 150 meters away from the hive
- ✿ The form of this dance is crescent-shaped
- ✿ A transitional dance between a round dance and a figure-eight waggle dance

- ✓ For waggle dance, or wag-tail dance
 - ☀ performed by bees foraging at food sources that are over 150 meters away from the hive.
 - ☀ A bee find a food source using sun as a guide.
 - ☀ Waggles body directed to the food source.
 - ☀ Runs straight ahead for a short distance, returns in a semicircle to the starting point, runs again
 - ☀ Through the straight course, then makes a semicircle in the opposite direction and complete a full, figure-eight circuit.
 - ☀ While running the straight-line course of the dance, the bee's body, especially the abdomen, wags vigorously sideways.
 - ☀ Bee emits a train of buzzing sound, produced by wingbeats, at a low frequency of 250-300 Hertz with a pulse duration of about 20 milliseconds and a repetition of frequency of about 30 seconds.





Direction:

- ☞ Orientation of the dancing bee during the straight portion of her waggle dance indicates the location of the food source relative to the sun.
- ☞ The angle that the bee adopts, relative to vertical, represents the angle to the flowers relative to the direction of the sun outside of the hive. The figure below gives three examples. A forager recruiting to a food source in the same direction as the sun will perform a dance with the waggle run portion directly up on the comb.
- ☞ If the food source were located directly away from the sun, the straight run would be directed vertically down. If the food source were 60 degrees to the left of the sun, the waggle run would be 60 degrees to the left of vertical.

☞ Forager's dance for a particular resource will change over time. This is because the sun's position moves over the course of a day.

For example, a food source located due east will have foragers dance approximately straight up in the morning, but will have foragers dance approximately straight down in the late afternoon. Thus the time of day (or, more importantly, the location of the sun) is an important variable to interpret the direction information in the dance.

☞ The sun's position is also a function of one's geographic location and the time of year. The sun will always move from east to west over the course of the day. However, above the Tropic of Cancer, the sun will always be in the south, whereas below the Tropic of Capricorn, the sun will always be in the north. Within the tropics, the sun can pass to the south or to the north, depending on the time of year.

Bees that follow a waggle dance can successfully forage without decoding the dance language information in several ways:

- Dance follower may use olfactory information from the dancer and find either the same resource or a different one with a similar scent.
- Following a dance may simply trigger foraging behavior. A forager may then search randomly for resources.
- Following a dance may reactivate private knowledge of a resource. After reactivation, the forager may return to the known resource.
- Using information communicated in the waggle dance is more useful to foragers when private information about resources is lacking.

Mechanism of Action:

- Honeybees accumulate an electric charge during flying when their body parts are moved or rubbed together.
- Bees emit constant and modulated electric fields during the waggle dance.
- Both low- and high-frequency components emitted by dancing bees induce passive antennal movements in stationary bees according to **Coulomb's Law**.
- The electrically charged flagellum of mechanoreceptor cells are moved by electric fields. Therefore, Sound and electric fields interact.
- Axons of the **Johnston's Organ** indicate its sensitivity to electric fields.
- Electric fields emanating from the surface charge of bees stimulate mechanoreceptors that play a role in social communication during waggle dance.

Evolution:

- Ancestors to modern honeybees performed excitatory movements to encourage other nest mates to forage. The excitatory movements included shaking, zig-zagging, buzzing and crashing into nest mates.
- The waggle dance is thought to have evolved to aid in communicating information about new nest site, rather than spatial information about foraging sites.
- Ancestors of different species of honeybees had different "dialects" of the waggle dance. Each species or subspecies dance varying by curve or duration.
- A mixed colony of Asiatic honeybees (*Apis cerana cerana*) and European honeybees (*Apis mellifera ligustica*) were gradually able to understand one another's "dialects" of waggle dance.

The buzzing run:

- The buzzing run is where a bee runs in a straight line while buzzing its wings and collides with another bee.
- They touch antennae, buzz and run off to collide with more bees.
- The dance has a cascading effect across the hive with bees buzzing, running and colliding until they swarm.
- Buzzing run is performed again by the swarm before flying off to its new home, and it is then sometimes called the *break dance*.



Other dances performed in hive:

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|-----------------------|---|
| Jostling dance | A prelude to the waggle dance. Foragers returning from a successful trip will run and push other bees to let them know they are about to do the waggle dance. |
| Spasmodic dance | A variation on the jostling dance that includes food sharing, and presumably gives the same message. |
| Swarming and Grooming | Specific type of waggle dance used during swarming to communicate possible nest sites. Grooming dance elicits nest mates to help a bee groom. |
| Trembling dance | Trembling dance seems to recruit more receiver and storage bees to help foragers unload nectar and pollen. A bee runs about on 4 legs and twitches and trembles. If it meets a bee performing a wagtail dance, it head-butts it and briefly pipes. |