The neural basis of the honey bee dance language

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Honey bees are famous for their ability to communicate the location of food to their nestmates by dancing on the honeycomb, but it has remained unclear exactly how a follower bee can read out this signal in a dark and busy hive. Using a mixture of behavioural experiments, neural mapping and computational modelling approaches, we have proposed the first plausible account of the sensory and neural mechanisms by which the follower bee can intepret the dance. By recording high-speed, high resolution video of the antennal positions of followers, we have discovered how they can detect their relative angle to the dancer.
Extending our existing computational model of the central complex region of the insect brain, in which the neural circuits support vector transformations, we show how this input can be integrated to produce a consistent estimate of the dancer's direction in world coordinates despite constant change in relative angles. Using a computer simulation of the circuit, we show that tracking the follower's antennal positions is sufficient to recover the flight vector signalled by the dancer. The model additionally explains how the vector, once acquired, can be used by the honey bee to navigate to a food source distant from the hive.