

Intense Gaming

and its effects on the human brain

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Abstract—A study on how the brain gets affected by intense gaming. The results showed increased efficiency in reaction time over a period of 4 days of gaming and no decreases in other brain functions.

reaction time, brain speed, intense gaming

I. INTRODUCTION

The focus has been on what happens to people that play intensively. A wide spectrum was not taken of this matter, but instead a focus on how a persons brain gets affected by playing a lot of intense twitch-gameplay. The research was meant to delve into what happens to the brain and not focusing on the game itself. Trying to measure the brains capacity and open questions for further studies in this area.

II. APPROACH

The idéa was to test a single person through an intense gameplay sessions over 3 days of gameplay to find out how reaction time and memory was effected. Also, to find out if intense gaming develops or degrades the brain by extreme stimulation, or maybe even both at the same time. The participant should eat and sleep well but play constantly to push the limits as much as possible to test the extremes of gaming.

A. Background

I have always been a gamer and I remember long before I started to study games, how I noticed interesting things happening after playing intensively for many days. One thing I remember noticing was that after playing intensively for a couple of days a fighting game called “Tekken” by Namco, it felt like everything went from smoothly run on the screen to stuttering. This had nothing to do with the games framerate as it was always at 60fps, running on a Playstation and a CRT television at 60Hz. What I figured out was that the brain had probably increased its speed of input and by doing that, everything looked like it was going more slowly. A similar likeness would be filming in slowmotion. You record at a faster framerate than you show it, thus making the movie slower than its input was. But why did I see stuttering then?

The tv-screen was 60fps and usually this seemed like fluid movement. If it had been showing 1 frame per second, it would have been seen as stuttering by everyone. You could say that the brain is the camera recording the tv-screen. If the brain sees at 60fps and looks at a screen showing 60, the picture will be smooth. If the screen shows 1 fps and the brain records 60fps, the brain will experience stuttering. If the brain speeds up to 120fps and the screens is at 60fps, then the brain experiences stuttering.

What I experienced was over days of constant gaming and not just a couple of minutes or an hour. Playing a fighting game, the input feedback is a lot higher than driving a car on a straight road in a high speed, mostly getting visual input. In the fighting game which I played (generally all fighting games are like this), you have to react constantly and feed back input constantly which makes the gaming and driving experiences different from each other.

What I wonder now is how does fast paced intensive gaming impact the brain functions? Is it changing reaction time? In what way?, How much? Can this information be used to develop the brain? Can other functions get decreased due to the lack of under stimulation?

B. Intense gameplay and brain stimulation

What is the core gameplay of a fighting game in terms of brain stimulation? In order to play you need to remember what buttons to push to do the different attacks or blocks. Then you need to remember what attacks your enemy might do against you. The attacks from the enemy is recognized by both graphics (visual attention) on the screen, displayed frame by frame in a certain framerate and sound (Auditive attention). After this, the core gameplay comes in where you try to analyze your enemy's move, figure out what attacks works best with or against other attacks and instantly react upon this. Thus core gameplay of a fighting game has a loop which looks something like this:

1)Recognize what we hear or see on the screen using the brains visual and audio cortex.

2)Remembering what to do as fast as possible.

3)Execute the chosen action by pushing the buttons
(Handled by the motor cortex of the brain).

4)Add the result to the memory.

5)Process the data and add the result of the reaction to the next event.

This process is repeated commonly every second or sooner if battles are intense thus making fighting games some of the most intense forms of gameplay there is. Now the question is: Is this extreme condition of focused brain activity something which enhances or dis-enhances the brain? or maybe both at the same time. As we see in this cycle, the brain is extremely focused on only gaming thus it's very interesting to know not only what the impact is on the parts being used but also how much of the other senses or brain patterns that might be influenced by this.

C. The setup

The participant is going to be playing a fighting game (in this case Soul Calibur 4) for 3 days with no restrictions in how to play as it is going to simulate an ordinary but intense gaming session. The game's only role is to stimulate the participants brain.

III. THE EXPERIMENT

A. Stimulus

Soulcalibur IV is the fifth installment in Namco's Soul series of fighting games, and was released on PlayStation 3 and Xbox 360 on 29 July 2008, in North America, on 31 July 2008, in Japan, Europe, and Australia, and on 1 August 2008, in the United Kingdom and New Zealand. The basic concept of the game is that you take control over a character on the screen in a 3D view and try to win fights against other characters. You only fight against one other character at a time, but depending on game mode the player and or enemy can shift it's character to another. The battles are viewed from the side of the characters. They can move towards, backwards and rotate around each other. There are many different fighting styles to choose from and each fighting style has around 50 attacks. Most attacks are similar to other fighting styles attacks. The moves are done by pressing the buttons in different combinations and/or combined with the movement pad. When you block you press the block button. There are 2 ways to block and those are standing or kneeling. If you stand you block high and middle attacks. If you kneel you block low attacks. You can also counter an attack by pressing a button combination in the exact moment the attack is going to hit.

The game can be played both single or against another player. The gameworld is set in a fantasy setting and the characters uses armor and weapons. Though the battles are violent the characters does not bleed or get limbs cut of. Special effects are used to demonstrate hits and also to enhance the view of movements, making them more recognizable. There are different ways of playing both solo or multiplayer but all

modes still uses the basic feature of winning a battle over an opponent with the battle seen from the sideview.

B. Logging

Everything that can be logged should be logged. Excluding the tests, these are things like:

- Timestamp of every event
 - When experiment starts
 - At each test
 - Length of playtime
- Every experience of the participant
- Mood of the participant (timestamped)

C. Environment

The participant will be sitting comfortably close to the screen in order to really activate the senses and get all impressions from the game. The room will be dark to enhance the experience of the game. Outside intervention should be kept low to keep the participants brain focused on the game to heighten the effect.

D. Conditions

Under these days, the participant is not going to take any drugs or mind altering substances (coffein, tobacco or alcohol).

E. Food

Food will be distributed frequently during the experiment. The food will have low glycochemical index and calories will be counted to keep bloodsugar levels at a constant level. This to keep the mind at the same efficiency level over the gaming period to keep the participant at optimal brain capacity all the time.

F. Items needed

- Playstation 3
- Soul Calibur 4
- Comfortable chair or sofa
- Headset
- Food
- Laptop
- Stopwatch software
- Cognition test software
- Sound recognition test
- Word recall test
- Verbal fluency test
- Reaction test

G. Time schedule

Day 1

The experiment starts with a number of tests. These tests are:

- Sound recognition test
- Word recall test
- Verbal fluency test
- Reaction test

The reaction test is the only test repeated during the sessions until the end. All other tests are only repeated once more on the third day after the gaming session. Once the gaming session is started, the participant is playing until bedtime.

Day 2

The participant plays the whole day until bedtime. The participant does reaction test every hour and starts the day with the reaction test and ends the day with the reaction test.

Day 3

The participant does reaction tests every hour until the gaming session ends. The gaming session ends 3 hours before bedtime. The participant will do all tests made in day 1 once again to see the difference.

H. Keeping Track

After the intense period of gaming has occurred, the participant must be tested in it's normal state. This will occur the day after the last gaming day session. The participant is going to do the reaction test once a day if reaction time has changed during the gaming sessions. This will be done until the effect has wared off and maximum 7 days after the experiment has ended.

IV. ANALYSIS

A. Changes

Changes was immediately made before the start of the project to compensate for time delays and noticed wrong calculations in the beginning. First thing was that a lot of time disappeared before the experiment could start. Therefore I compensated this by adding another day. I also figured that testing each 15minutes the first hour on the first day was completely pointless. The first hour the player do not know the game and wont play intensively. So I started doing all the tests before playing and did the reaction test each hour after that.

B. Brain speed

The brain speed test was done as scheduled the first day with the outcome of 28milliseconds, and the last day with the outcome of 24 milliseconds. Change was rather mild but at least visible. A minor speed increase maybe if not just a coincidence. The outcome for people in general of this test is between 32 – 200 milliseconds so I was above ordinary already before I started playing which makes it even harder to see a positive change as I already was in the top range.

Brainspeed test	Milliseconds
Before the experiment	28
After the experiment	24

C. Word recall

The word recall test was not very effective and should be replaced in a further study with a much better memory test. I have seen those that I would have liked to use but I did not have the time to get them. I took this test anyway as I figured it would be better than anything and I got the same result day 1 as day 2. I remembered 4 words. 7 words would be medium for my age (33). 4 words was medium for an 80 year old.

Word recall test	Words remembered
Before the experiment	4
After the experiment	4

D. Reaction time

The reaction test measured the time reacting to push a button by looking at a white square on a computer screen and pressing a button once the square became green. This test varied greatly from start of the experiment to the end. Reaction time went from around 300milliseconds to around 200milliseconds.

E. Test accuracy

The accuracy of the experiment is low however due to many factors and needs further study to reinforce the outcome. Following is a list of factors which may lower the accuracy of the experiment. Only one participant was tested.

- 1)The memory test could have been a better one, more efficient and testing a wider range of memory functions.
- 2)The outcome of the reaction test could differ depending on the learning curve of the test independent from the effects of the gaming sessions.
- 3)The reaction test did not include any form of calculation of the input data to the brain.

V. CONCLUSION

The conclusion of the experiment is that playing a twitching game intensively, enhances the brains reaction processing and do not decrease any other functions.

Reaction test - Days overlapped

