Computational Analysis of the foraging strategy in the honeybees, *Apis mellifera*.

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A honeybee informs her nestmates of the location of a flower by a waggle dance. To reveal the effects of the waggle dance in terms of the colony's benefit, we created mathematical models and performed computer simulation, together with behavioral analyses.

Video analysis showed that angle and duration of waggle runs varied from run to run, with the range of $\pm 15°$ and $\pm 15\%$, respectively. We also found that a follower that listens to the waggle dance attended to multiple dancers before her flight and that most dance followers turned away from the dancer after one or two sessions of listening.

We, then, created a Markov model of bee foraging behavior and performed simulation experiments by incorporating those biological parameters. The simulations showed that information transfer by the dance was important for the effective food collection. A colony in which honeybees danced and correctly transferred information made 2.15 times more successful visits to food sources compared to a colony with non-accurate information transfer. Furthermore, our simulations suggested that accuracy of orientation information must increase along the increase of the distance between the food sources and the hive. This finding is consistent with results obtained from biological experiments.