

# Video games activate reward regions of brain in men more than women

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Allan Reiss, MD, and his colleagues have a pretty good idea why your husband or boyfriend can't put down the Halo 3. In a first-of-its-kind imaging study, the Stanford University School of Medicine researchers have shown that the part of the brain that generates rewarding feelings is more activated in men than women during video-game play.

"These gender differences may help explain why males are more attracted to, and more likely to become 'hooked' on video games than females," the researchers wrote in their paper, which was recently published online in the *Journal of Psychiatric Research*.

More than 230 million video and computer games were sold in 2005, and polls show that 40 percent of Americans play games on a computer or a console. According to a 2007 Harris Interactive survey, young males are two to three times more likely than females to feel addicted to video games, such as the Halo series so popular in recent years.

Despite the popularity of video and computer games, little is known about the neural processes that occur as people play these games. And no research had been done on gender-specific differences in the brain's response to video games.

Reiss, senior author of the study and the Howard C. Robbins Professor of Psychiatry and Behavioral Sciences, has long been interested in studying gender differences; in 2005, he published a study showing that men and women process humor differently. He and his colleagues

became interested in exploring the concept of territoriality, and they determined the best way to do so was with a simple computer game.

The researchers designed a game involving a vertical line (the "wall") in the middle of a computer screen. When the game begins, 10 balls appear to the right of the wall and travel left toward the wall. Each time a ball is clicked, it disappears from the screen. If the balls are kept a certain distance from the wall, the wall moves to the right and the player gains territory, or space, on the screen. If a ball hits the wall before it's clicked, the line moves to the left and the player loses territory on the screen.

During this study, 22 young adults (11 men and 11 women) played numerous 24-second intervals of the game while being hooked up to a functional magnetic resonance imaging, or fMRI, machine. fMRI is designed to produce a dynamic image showing which parts of the brain are working during a given activity.

Study participants were instructed to click as many balls as possible; they weren't told that they could gain or lose territory depending on what they did with the balls. Reiss said all participants quickly learned the point of the game, and the male and female participants wound up clicking on the same number of balls. The men, however, wound up gaining a significantly greater amount of space than the women. That's because the men identified which balls - the ones closest to the "wall" - would help them acquire the most space if clicked.

"The females 'got' the game, and they moved the wall in the direction you would expect," said Reiss, who is director of the Center for Interdisciplinary Brain Sciences Research. "They appeared motivated to succeed at the game. The males were just a lot more motivated to succeed."

After analyzing the imaging data for the entire group, the researchers

found that the participants showed activation in the brain's mesocorticolimbic center, the region typically associated with reward and addiction. Male brains, however, showed much greater activation, and the amount of activation was correlated with how much territory they gained. (This wasn't the case with women.) Three structures within the reward circuit - the nucleus accumbens, amygdala and orbitofrontal cortex - were also shown to influence each other much more in men than in women. And the better connected this circuit was, the better males performed in the game.

The findings indicate, the researchers said, that successfully acquiring territory in a computer game format is more rewarding for men than for women. And Reiss, for one, isn't surprised. "I think it's fair to say that males tend to be more intrinsically territorial," he said. "It doesn't take a genius to figure out who historically are the conquerors and tyrants of our species-they're the males."

Reiss said this research also suggests that males have neural circuitry that makes them more liable than women to feel rewarded by a computer game with a territorial component and then more motivated to continue game-playing behavior. Based on this, he said, it makes sense that males are more prone to getting hooked on video games than females.

"Most of the computer games that are really popular with males are territory- and aggression-type games," he pointed out.

Reiss said the team's findings may apply to other types of video and computer games. "This is a fairly representative, generic computer game," he said, adding that he and his colleagues are planning further work in this area.

Source: Stanford University

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