



**The Science of Learning Blog**

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## The Truth About Video Games and the Brain: What Research Tells Us

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We've all seen the news reports, but how do video games really affect the brain? The short answer is this: researchers are working on it. While a great many studies have been done, science has a long way to go before we fully understand the impact video games can have.

The brain is a malleable, "plastic" structure that can change and evolve with every stimulus we give it. Whether that stimulus comes from listening to Tchaikovsky, studying Spanish, training in karate, or jumping through the mushroom kingdom in Super Mario Bros. Wii, every single input can affect the wiring of the brain if the conditions are right.

In a December 2011 article in *Nature Reviews Neuroscience*, six experts in neuroscience and cognitive psychology – Daphne Bavelier, C. Shawn Green, Doug Hyun Han, Perry F. Renshaw, Michael M. Merzenich and Douglas A. Gentile – offer their perspectives on frequently asked questions related to the effects of video games on the brain:

**Are there beneficial effects of video games? Does evidence point to improvements in cognitive function?** Given the wide variety of game types and the tasks they demand of the brain, this is an extremely complex and layered issue. Han and Renshaw cite studies indicating that game play may improve visual-spatial capacity, visual acuity, task switching, decision making and object tracking. In perception, gaming has been shown to enhance low-level vision, visual attention, processing speed and statistical inference. These skills are not necessarily general improvements in cognitive functioning, but specific skills transferrable to similar tasks. (Gentile)

**Does playing video games have negative effects on the brain and behavior?** On this issue, the jury is essentially unanimous: intensive play of high-action games has been shown to have negative cognitive effects. Merzenich references studies that indicate such games can create "listlessness and discontent in slower-paced and less stimulating academic, work or social environments." Research has drawn connections between playing more violent games and an increase in more aggressive thoughts. Games with anti-social or violent content "have been shown to reduce empathy, to reduce stress associated with observing or initiating anti-social actions, and to increase confrontational and disruptive behaviors in the real world." (ibid)

**How strong is the evidence that video games are addictive?** While

strong evidence is mounting, research is proceeding but still incomplete. According to Han and Renshaw, investigations suggest that "brain areas that respond to game stimuli in patients with on-line game addiction are similar to those that respond to drug cue-induced craving in patients with substance dependence." In addition, they state that gaming dependence has been shown to create "dysfunction in five domains: academic, social, occupational, developmental and behavioral." While gaming addiction may differ from other types of addiction, it clearly appears to be a very real issue.

#### **What should the role of video games be in education and rehabilitation?**

Again, if we come back to the underlying fact that any stimulus can change the brain under the right conditions, video games – a source of stimuli – certainly have a role to play in these areas. The question is, what stimuli are beneficial to which individuals, and how can we customize the gaming experience to give the learner or patient the stimuli that they most need at a given moment? Adaptive technologies that track a user's responses and present follow-up material based on those response patterns, especially when wielded by an experienced educator or clinician, offer immense potential.

The last question these experts address is: **Where is neuroscience headed in this field?** Clearly, studies have shown that video games affect and change the brain, both for ill as well as for good. Some researchers, such as neuroscientist Paul Howard-Jones of Bristol University, are already experimenting with ways to harness computer gaming to enhance classroom learning. Future studies are likely to uncover both detrimental effects of video games and significant benefits of their employment as learning and rehabilitation tools.

"Because of their great didactic efficiencies," says Merzenich, "and because of brain plasticity-based exercises can improve the performance characteristics of the brain of almost every child, these new game-like tools shall be at the core of a schooling revolution."

#### **For Further reading:**

Brains on Video Games . Daphne Bavelier, C. Shawn Green, Doug Hyun Han, Perry F. Renshaw, Michael M. Merzenich and Douglas A. Gentile. Nature Reviews | Neuroscience. Vol. 12, December 2011.

Harnessing Gaming for the Classroom . D.D. Guttenplan. New York Times Europe, January 29, 2012.

#### **Related Reading:**

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