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Therapeutic digital gaming and VR to level-up treatment for addiction

Researchers developing treatments for addiction are turning to virtual reality and gaming to help patients overcome their lack of impulse control and decrease relapse rates.

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In a lab in Berlin, Germany, healthy older adults are immersed in a cruise trip simulation called Schiff Ahoi! (Ship Ahoy!). Armed with a tablet device, they must quickly move food items from the ship's buffet onto a plate before they disappear, while avoiding items they have been instructed not to take. Performance-related points help sail the ship to Mediterranean destinations, where players can collect virtual postcards.

Such games may hold the key to finding innovative ways of training inhibition in people with addictions or impulsive behaviours. From alcohol and drug use to smoking, gambling and food-related disorders, these can be notoriously hard to break, and there is a significant chance of relapse even when evidence-based treatments are applied.

Relapse rates

‘Relapse rates are really high, especially in the first year after treatment,’ said Dr Leonie Ascone Michelis, a postdoctoral clinical psychologist at the University Medical Center Hamburg-Eppendorf (UKE) in Germany. ‘It’s a global burden concerning costs, the economy, and especially the lives of people who are detrimentally affected.’

While there’s no substitute for counselling, the continuing challenge in overcoming addictions suggests it is important to find supplementary and easily accessible methods to beat them. EU researchers are therefore working to create more immersive experiences via digital formats to aid self-control as part of the addiction recovery process.

In the Self-Control project in which Dr Ascone is involved, part of the ethos is that methods for overcoming addiction do not need to be dull and can be developed in a more positive and fun way. The aim is to create interactive methods using such means as video games and smartphone apps, making patients more enthusiastic to engage and thus improve their capacity for self-control.

The project is also using virtual reality (VR) to closer replicate the real-life environments in which people face temptations. ‘We’re trying to implement these gaming interventions or virtual reality interventions as part of our clinical programme,’ Dr Ascone explained. ‘A lot of people like computer games, so if we combine them with something useful then hopefully it will help.’

Impulse control

It has been hotly debated whether self-control can really be trained. Such attempts have often failed, but the seeds of the project were planted in a study that produced evidence of successful inhibition training using video games.

In the study, led by Simone Kühn, principal investigator on Self-Control and a neuroscientist also at UKE and the Max Planck Institute for Human Development in Berlin, a group of older adults trained by playing Ship Ahoy! for around 15 minutes daily for two months.

Participants who completed the training were found to perform better than control groups in a classical task used to test inhibition. Participants were asked to press buttons in response to the direction of an arrow, but withhold this reaction when the arrow turned red. The results of this so-called “stop-signal task” suggested potential for transferring self-control to other situations.

Interestingly, brain scans using magnetic resonance imaging (MRI) taken after the raining discovered a rise in thickness of a prefrontal area of the brain known as the right inferior frontal gyrus. Earlier research had shown this to be linked to inhibitory responses.

‘Based on these findings, it’s possible to modify our inhibitory behaviour,’ said Dr Ascone. ‘The question is, to what degree?’

VR headsets

The initial study showed promise for investigating this question through further development of digital and game-based approaches, something that the Self-Control team has been exploring.

Some games are based on adaptations of self-control methods that have already shown promise in earlier studies. For example, one builds on a method called approach-avoidance training (AAT), which stems from a finding that people who are dependent on alcohol have a faster tendency to approach representations of alcohol than they do to avoid them.

Traditionally played on a PC with a joystick using images of alcoholic and non-alcoholic drinks that they pull towards them or push away, such training has been linked in some studies to reductions in relapse rates.

In the Self-Control project, this concept has been extended to create a game that uses a VR headset where participants train in the more real-life 3D setting of a virtual bar with virtual drinks and replicate true-to-life arm movements. The concept is being tested alongside standard treatments in inpatient alcohol rehabilitation clinics in Denmark, Germany and Poland.

'In the end, we will have data from different countries and can check whether it works like we hope,' said Dr Ascone. 'But patients like it and we hope we can do a planned three-month follow-up in most cases, because the three months after hospital discharge are often the most vulnerable.'

The team is also working on a portable VR version that people can use at home and that Dr Ascone likens to the lightsabre-based VR game Beat Saber. 'I want to call that one AAAT, instead of the commonly used term AAT, as it will be some sort of anti-alcohol aggression training.'

Various other games and apps are also being evaluated with participants to see what works. One game is set in a supermarket and requires players to collect healthy snack options from shelves and avoid unhealthy ones, again using the stop-signal concept. Another app, which is based on AAT and conducted on a tablet, aims to combat smoking. 'We are trying out different approaches, combining gaming elements and clinical knowledge in applications that are both fun and effective,' said Dr Ascone.

High relapse rates suggest it is just as important to investigate the wider neuroscience behind addiction and the factors that aid recovery.

'We should be very critical and think about whether we are looking even in the right directions. Should we approach this from a different angle?' said Dr Janna Cousijn, a neuroscientist at Erasmus University Rotterdam in the Netherlands.

One way of generating new insights is to start bringing together separate strands of research, Dr Cousijn explained. 'We have developed more and more methods to zoom into specific mechanisms,' she said. 'To me, it feels like the next challenge would be to bring those together, integrating the evidence at multiple levels.'

She thinks a starting point is filling in some key research gaps, several of which she identified as the basis for a project she leads called Aging Matters. One is that studies on addiction tend to separately look at adolescents and adults, while few compare them, meaning knowledge is limited on the impact of age on underlying mechanisms.

Age of addiction

In addition, Dr Cousijn points out, studies in adolescents usually focus on risk of addiction rather than looking at their ability to bounce back, which tends to be greater than in adults. 'If you know why some people can recover and do it on their own, maybe studying those processes in more detail can tell us more about the brain's natural potential to recover,' she said.

To carry out the age comparison part of the project, Dr Cousijn plans to recruit 300 people between the ages of about 16 and 35 who use alcohol, cannabis or both for a three-year longitudinal neuroimaging study, which she hopes to begin around September. 'I want to go from low to severe users to capture the whole range,' she said.

Dr Cousijn intends to conduct MRI tests to assess cognition and brain function at both the start and end of the period, correlating that to how people say their cannabis or alcohol use has changed. In addition, she plans to conduct interventions with computer tasks and games to further assess cognitive control-related functions.

'I really hope to isolate crucial elements of similarities and differences between young people and adults who use drugs, and that this information can guide others into optimising prevention and treatment strategies targeted at specific age groups,' she said.

To fill in further gaps through another comparative study – this time between people and animals – Dr Cousijn will study the same addictions in rats during adolescence and adulthood, for which her team has developed a

protocol for testing humans and animals with the same scanner set-up.

The advantage of this approach is that the researchers can both perform more in-depth analyses of brain function in rats and have much more control over their environment, helping eliminate the influence of external factors. ‘This means that if you find similar associations between both, then we’re more sure about causality,’ explained Dr Cousijn.

Rating images

To address yet another gap, she will look at the complex role of social environment in addiction through use of a questionnaire, as well as tasks such as rating images of beers and seeing how answers are affected after people receive feedback from their peer group. This is a key part of the equation for tackling the issue of addiction, with the need to compare how the brain reacts to substances in social versus non-social situations, says Dr Cousijn.

Tackling addiction, she emphasises, will ultimately need fresh approaches, whether these stem from technology or experimental methods. ‘I’m very much invested in developing new experimental paradigms to test the processes underlying addiction,’ she said. ‘Then I hope that information can be used by others to help develop treatments and for prevention.’

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Self-Control

Aging Matters