INSIDE JEB

Australian jack jumper ant foragers have no need for mental map

An Australian jack jumper ant (*Myrmecia croslandi*). Photo credit Ajay Narendra.

Before embarking on their careers as fully fledged foragers, novice ants take a few tours of their neighbourhood to familiarise themselves with the lay of the land. 'Much evidence has accumulated to show that ants form visual memories of how the scene looks at their nests and along routes', says Jochen Zeil from the Australian National University. However, it wasn't clear how ants use these visual snapshots to help them navigate. Do they build a mental map that allows them to keep track of their location at all times, or are they using a simpler navigation system, where they prefer to walk toward some views while actively avoiding others? Wondering how the intrepid explorers negotiate their surroundings, Trevor Murray, Zoltán Kócsi, Ajay Narendra and Zeil decided to find out how Australian jack jumper ants (*Myrmecia croslandi*) behave at various locations around their natural foraging range in the hope of bamboozling the insects into revealing the key to their navigational success.

Intercepting 28 foragers either as they emerged from their nest or when they arrived at a tree that was popular for foraging, the researchers then set the detainees trotting on a mobile treadmill (constructed by Hansjürgen Dahmen at Tübingen University, Germany) at several locations in the area – including a site midway between the tree and nest on the foraging route, one 6 m west of the nest and one directly above the nest – to find out in which directions they preferred to scamper. Recording the direction of each ant stride, the team realised that the ants that were positioned on their foraging route and west of the nest seemed to know in which direction they should be heading. They always swivelled toward their intended goal, even when the treadmill was off course at a location that they had never visited before. However, it was clear that the ants weren't keeping track of the distance that they had travelled, as they continued scampering long after they had covered the distance to their goal. 'They knew where to go but did not know where they were', says Murray. In addition, when the team set ants that had just returned to the nest upon the treadmill directly above the nest, they seemed to recognise where they were, scurrying in random directions in search of their home, while the ants that had been intercepted at the tree turned consistently in the direction where they expected to find home. They ants seemed to know where they were, but was that all there was to the story?

Meanwhile in France, Floret Le Möel and Antoine Wystrach from the University Paul Sabatier had been asking the same question and wondering whether a simple rule based on the insects' view of their surrounding landscape could explain their navigation. Were the ants simply compelled to run toward views that were similar to their memories of the landscape surrounding the nest, while heading away from views that lay in directions away from home? Based on this idea, the pair built a computer-simulated ant and when they compared the cyber-ants' navigation with that of the Canberra ants, Murray says that they were 'stunned by the similarities between the two'. By simply following the rule directing them toward attractive views and away from repellent views, the simulated insects performed exactly like the biological ants on Dahmen's treadmill.

Ants have come up with a simple strategy that helps them to find home, no matter where they have roamed, and Zeil concludes, 'Ants know their way around the world without having a map'.

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Murray, T., Kócsi, Z., Dahmen, H., Narendra, A., Le Möel, F., Wystrach, A. and Zeil, J. (2020). The role of attractive and repellent scene memories in ant homing (*Myrmecia croslandi*). *J. Exp. Biol.* **223**, jeb210021. doi:10.1242/jeb.210021

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