Two types of odor-triggered walking behaviors of honeybees controlled by classical olfactory conditioning

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Honeybee foragers transmit information on valuable flower locations and their odors to hive mates through waggle dance and trophallaxis. During both forms of communication, hive mates are thought to orient with respect to odorants that they have previously learned during foraging or as receivers during trophallaxis. In order to test the hypothesis that odor source orientation towards floral odors is important inside the hive, we analysed the orientation behaviour of honeybess that were previously subjected to classical differential odor conditioning. Walking honeybees chose the positively reinforced odor (CS+) significantly more frequently than the unrewarded odor (CS-) in a Y-maze. When analyzing walking patterns in response to the stimuli in detail using a trackball, it was found that the CS+ induces “zig-zag” walking, a slow forward locomotion with counter-turns while the CS- causes “turn” walking, a rapid forward locomotion pattern that is biased by turning continuously in one arbitrary direction. We propose that zig-zag walking is involved when hive mates detect a known floral odor and try to orient towards a forager carrying this odor while turn walking may be reflecting the behaviour of naïve bees orienting towards returning foragers.