

# Effect of video games on brain functions



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## The Immersion of the Human Mind In Video Games

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Abstract

This research paper was created with the intention of taking the reader on a guided journey towards understanding how the human mind functions within the virtual world of video games. It explores the interaction between the senses of the nervous system and the game's artificial reality and attempts to establish a connection between an individual's brain capabilities and the demanding requirements of a game's level environment and attempt to find a balanced relationship between the two.

The paper is based around a research, conducted in order to come up with approximate statistics about how the game's world triggers brain sensors and how and how much the human consciousness responds according to the information input it receives.

A racing track, named the " Blackstone International Circuit" was created as a supporting piece of level design work. With the help of an external controller, a steering wheel with resistance and force feedback, fellow students, who took part in the research, were required to compete three laps

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around the circuit. The track was also released on several online websites and that made possible the involvement of other anonymous individuals. After they had their turn, they were asked to complete a track questionnaire with questions related to their experience.

The data of the questionnaire was later collected and analysed in order to establish a statistics database of how the separate senses take part when the human mind is engaged. The results revealed that the brain's involvement was maximised and participants felt fully immersed within the game environment. That allowed the collection of subconscious activity that was categorised to determine the type of game presence they had – tactical, strategic or narrative.

Findings also helped support the claim that a person with a strong co-ordination and reflex abilities, which are the main part of having a tactical game presence, would be called a “ good gamer”. The majority of participants in the survey belonged to the group of players that have tactical presence and had a very similar approach.

Throughout this paper, objective analysis and criticism, as well as self-assessment and reliable sources were the foundation for building a valid and evident piece of academic writing.

The paper concludes with suggested criteria for analysing the mind's activity when playing a video game and getting clearly distinguished results about the type of people that play video games in today's world.

Literature Review

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At the beginning of each life experience, there is the perception of it. It is the initial start of the human mind's interaction with the surrounding environment and ultimately serves as the foundation, on which events occur and build up.

In the Oxford dictionary, the definition for the word “ perception” is “ the ability to see, hear, or become aware of something through the senses.” The environment of reality is consisted of an infinite number of information flows, which inevitably and constantly interact with the mind. If the “ filter” of perception did not exist, there would be an extreme mental overload, as the amount of streaming actions would be too big to comprehend.

Blake and Sekuler (2006) state that “ what is crucial is that perception provide us with a *useful* view of the world”, rather than detailed and accurate one; “ where useful means being able to interact safely and effectively within our environment.” Perception acts like an information distributor to the mind, allowing only relevant data to reach the brain, while the unnecessary parts of the occurring event may even not make their way through.

The two authors also explain that “ stimulation comes in various forms of physical energy: thermal, mechanical, chemical, acoustic and electromagnetic.” As a consequence, the human brain's ability to accept and process information is applied through the five senses – sight, hearing, smell, taste and touch. Working together, they create a complete image of the surrounding environment, enabling us to co-ordinate and interact with at a level of full immersion.

The word “immersion” originally meant “to submerge someone or something in a liquid.”, however, since the invention of video games and entertainment media in general, the meaning has evolved significantly, as far as it affects the human mind. According to Wikipedia, “immersion”, in relation to a video game, can also mean “a perception of being physically present in a non-physical world.”

The immersion in the video game world can be split into three different types – tactical, strategic and narrative (Adams, 2005). The first two are easy to achieve, as they require problem solving; tactical is the type that requires skill and repetition of actions on the way to success; Strategic immersion involves calculation and prediction to overcome obstacles. However, narrative immersion is hard to accomplish, as a lot of elements must work together – story, characters, setting, acting, presentation, to compile everything together in a successful emotional state.

Rigby and Ryan (2010, p. 84) explain how Authenticity is a key factor to the believability of an experience. It is what provides ground for the extra step towards immersion, as people usually choose to keep their distance from things that they consider fake. Authenticity makes a product trustworthy and reliable, and helps the individual achieve the desired blending of the real (factual) and the imaginary (mental) world. According to the authors, each person has an individual set of requirements, called “schema”, which is applied to every experience in order to compare it to previous ones and determine if it can be classified as “authentic”.

According to Madigan (2010), it is spatial presence that comes closest to what game players perceive as immersion. It is considered to exist when the elements of a game world are accepted as “real”, allowing one to submerge fully into a product of the imagination and feel like they are as much present in the scene, as they would be in reality.

The process takes place over two defined stages. At the First stage, a player is accepting the surrounding world, composed of a variety of objects, sounds and events, which help create a saturated mental model of the game’s virtual universe. The Second stage is engaging the mind on a subconscious level, where it feels part of a flawless reality and is fully immersed within the experience. It has the imagination filling in the imperfections of a certain part of a game level, for example, which were imposed by the limitations of the machine or the level of object detail.

Daphne Bavelier, a cognitive research scientist, in a keynote presentation (2012) about the relationship between the human brain and playing fast-paced computer games, suggested that doing so actually improved the brain’s capabilities. According to her team’s research, people who often play action games tend to solve problems faster, perform better in multitasking and recognise and react to the surrounding environment more accurately and with greater precision than people who do not. That is due to the fact, that, when fully immersed inside the game world, the brain would have to process often times a lot more information than in a lot of real-life situations, which would essentially serve as training process and help the individual improve on problem solving. The results of that research were valid even months after it was conducted.

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A very important, if not crucial factor for achieving a full immersive experience, when playing a game, is Realism. McMahan (2003) splits Realism of video games into two sub-divisional types – Social and Perpetual. The first type suggests the comparison between social interactions within a game's environment compared to the real world, but the Perpetual Realism is the level of visual resemblance of the objects in that environment to the ones in reality.

Most fast-paced games in today's world offer the possibility of complete interaction of the mind and game world, due to the fact that computer graphics and processing of game data is becoming rapidly faster with each year that passes. Game genres like any modern First-Person Shooter (FPS) game, such as Call of Duty or Battlefield, require almost the same skill set for a proper playing experience. According to Gamer Institute (2014), the top skills of a professional player are Love of the Game, Unwavering dedication, Manual dexterity, Twitch reflexes, Strong multi-tasking, Analytical ability and Emotional Control.

One of the most realistic genres of games in today's world is the Simulator. It considers factors, such as physics, lighting, shadows, shapes or events to create a world, which resembles reality as close as possible. Depending on the type of simulator, reality's properties can be used for a variety of purposes. Some games, such as Moon Tycoon (2001) tend to focus on events that cannot occur in the current state of the world we live in. Others, such as SimCity (2013), use reality to propose a virtual representation of events in a real-time game universe.

A Racing Simulator is the type of game that would make a significant difference in how the mind can deal with reality. According to SAE (2014), the delay between events in the racing simulator can even cause motion sickness in drivers; that is why it is unacceptable, as “ it can reduce effectiveness of driver-in-the-loop (DIL) systems used for studying vehicle dynamics”. A game called rFactor Pro (2008) was developed to ensure the maximum of the virtual reality is extracted and a life-like experience is delivered to the drivers in order to get them fully engaged and prepared for a race. SAE also writes that, as of 22 Jan 2014, the game is currently the dominant software in the simulator market, used in F1 and NASCAR teams to mentally prepare drivers.

RFactor Pro is an upgraded version of rFactor, a racing simulator game, developed by Image Space Incorporated (ISI) and released in 2005. RFactor has a very large community and a rich and diverse database of game extensions, called otherwise “ Mods” – tracks, cars, menu interface images, sounds and miscellaneous add-ons, developed almost entirely by third-party source, such as myself. The game itself has a very realistic physics engine that enables accurate simulation of life-like racing experiences – tire and engine wear, fuel consumption, wind resistance, tire grip, etc. It engages the players in a believable environment (roads and racing tracks) to get them concentrated on the objective of racing against other cars or beating a time record.

According to Angel Ever (2014), safety is the biggest benefit of racing simulation. In virtual reality, there is no possibility for the risk of real-life damage and danger. This removes the “ hazard” factor, while preserving all



other fun factors that driving a fast car can provide. A player is not required to wear safety equipment, or have their car inspected at all times, in contrast to a racing driver. Moreover, real racing is a lot more expensive, compared to virtual one, as the cars' integrity is reset at the beginning of each playing session. There is also the freedom to drive, regardless of the rules of the real world and experience pure fun when doing so.

On the other side, a research, conducted by Continental Tyre UK (2011), suggested that people who often play driving games tend to be poorer drivers in real life. According to results, gamers are likely to take more risks, speed and be susceptible to reckless driving more often than non-gamers. Around 16% of all the participants agreed that driving games would make someone perform better in real conditions, while 40% said that virtual experiences contribute to dangerous behavior on the real roads.

### Current Perceptions

The process of investigation is iterative and information is collected in a database for later evaluation. Since the method used in it does not change over time, that means that as the quantity of participants grows, the results' accuracy grows as well.

At the beginning of the project I already had a personal understanding of how a player interacts within the game world, based on my gaming experiences in the past. I wanted to examine the brain's activity and how important it was for a player to have a complete image of the surrounding environment in order to extract the maximum of their performance. Several categories of interest were defined in order to achieve a guideline

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