Researchers find mouse and human eye movements share important similarity

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In a study published today in *Current Biology*, Arne Meyer, John O'Keefe and Jasper Poort used a lightweight eye-tracking system composed of miniature video cameras and motion sensors to record head and eye movements in mice without restricting movement or behaviour. Measurements were made while the animals performed naturalistic visual behaviours including social interactions with other mice and visual object tracking. While the eyes in humans typically move together in the same direction, those in mice often moved in opposite directions. Although humans also make eye movement without head movement, for example when reading a book, the study found that mouse eye movements were always linked to head movement.

The researchers identified two types of mouse eye movement coupled to head movement with different functions: 'head tilt compensation' and 'saccade and fixate' eye movements. 'Head tilt compensation' allows mice to maintain a consistent view of the world by compensating for slow changes in head tilt, and results in the two eyes moving in opposite directions, which is typically not observed in humans. 'Saccade and fixate' eye movements allow animals to stabilise their view during fast head rotations and shift their gaze in the direction of the head rotation. These 'saccade and fixate' movements are similar to those seen in humans and monkeys, which often sample their environment by a sequence of stable images (fixations) and result in the two eyes moving in the same direction. 'Fixate' eye movements keep the flow of visual information steady while 'saccade' movements allow the animal to select relevant visual information to focus on.

The mouse is an important species to help understand how the human brain functions. First, the organisation and function of the mouse and human brain is similar in many ways, although there are also important differences. Second, scientists can use unique genetic research tools in mice to study brain circuits at a level of detail not possible in other mammals. Third, scientists use genetic tools in mice to model human brain disorders.

The traditional approach to studying vision in humans, monkeys and mice involves restraining head movement. While this facilitates the interpretation of data and allows researchers to use a wider range of experimental measuring methods, it has been unclear whether the results can be generalised to naturalistic behaviours where both head and eyes are free to move. Understanding how mice visually sample their surroundings is also crucial to further close the gap between vision and navigation which has traditionally been studied in freely moving rodents.

This research validates using mice to study important aspects of how humans select visual features that are most important for navigation and decision-making. This visual process is impaired in multiple neurological and neuropsychiatric disorders, including schizophrenia, Alzheimer's disease and stroke. These impairments are

currently difficult to treat, and using mice to model these conditions will allow scientists to study the underlying brain mechanisms to help identify and develop new treatments.

More information: Arne F. Meyer et al, Two Distinct Types of Eye-Head Coupling in Freely Moving Mice, *Current Biology* (2020). DOI: 10.1016/j.cub.2020.04.042

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