# Certain navigational mistakes could be early signs of Alzheimer's disease

October 11 2023

Credit: Pixabay/CC0 Public Domain

People with early Alzheimer's disease have difficulty turning when

walking, according to a new study using virtual reality led by UCL researchers.

The study, published in *Current Biology*, used a computational model to further explore the intricacies of navigational errors previously observed in Alzheimer's disease.

Researchers, led by Professor Neil Burgess and colleagues in the Space and Memory group at the UCL Institute of Cognitive Neuroscience, grouped participants into three categories: healthy younger participants (31 total), healthy elderly participants (36 total) and patients with mild cognitive impairment (43 total). They then asked them to complete a task while wearing virtual reality goggles, which allowed them to make real movements.

In the trial, participants walked an outbound route guided by numbered cones, consisting of two straight legs connected by a turn. They then had to return to their starting position unguided.

The task was performed under three different environmental conditions aimed at stressing the participant's navigational skills: an unchanged virtual environment, the ground details being replaced by a plain texture, and the temporary removal of all landmarks from the virtual reality world.

The researchers found that people with early Alzheimer's consistently overestimated the turns on the route and showed increased variability in their sense of direction. However, these specific impairments were not observed in the healthy older participants or people with mild cognitive impairment, who did not show underlying signs of Alzheimer's.

This suggests that these navigational errors are specific to Alzheimer's disease—rather than an extension of healthy aging or general cognitive

decline—and could help with diagnosis.

Joint first author, Dr. Andrea Castegnaro (UCL Institute of Cognitive Neuroscience), said, "Our findings offer a new avenue for the early diagnosis of Alzheimer's disease by focusing on specific navigational errors. However, we know that more work is needed to confirm these early findings.

"We aim to develop practical tests that can be easily integrated into clinical settings, considering common constraints such as limited space and time. Traditional navigation tests often have requirements that are challenging to meet in a clinical environment. Our research focuses on specific aspects of navigation that are more adaptable to these constraints.

"We are designing these tests to be both quick and comprehensive, aiming to collect sufficient data for a reliable diagnosis in a time-efficient manner, thereby increasing the likelihood of their widespread adoption."

It is estimated that there are currently 944,000 people living with dementia in the UK and over 60% of those diagnosed are thought to have Alzheimer's disease.

Similar projections in the US estimate that the number of people aged 65 and older living with Alzheimer's dementia could double, growing to 13.8 million in the US by 2060, barring medical breakthroughs. These trends indicate the increasing burden of Alzheimer's on health care systems and society at large.

Early diagnosis is crucial for better management and treatment of the disease. While recent advancements in blood tests can detect levels of tau and amyloid proteins that could signal potential Alzheimer's disease,

these tests might not be sufficient on their own.

Dr. Castegnaro said, "Cognitive assessments are still needed to understand when the first cognitive impairments develop, and when it comes to existing spatial memory tests used in clinics, those often rely on verbal competence. Our tests aim to offer a more practical tool that doesn't rely on language or cultural background."

**More information:** Overestimation in angular path integration precedes Alzheimer's dementia, *Current Biology* (2023). DOI: 10.1016/j.cub.2023.09.047. www.cell.com/current-biology/f …0960-9822(23)01296-4

Provided by University College London