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Sniff and track or run and scan?

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It's dinnertime, and the smell of delicious food makes your tummy rumble. However, it's dark because of a powercut and you can't see very clearly. Should you try to 'follow your nose' to locate food? Or should you simply guess and peek into the kitchen, or the dining room or the veranda - the likeliest places for dinner to be served? A recent study shows that the latter method - dubbed 'run-and-scan' - may actually be more efficient in finding your target than just following your nose.

Research by Urvashi Bhattacharyya and Upinder Bhalla from the National Centre for Biological Sciences (NCBS), Bangalore, reveals that while searching in a familiar area with limited choices, a run-and-scan strategy is more efficient than a tracking strategy. In a recently published paper in the journal *eNeuro*, Bhattacharyya and Bhalla used rats to study how animals choose navigational strategies when presented with an odour signal.

The sense of smell is essential for many animals to track food, mates or predators. Dogs, rats, insects and even humans are known to adopt a zig-zag path while tracking smells - a strategy known as 'casting'. Under natural conditions in large, unfamiliar environments, casting is thought to be useful when animals search using smell-based cues. However, what happens when organisms are within familiar environs? With access to more information such as well-known paths to food, or memories of past explorations, how do they optimize their searches?

"So, the question we asked was - what could be the best strategies an animal might use in terms of either speed, accuracy or both, for target

selection?", says Bhattacharyya, one of the authors of the work. To address this question, Bhattacharyya trained rats within an arena to recognise targets having specific odours. Correct identification of the scent-emitting target would result in the rat receiving a reward. This was followed by a series of target-recognition tests which included disturbances to the 'normal environment' of the arena such as addition of background odours and air turbulence (which disrupts the smell gradient). The rats' choices and behaviours were observed to analyse the strategies they used in identifying the correct targets.

"We found that rather than casting, rats ran towards a potential target, and then serially scanned across other targets till they found the right one", says Bhattacharyya. In human terms, this kind of search is equivalent to picking a likely room where dinner could be served, then peeking into different rooms to find dinner if the first one was wrong - a very different approach to actually using one's sense of smell to pin-point the room with food. Surprisingly, this strategy seems to assure very good accuracy in locating correct targets. Even in the presence of other background odours or air turbulence, the animals were able to identify the correct targets though they tended to be marginally slower than under normal conditions.

Mathematical modelling of casting and run-and-scan situations suggests that the two modes of searching can be useful in different situations. Although casting is advantageous in free-range searches, the run-and-scan approach seems more efficient in situations with known targets in familiar surroundings.

The take home message here? In familiar territory, the run-and-scan plan works!

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