PHYS.ORG

A step in the right direction for navigational understanding

September 8 2016

Credit: Leah Kelley from Pexels

With fresh insights into navigational behavioural, the EU ANT NAVIGATION project brings us a step closer to the next generation of neuroscience breakthroughs.

Most animal species, including humans, rely on the ability to navigate through their environment. Indeed, survival often depends on it, such as when foraging for food.

Being able to navigate effectively requires the combination of information from different sources (multi-modal integration). For this reason, it has often been regarded as an indicator of high-level cognitive functioning, as it infers skills of analysis, comparison and judgement to come up with the best strategies, along with the ability to learn and remember.

However, research indicates that complex navigational behaviour may not require the brain power previously thought. The EU ANT NAVIGATION project investigated this hypothesis through the close study of ants. According to Dr. Paul Graham, the research coordinator, the value of studying ants was precisely that, 'as insects have evolved with limited neuronal resources, they demonstrate economical strategies by which problems might be solved.' The implication being that a more accurate comprehension of how insect navigation works also offers an insight into the economical ways by which brains process and use information generally, including in humans.

Multi-modal integration in desert forager ant navigation

Dr. Graham and his team closely investigated the behaviour of desert ant foragers in southern Spain and Tunisia. Firstly, because as he puts it foragers, 'Do very little in their life, except navigation.' Secondly, these ants are solitary and so don't rely on social cues such as chemical trails. Combined with the fact the desert landscape offers little in the way of visual cues to begin with, both traits afford a unique opportunity to study navigational techniques.

As desert ants forage for food, it was traditionally presumed that the principle navigational strategy enabling them to return successfully to their starting point, usually their nest, was that of Path Integration. This has been likened to the maritime technique of continually updating distance from a starting point, with direction of travel, to provide orientation. This technique has been demonstrated through past experiments that manipulate the appearance of the sun to alter perception of direction, or by elongating the length of ants' legs, resulting in them overshooting their return target (e.g. their nest).

One of the contributions of the ANT NAVIGATION project was in the careful tracking of ant movements. 'We were one of the first groups to record not just ant paths but also the speed of the ants when they were guided by Path Integration and in the early stages of learning about other environmental cues. This was a simple task, but it hadn't been done previously," explains Dr. Graham.

By tracking ant speed, the project was able to suggest that ants follow an inbuilt rule. That rule correlates their speed to the significance of a location, therefore ants give themselves the time necessary to assimilate higher quality visual information at key locations. As Dr. Graham asserts, 'This is exciting because it shows how ants balance the relative merits of different sources of information without having to 'think' about the value of this information.'

Shared knowledge for a great leap forward

When asked about the impact of the ANT NAVIGATION project, Dr. Graham highlights how a richer understanding of the computation involved in the navigational strategies of insects, can better inform the design of small autonomous robots that might one day match insects' behavioural performance. 'We work closely with engineers so that the insights of our biological studies can be translated into robotics,' he explains.

The biological sciences have learned a lot about how organisms function through the study of so called 'model systems', such as flies and mice. Additionally, some animals have been studied intensely for specialist functional ability such as desert ants for visual navigation.

To take the science to the next level Dr. Graham points to the need for a synthesis of behavioural science with neuroscientific knowledge. He expounds that, 'We hope soon to be able to manipulate the neural circuits of navigating ants and relate our findings to the detailed knowledge of key neural circuits in flies. This will be a great leap forward in neuroscience and will provide hope for truly autonomous small robots that could be useful for applications such as post-disaster surveillance and agricultural monitoring.'

More information: Project page: cordis.europa.eu/project/rcn/187878_en.html

Provided by CORDIS

Citation: A step in the right direction for navigational understanding (2016, September 8) retrieved 25 April 2024 from https://phys.org/news/2016-09-a-step-in-the-right.html