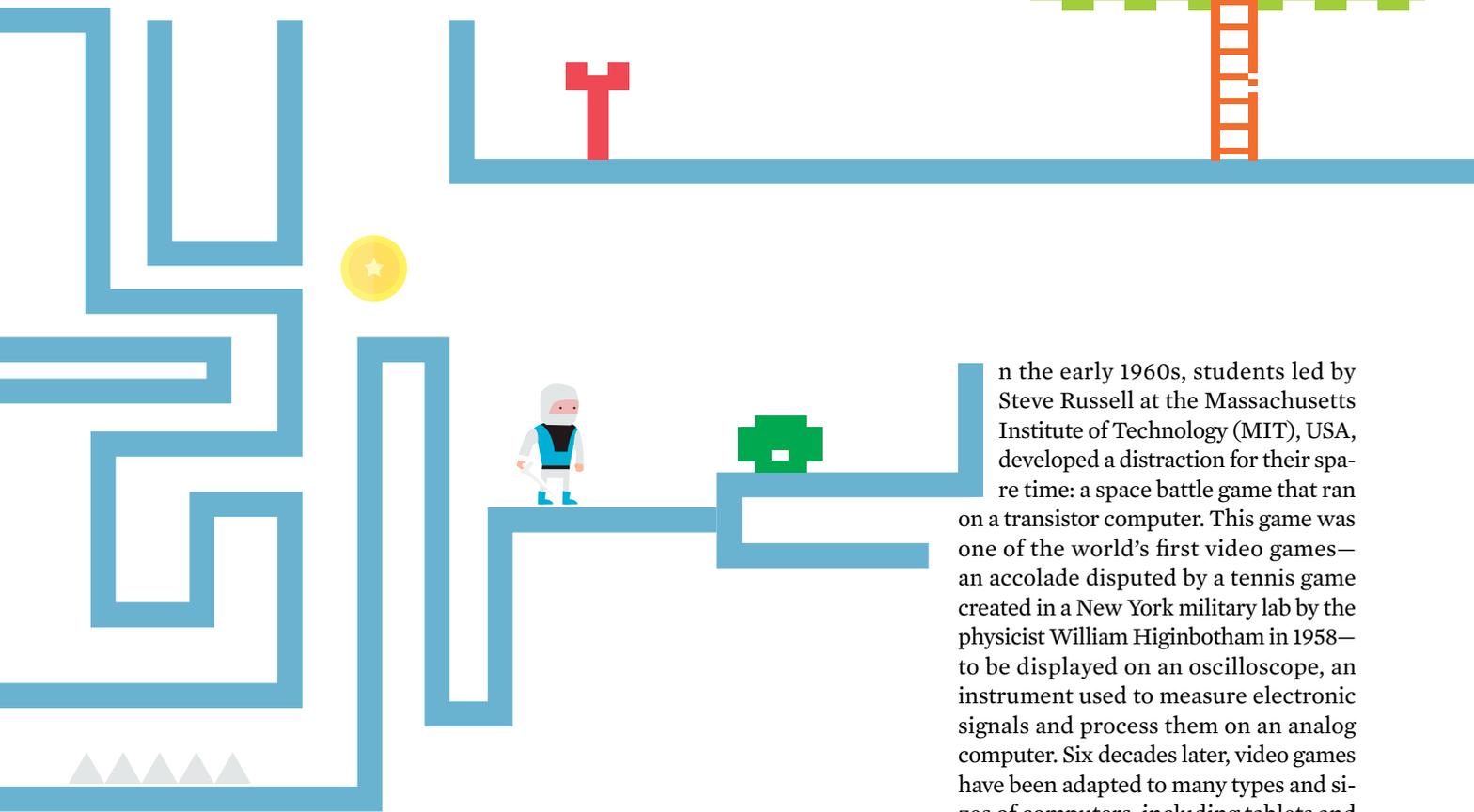
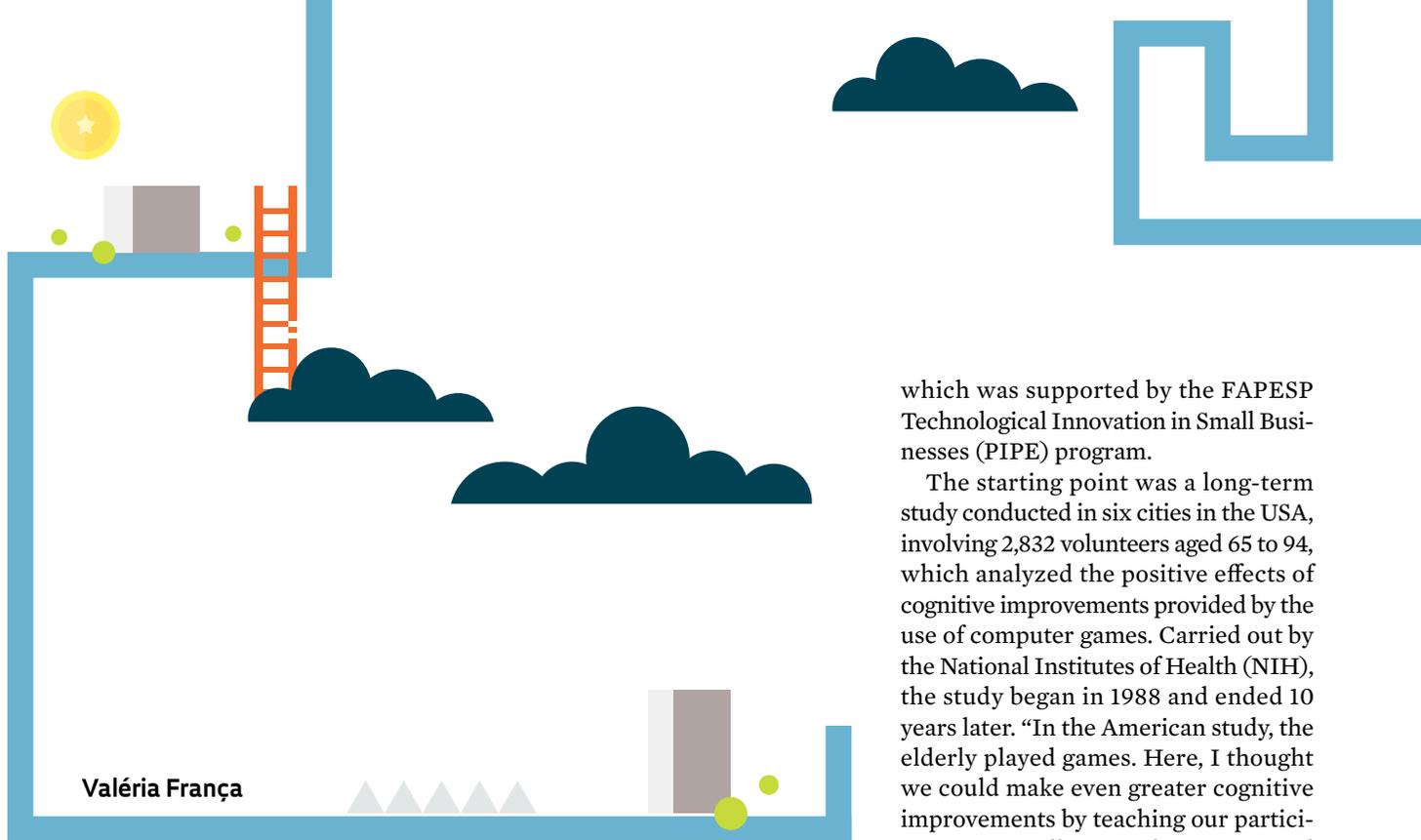


# science and video games



In the early 1960s, students led by Steve Russell at the Massachusetts Institute of Technology (MIT), USA, developed a distraction for their spare time: a space battle game that ran on a transistor computer. This game was one of the world's first video games—an accolade disputed by a tennis game created in a New York military lab by the physicist William Higinbotham in 1958—to be displayed on an oscilloscope, an instrument used to measure electronic signals and process them on an analog computer. Six decades later, video games have been adapted to many types and sizes of computers, including tablets and smartphones. Video games are played by 2.3 billion people worldwide, according to the 2017 *Global Games Market Report*, and are now regularly the subject of scientific research. As well as assessing the impact of their use—according to a



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## Researchers discover new uses for computer games

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recent classification by the World Health Organization (WHO), excess use can be considered a mental disorder (*see box on page 94*)—researchers from different fields of knowledge are discovering new applications for video games.

This is the case for Fabio Ota, who has an MBA in strategic IT management from the Getulio Vargas Foundation (FGV-SP), a diploma in gamification from the University of Pennsylvania, USA, and is CEO of the International School of Game (ISGAME), which offers games development courses in São Paulo. After organizing a course at the University of Campinas (UNICAMP) for people over 50 interested in preventing the adverse conditions that often accompany human aging, Ota created a project with the objective of improving cognitive function in the elderly by teaching them to develop video games,

which was supported by the FAPESP Technological Innovation in Small Businesses (PIPE) program.

The starting point was a long-term study conducted in six cities in the USA, involving 2,832 volunteers aged 65 to 94, which analyzed the positive effects of cognitive improvements provided by the use of computer games. Carried out by the National Institutes of Health (NIH), the study began in 1988 and ended 10 years later. “In the American study, the elderly played games. Here, I thought we could make even greater cognitive improvements by teaching our participants to actually write the games,” said Ota. He initially planned to work with a group of 20 people, but after receiving 74 volunteers, he decided to expand the initiative.

With a mean age of 65, most of the participants, an equal number of females and males, have at least a high-school education. Before starting, the volunteers took memory tests and physical exams. They also responded to questionnaires designed to evaluate their quality of life and underwent psychological testing to measure their degree of cognition and track possible cognitive losses, including the Mini-Mental State Examination (MMSE), which assesses spatial and temporal orientation, memory, and arithmetic ability. They then filled out the Kihon Checklist, used to provide a fragility index, and other tests to calculate their motor skills and coordination.

The volunteers were then divided into three groups: players (14 participants), developers (45 participants), and a control group (15 participants). Between August and December 2016, those in the first two groups took game development classes, while the control group received digital inclusion lessons. The students’ mission was to create a simple, two-dimensional game. The PIPE project lasted for nine months and involved special software that enabled the participants to develop games without having to write

computer code. Each class consisted of a physical warm-up followed by 70 minutes of programming and a stretching session at the end. In the third month of classes, the volunteers were submitted to another round of tests, which were also repeated one week after conclusion of the course.

At the end of the experiment, the results of the three phases were compared. Ota found that the developers group achieved the best performance, followed by the players. The study showed that the game development classes improved memory and cognition. The control group showed no change, suggesting that computer use alone is insufficient to improve these traits. “In developing the game, the elderly performed activities that they previously thought impossible, and they were even able to share the experience with their grandchildren, creating new bonds with the younger generation,” explains Ota. As well as developing a teaching methodology for the elderly, which has led to a number of courses aimed at improving cognition, memory, and concentration, the research also helped validate a video game created by ISGAME for use in one of the classes.

Long associated with sedentary habits, computer games also attract researchers interested in understanding



their potential for stimulating physical activity. Mateus David Finco, a professor at the Federal University of Paraíba (UFPB), studied exergames—which track the real movements of the player’s body and translate them into the virtual universe on the screen — during his PhD in informatics in education at the Federal University of Rio Grande do Sul (UFRGS). Exergames are played on con-



## Video game addiction

Classification as a disorder by the WHO is likely to boost research

Those who suffer from gaming disorder spend hours immersed in video games, unable to work, study, or even socialize. The disorder was added to the WHO International Classification of Diseases (ICD-11) in June. It was also added to the American Psychiatric Association’s Manual of Mental Disorders (DSM-5) in October last year. According to the DSM, unhealthy video gaming can be recognized as a disorder when symptoms manifest themselves for a year or more. Depending on the intensity, the disorder can be classified as low, moderate,

or severe. In general, it affects children and young adults from 12 to 20 years of age.

Gaming disorder still needs further study. Recognizing the disorder was necessary to enable advances in knowledge on the subject, explains psychologist Cristiano Nabuco, coordinator of the Technology Dependency Group of the Impulse Disorders Program at the USP Institute of Psychiatry.

The USP School of Medicine’s teaching university in São Paulo has had a gaming addiction clinic since 1996. Over the last 10 years, it has treated 400 patients. Diagnoses are

based partly on international tests, such as the Gaming Addiction Scale, which looks at 21 aspects of the patient’s daily routine. Once the disorder is confirmed, patients are put into groups of 12 and undergo psychotherapy together for 18 weeks. When necessary, they are prescribed medication. “Games are just a small part of the addiction problems created by the internet,” Nabuco says. When the internet became available on cell phones, he notes, social media and gaming addictions exploded: “I had a young patient who spent 55 straight hours in front of the computer, without even going to the bathroom.”

soles and often use a peripheral platform on which the player stands during yoga or aerobics exercises, for example. More advanced versions use a camera and infrared tracking to capture movement.

Five years ago, when Finco decided to create an exergames laboratory in partnership with a college in Porto Alegre, he realized that by switching the joystick for motion capture, the industry was developing a new form of interaction, and, like tablets and cell phones, it had potential as a new educational tool. “The idea was to investigate how they could help engage students who do not generally enjoy physical activity,” says Finco.

In Finco’s study, each of the 24 volunteers, aged 11 to 17, was allowed to use the equipment for 50 minutes three times a week over six months and was filmed doing so. The goal was to record the participants’ development, their social interactions, and how they used the equipment. By analyzing the videos, Finco found that the device served as a motivational resource, increasing interaction between students and improving motor skills. “The project showed that an exergames laboratory can offer an alternative to regular physical education classes,” summarizes Finco, who believes such games could also be useful for students with motor, physical, and mental disabilities.

Research recently completed by the Pennington Biomedical Research Center at Louisiana State University indicates that virtual games that require physi-

## Studies indicate that video games can help increase cognitive capacity in the elderly

cal movement, combined with virtual support from physical trainers, can improve the health of obese children. Titled “Home-based exergaming among children with overweight and obesity: A randomized clinical trial,” the study, led by developmental psychology expert Amanda Staiano, involved 46 children aged 10 to 12 and will be published in a special edition of the scientific journal *Pediatric Obesity*. Half of the participants and their respective families comprised the players group, and the other half,

a control group. At the end of the six-month program, 22 of the 23 families in the players group had completed 94% of the gaming sessions and attended 93% of the video-chat sessions. Children in this group reduced their body mass index (BMI) by 3% and their cholesterol levels by 7%, while those in the control group showed increases of 1% and 7%, respectively.

### ATTRACTIVE LANGUAGE

Since video games involve a predetermined narrative, characters, and objectives, they can also function as a means of communication, according to Sérgio Bairon, a professor at the School of Communication and Arts of the University of São Paulo (ECA-USP). “With technological resources continuing to advance rapidly, especially with respect to artificial intelligence, video games serve as a language capable of expressing the interaction between living beings and scientific concepts. Sometimes even in a more meaningful way than the written word,” he says.

Despite being studied in various areas of the humanities, video games are rarely used as language in academia. “My supervisees have developed projects in which they use video games as a support tool, but it is still not common for examining bodies to accept forms other than the written word,” says Bairon, noting that such acceptance already happens outside Brazil. He believes that this form of language could be a way of democratizing academic production: “I believe we could use this to transform a lot of scientific content into teaching material for schools, for example.”

Preliminary data from the 2<sup>nd</sup> Census by the Brazilian Digital Games Industry, released at the end of June by the Ministry of Culture, indicates that 1,718 games have been produced in Brazil in the last two years—874 of which were educational and 785 for entertainment. In the last five years, the number of game development studios in Brazil has increased from 142 to 375. ■

Salah H. Khaled, Jr., a doctor of criminal science and a professor at the Federal University of Rio Grande (FURG) Law School, believes the WHO classification is misleading, partly because the comparison with gambling and drugs is tenuous since video games are cultural products. For him, officially defining gaming disorder is a case of “pathologizing” games. “The supposed ‘addiction’ may be a symptom of another condition, such as anxiety or depression, for example. The emphasis on this symptom can leave a bigger problem untreated,” he says.

“The pharmaceutical industry is behind the creation of several ‘disorders’ treated by psychiatrists and psychologists. These classifications result from historical debates, and they do not reflect absolute truths,” observes Khaled, author of *Videogame e violência: Cruzadas morais contra os jogos eletrônicos no Brasil e no mundo* (Video games and violence: Moral crusades against video games in Brazil and worldwide). “Similarly,” he notes, given a review of the literature on the subject, “there is no concrete evidence that games provoke violence.”

### Project

Game programming as a means of developing logical reasoning and preventing cognitive decline in the elderly (no. 15/08128-1); Grant Mechanism Technological Innovation in Small Businesses (PIPE); Principal Investigator Fabio Ota (ISGAME); Investment R\$181,488.40.