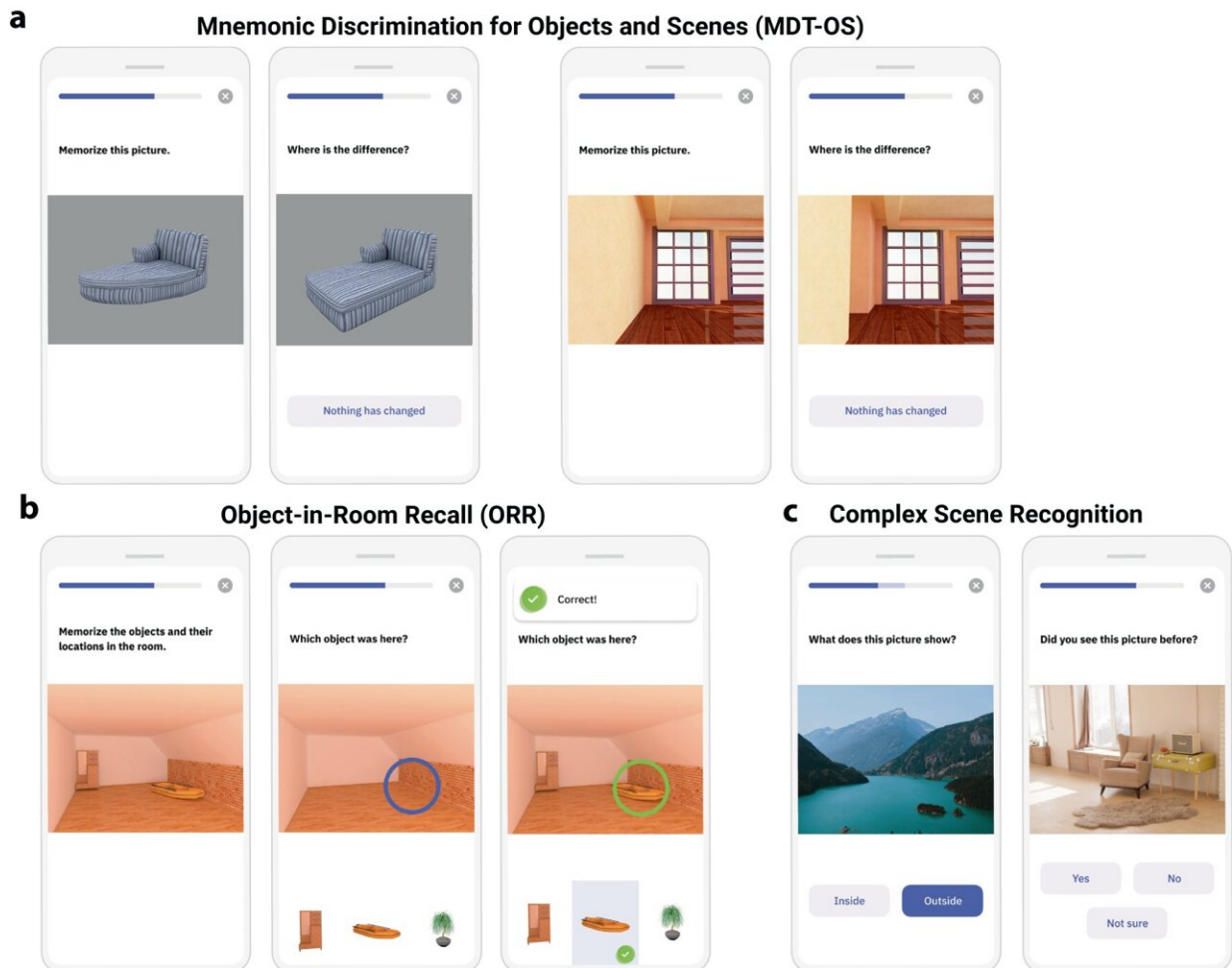


Memory self-test via smartphone can identify early signs of Alzheimer's disease

March 27 2024, by Marcus Neitzert



Memory tests constituting the RDMC score. a Mnemonic discrimination test for

objects and scenes (MDT-OS). b Object-in-room-recall (ORR) test. c Complex scene recognition test (CSR). Credit: *npj Digital Medicine* (2024). DOI: 10.1038/s41746-024-00999-9

Dedicated memory tests on smartphones enable the detection of "mild cognitive impairment," a condition that may indicate Alzheimer's disease, with high accuracy. Researchers from DZNE, the Otto-von-Guericke University Magdeburg and the University of Wisconsin-Madison who collaborated with the Magdeburg-based company Neotiv report these [findings](#) in *npj Digital Medicine*. Their study is based on data from 199 older adults.

The results underline the potential of mobile apps for Alzheimer's disease research, [clinical trials](#) and routine medical care. The app that has been evaluated is now being offered to medical doctors to support the early detection of memory problems.

Memory problems are a key symptom of Alzheimer's disease. Not surprisingly, their severity and progression play a central role in the diagnosis of Alzheimer's disease and also in Alzheimer's research.

In current clinical practice, memory assessment is performed under the guidance of a medical professional. The individuals being tested have to complete standardized tasks in writing or in conversation: for example, remembering and repeating words, spontaneously naming as many terms as possible on a certain topic or drawing geometric figures according to instructions. All these tests necessarily require professional supervision, otherwise the results are not conclusive. Thus, these tests cannot be completed alone, for example at home.

Prof. Emrah Düzel, a senior neuroscientist at DZNE's Magdeburg site and at University Magdeburg as well as entrepreneur in [medical technology](#), advocates a new approach. "It has advantages if you can carry out such tests on your own and only have to visit the doctor's office to evaluate the results. Just as we know it from a long-term ECG, for example. Unsupervised testing would help to detect clinically relevant memory impairment at an earlier stage and track disease progression more closely than is currently possible. In view of recent developments in Alzheimer's therapy and new treatment options, early diagnosis is becoming increasingly important."

Comparison between remote at-home and supervised in-clinic testing

In addition to his involvement in dementia research, Düzel is also chief medical officer of Neotiv, a Magdeburg-based start-up with which the DZNE has been cooperating for several years. The company has developed an app with which memory tests can be carried out autonomously with no need for professional supervision.

The software runs on smartphones and tablets, and has been scientifically validated; it is used in Alzheimer's disease research and is now also offered as a digital tool for medical doctors to support the detection of mild cognitive impairment (MCI). Although MCI has little impact on the affected individuals daily living, they have nevertheless an increased risk of developing Alzheimer's dementia within a few years.

Dr. David Berron, research group leader at DZNE and also co-founder of Neotiv explains, "As part of the validation process, we applied these novel remote and unsupervised assessments as well as an established in-clinic neuropsychological test battery. We found that the novel method is comparable to in-clinic assessments and detects [mild cognitive](#)

[impairment](#), also known as MCI, with high accuracy. This technology has enormous potential to provide clinicians with information that they cannot obtain during a patient visit to the clinic."

Participants from Germany and the US

A total of 199 women and men over the age of 60 participated in the current study. They were located either in Germany or the U.S. and were each involved in one of two long-term [observational studies](#), both of which address Alzheimer's—the most common dementia: DZNE's DELCODE study (Longitudinal Cognitive Impairment and Dementia Study) and the WRAP (Wisconsin Registry for Alzheimer's Prevention) study of the University of Wisconsin-Madison.

The study sample reflected varying cognitive conditions as they occur in a real world situation: It included individuals who were cognitively healthy, patients with MCI and others with subjectively perceived but not measurable memory problems. The diagnosis was based on established assessments that included, e.g., memory and language tasks. In addition, all participants completed multiple memory assessments with the Neotiv app over a period of at least six weeks, using their own smartphones or tablets—and wherever it was convenient for them.

"We found that a majority of our WRAP participants were able to complete the unsupervised digital tasks remotely and they were satisfied with the tasks and the [digital platform](#)," says Lindsay Clark, Ph.D., neuropsychologist and lead investigator of the Assessing Memory with Mobile Devices study at the University of Wisconsin-Madison.

Remembering images and detecting differences

"Assessments with the Neotiv app are interactive and comprise three

types of memory tasks. These address different areas of the brain that can be affected by Alzheimer's disease in different disease stages. Many years of research have gone into this," Düzel explains. Essentially, these tests involve remembering images or recognizing differences between images that are presented by the app. Using a specially developed score, the German–U.S. research team was able to compare the results of the app with the findings of the established in-clinic assessments.

"Our study shows that memory complaints can be meaningfully assessed using this digital, remote and unsupervised approach," says Düzel. "If the results from the digital assessment indicate that there is memory impairment typical of MCI, this paves the way for further clinical examinations. If test results indicate that memory is within the age-specific normal range, individuals can be given an all-clear signal for the time being. And for Alzheimer's disease research, this approach provides a digital cognitive assessment tool that can be used in clinical studies—as is already being done in Germany, the U.S., Sweden and other countries."

Outlook

Further studies are in preparation or already underway. The novel memory assessment is to be tested on even larger study groups, and the researchers also intend to investigate whether it can be used to track the progression of Alzheimer's disease over a longer period of time. Berron says, "Information about how quickly [memory](#) declines over time is important for medical doctors and patients. It is also important for clinical trials as new treatments aim to slow the rate of cognitive decline.

"To advance such self-tests, a patient's clinical data must be linked to self-tests outside the clinic, in the real-world. This is no easy task, but as our current study shows, we are making progress as a field."

More information: David Berron et al, A remote digital memory composite to detect cognitive impairment in memory clinic samples in unsupervised settings using mobile devices, *npj Digital Medicine* (2024). DOI: [10.1038/s41746-024-00999-9](https://doi.org/10.1038/s41746-024-00999-9)

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