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# *The Honeybee Waggle Dance: An Active Participation, Role Playing Game*

As the resident entomologist at a botanical garden with an active education program, I have had a number of opportunities to introduce entomology to elementary students of all grades. I have found focusing on insect behavior to be a successful strategy for sharing the wonder of insects with children. What better way to demonstrate what fascinating animals insects are than by looking closely at things they do?

The migratory behavior of monarch butterflies, the ultrasonic detection of bats by moths and their subsequent evasive flight patterns, the clipping of veins in leaves by some insects in order to circumvent the chemical defenses of the plants they feed on, the aphid-tending behavior of some ants, the territoriality and mating behavior of dragonflies, and the deceptive use of chemical mimicry by bolas spiders and flashing mimicry by some fireflies to lure their unsuspecting prey are just a few of many captivating examples of insect behavior that may be used to illustrate a lesson on insects.

Excellent sources of examples include Evans (1966, 1985), Matthews and Matthews (1978), Stokes (1983), and Berenbaum (1989). It is easy to incorporate information about insect structure, taxonomy, life history, interaction with human society, and other aspects of entomology into discussions of any of these examples.

Perhaps the most fascinating example of insect behavior is that of one of the most familiar, the honey bee. Like other social insects, honey bees live in societies in which survival is dependent on mutual cooperation and division of labor. A colony consists of a queen (reproductive female) and her offspring. Drones (males) are few, existing only to mate with queens. Once their duty is performed, they are driven away from the hive before winter. Workers (sterile females) fill virtually all other roles. Larvae develop in the cells of the comb that the workers construct from wax secreted from specialized glands. If a new queen is needed to replace one that has died, or to lead a swarm from a colony that has out-grown its hive, a larva is selected by the workers and fed royal jelly. This regal diet alters the larva's development, and a queen bee develops. The vast majority of larvae do not receive royal jelly in their diet and thus are destined to become workers.

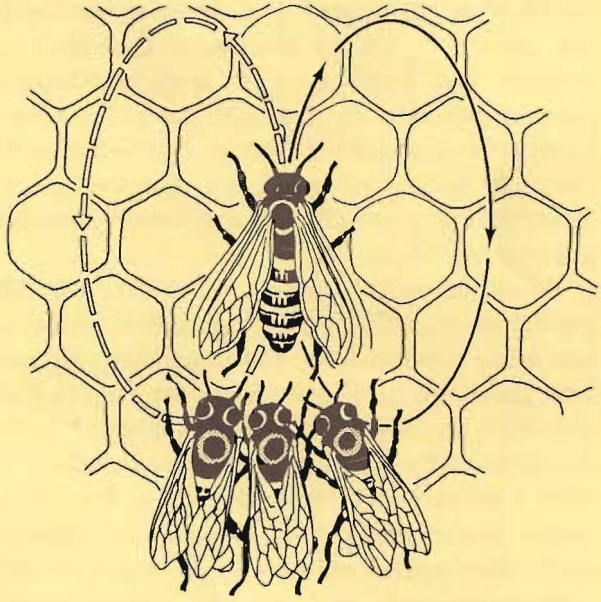

**Fig 1.** The Waggle Dance

The tasks performed by workers change as they age. Upon emergence as an adult worker, her first job is that of a maid, cleaning the cells in which the queen lays eggs and where food is stored. As the worker ages, she spends less time cleaning and begins caring for young larvae. After several more days, as her wax-secreting glands mature, she enters the construction business, building the cells the comb.

Two weeks or more into her adult life the worker serves as a guard for a short period, protecting the entrance of the hive from would-be intruders such as mice, ants, and marauding bees.

The last, and most hazardous job in the short life of the worker is that of a forager: a collector of nectar (from which they make honey, their source of energy) and pollen (their source of protein) from flowering plants. How a worker communicates the location of a pollen and nectar source to other workers in the hive may be the most incredible and complex form of social behavior existing outside of the human race.

Upon her return to the hive with pollen and nectar, the worker bee performs an elaborate dance on the vertical surface of a comb. If the source is relatively distant from the hive (as it generally is), the dance takes the form of a figure-eight. The forager waggles her body from side to side as she moves forward in a straight line, then circles to the right, back to her starting point, waggles ahead again, and then circles to the left (Fig. 1). This dance pattern is repeated a number of times. The angle of the straight run, or "waggle," from vertical is equal to the angle from the hive between the sun and the nectar/pollen source. If the flowers are located 45 degrees to the right of the sun, the dance will be oriented 45 degrees to right of vertical. The distance of the straight waggle run is proportional to the distance from the hive to the source. Details of this behavior can be found in many books, including an excellent discussion in Gould and Gould (1988), an easily read and comprehensive reference on the honey bee.

At some point I picked up an idea for a student participation, role-playing game that I have used to teach honey bee behavior to elementary-age students. I set the stage for the students through explanation, outlining the behavior on the blackboard. A "hive" is constructed by positioning desks or chairs in a circle with a break in the circle serving as the entrance. A queen bee is designated (usually the teacher) and students adopt the various roles of workers, including cleaners, guards, and foragers. Other students are designated as flowers, positioned somewhere outside the hive, and given yellow balloons representing pollen grains. I act as a foraging scout, leaving the "hive" first and locating the "flowers." Upon collecting "pollen" I return to the "hive" and perform a waggle dance, with the direction of the waggle run pointing towards the "flowers." The rest of the "foragers" then pour out of the "hive" armed with the knowledge, gleaned from my dance, of where to find the flowers with their valuable nectar and pollen. My dance represents a horizontal abstraction of the dance performed vertically by the bee, however, I find that this can be explained to and understood by the students rather easily. Even if this detail slips by some students, the concept does not.

Students are taught that the bees are not the only ones to benefit from their foraging foray. Many plants depend on pollination by bees and other insects for their very survival, and many people and other animals depend on the resulting fruits for food. As "foragers" collect "pollen" they are encouraged to exchange some among the "flowers." As "flowers" receive "pollen" from other "flowers," their yellow balloons are exchanged for red ones, representing the development of apples and other fruits following pollination .

We have played this game inside the classroom, on the playground, and at day camp. Young students invariably find it to be fun, and I believe, educational. Maybe the next time they see a honey bee bounding from flower to flower they will remember a guest teacher called "Dan the Bug Man" shaking his rear-end back and forth as he waggles and buzzes his way through a "hive" of their class mates. Maybe they will remember a little bit about the incredible behavior of the amazing honey bee. And maybe, just maybe, they will take with them through life a sense of appreciation for the most plentiful, most diverse, and most fascinating of all the Earth's creatures: the insects!

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