



## Research Article

# Pong, Super Mario, Minecraft; to click or not to click

Arya Nahavandi<sup>1</sup>, Malay Myaing<sup>2\*</sup>, Kyawt K Ayee<sup>3</sup>

<sup>1</sup>11<sup>th</sup> Grade Del Norte High School PUSD, USA

<sup>2</sup>Hospital Medicine Southern Kaiser Permanente, USA

<sup>3</sup>Geriatric Specialist at Kadlec Regional Medical Center, USA

\*Corresponding author: Malay Myaing, Hospital Medicine Southern Kaiser Permanente, USA

**Citation:** Nahavandi A, Myaing M, Ayee KK (2023) Pong, Super Mario, Minecraft; to click or not to click. J Family Med Prim Care Open Acc 7: 219. DOI: 10.29011/2688-7460.100219

**Received Date:** 24 April, 2023; **Accepted Date:** 02 May, 2023; **Published Date:** 04 May, 2023

### Abstract

The goal of this short review article is to simply highlight the correlating trends between video games and cognitive brain function. The conclusion of this paper was found by diving into rapidly growing variables of the video game industry. We tracked the gaming industry's history and development, then conducted a simple comparative analysis of data gathered on illnesses such as hypertension, diabetes, and stroke in comparison to the growth of the video game industry to dementia. A cross comparative analysis of a variety of papers and statistics (all listed below), was done in order to establish credible backing behind our findings and conclusion.

**Keywords:** Videogames; Evolution; Dementia; Incidence

### Introduction

It's a common phrase in every household; "those video games will rot your brain!" Does evidence actually support this contention? Recent studies show developments from what we know regarding children's consumption of video games. In this article, we review possible association between the decline in dementia incidence with the evolution of video games over decades.

### Background

Typically, as the average life expectancy increases, the prevalence of dementia is supposed to increase exponentially. Instead of this expected trend, the Framingham Heart study of 2016 reflects a down trending of the dementia incidence. [1]. The study surveyed the incidence of dementia since 1975, with 5205 subjects all of which were 60 years of age or older. Results revealed a decline in incidence from 3.6/100 (late 1970- early1980), to 2.8/100 (late 1980- early1990s), 2.2/100(late 1990-early 2000) and 2/100 (late 2000-early 2010s) [1].

In same study the factors contributing to this decline have not been completely identified even with correlation of prevalence of vascular risk factors.

Recent publication by Chaarnari, et al. regarding association of Video gaming and better cognitive performance [2] led us to

look into possible association of the evolution of video games, accessibility to them, youth participation, and a decline of dementia incidence.

### Methods

We reviewed the Dementia incidence, physiology, association factors including hypertension diabetics other vascular risk factors like stroke prevalence from existing published articles [1,3-6].

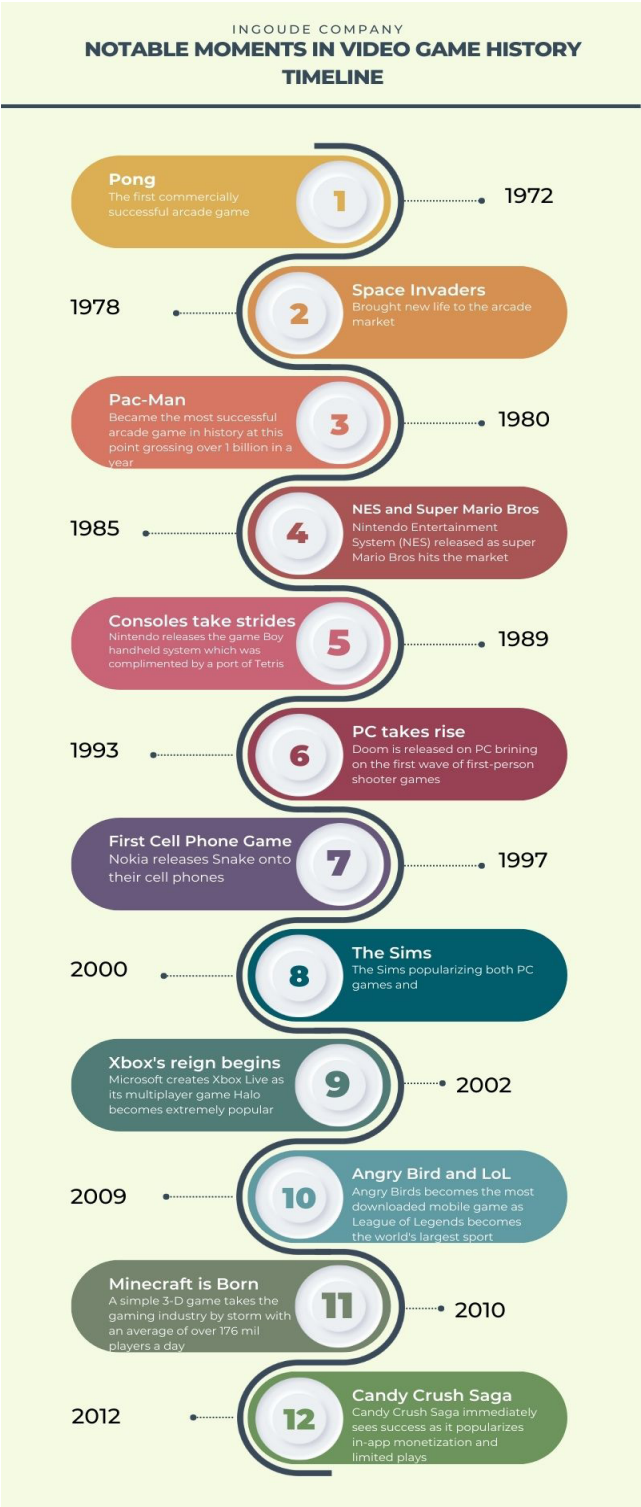
The evolution of the video game industry was reviewed; starting from Atari's Pong (one of the earliest video games), moving onto Nintendo's Mario, and ending with Mojang's Minecraft. We also look at the physiology of brain function playing these games from existing studies.

### Observation

The first video game prototypes in the 1950s and 1960s were simple extensions of electronic games using video-like output from large room-sizes. The Pong video game, manufactured by Atari, was created on console in 1972. The generation of youth who had played these video games are already in 60s or older.

The industry grew quickly during the golden age of arcade video games from the late 1970s to early 1980s. The game format evolved from stationary arcade to hand held devices in 1980s which suggest higher consumption -- especially by youth demographics that many advertisements targeted.

Pong is a simple 2-dimensional sports game that mimics table tennis (Ping Pong), incorporating a simple premise with even simpler mechanics. The game had two players, (or a single player fighting a simple AI), as they controlled their paddles in vertical movements with a simple joystick, aiming to continue the rally until the other player fails to return the ball (Figure 1).





**Figure 1:** Videogame Evolution.

Pong's simple mechanics and coordination may improve the function of the frontal lobes of the brain, which regulate decision making, problem-solving and voluntary movements while increasing attention and focus. Even though there was no direct research on using the Pong game version as a cognitive benefit tool for older adults, multiple studies suggested cognitive benefits of exergames (which are more sophisticated versions of pong game) [7,8].

Pac man and Super Mario came to market in 1980 and 1985 respectively.

In study by Kuhn, et al., video game naïve participants played the three-dimensional platformer game Super Mario 64 over a period of 2 months for at least 30 min per day. Participants' medium age was 24.1 without mental health disorder, neurological diseases or abnormal brain MRIs. Scanning (MRI) results done pre and post study, showed significant gray matter increase in right hippocampal, right dorsolateral pre-frontal cortex and bilateral cerebellum [9].

Gray Matter (GM) increases in right hippocampal will have positive effect on cognition. GM increase in right dorsolateral pre-frontal cortex will benefit decision making, memory consolidation, conflict management and mood regulation.

West et al 2017 did a similar study in adult's 55-75 age group, and replicated same results [10].

Minecraft was created in 2010. Several studies have done relating this video game to changes in brain function. The most notable one is Clemenson, et al. publication regarding improving hippocampal- dependent memory in young adult's average age 19 [11]. Stark, et al. study endorsed similar results of improvement in memory performance on a hippocampal dependent memory task in Middle Aged Adults 40-49.

Another recent Study on video gaming and cognitive performance in 2000 children aged 9-10-year old by Chaarani et al suggested that children who are playing videogames for 3hours or more, have better performance on impulse control and working memory [2].

All these studies are supporting the theory that videogame exposure to children, young adults or adults have positive impact on their cognitive skills.

The youths who are around age 19 and older who started playing Video games like pong in 1970s and then possibly moved onto Super Mario would be in their 60s or older by 2010s. These subsets of people would have benefited in their cognitive function from all these games.

Players 'exposure to videogames varies in all mentioned studies from as short as 30 mins to as long as 3 hours or more.

We observed the trends of other factors which can affect brain function. Hypertension is a highly prevalent condition which has been established as a risk factor for cardiovascular (coronary artery disease) and cerebrovascular disease (stroke) which in turn can have negative impact on brain health.

Hypertension prevalence in the 1960- 1970 was 29.1%, in 1970s-1980 prevalence was 26.1%, in 1980s-1990 prevalence was 25.2%, in 1990s-2000 prevalence was 26.2% and in 2000-2010 prevalence was 28.6% [3,12].

Diabetes has adverse effect on brain with its vascular complications. The prevalence of Diabetes has steadily increased since the 1960s, starting at 1.3% from 1960-1970, to 2.5% from 1970-1980, 2.6% from 1980-1990, 4.9% from 1990-2000, and finally 9.4% from 2000-2010 [4].

Stroke related morbidity and mortality over all improved due to increased awareness of risk factors and better treatment over the decades. In 1970-80 stroke prevalence was 1.5%, in 1980-1990 prevalence was 2%, in 1990-2000 prevalence was 3.4 %and in 2000s-2010 prevalence was 2.6 % [6,13].

As per Framingham study, the adjustment for stroke risk profile score and its components, did not explain the decline in dementia [1].

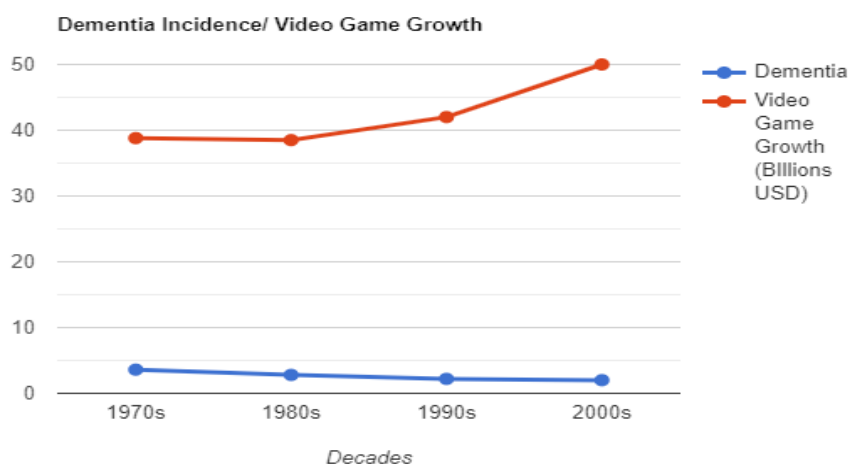
Figure 3 shows the trends of negative contributing factors for brain health with dementia incidence over time.

Videogames growth trends were observed through their net profit over decades from a Bloomberg report. From 1970-80, the gaming industry was racking in profits of 38 billion, and not much changed in 1980-90 when their figures moved to 38.5 billion. However, there was a stark increase in profits from 1990-2000 with figures of 42 billion, then increasing to 80 billion by 2000-2010.

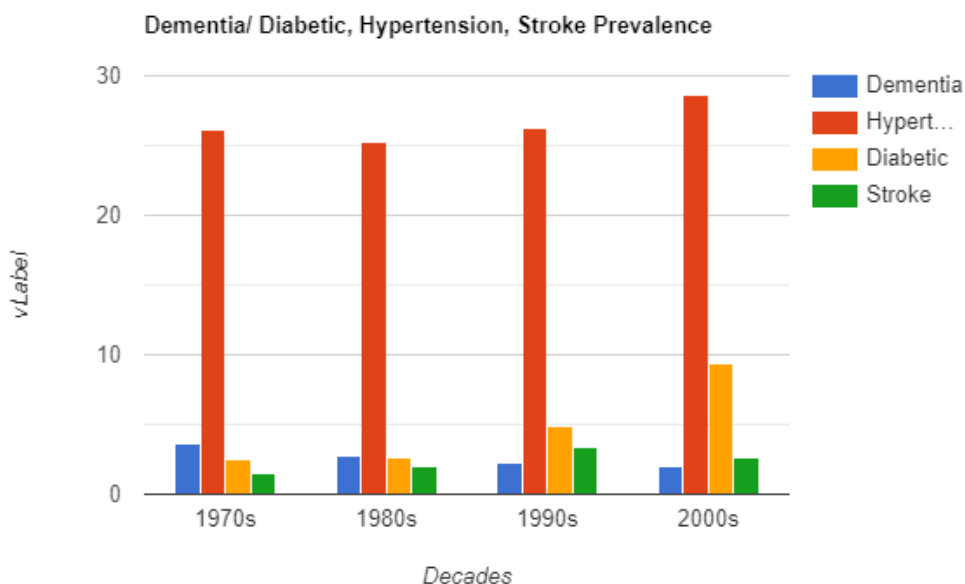
Figure 2 shows the growth of videogames (which is measured by net profit) in comparison with dementia incidence over decades.

The accessibility of a video game evolved from the bulky arcade game format in 1973 by Atari, to the home console in 1975 by Odyssey Magnavox and Atari, to the 1980 Nintendo and Sega master system. By the 1990s, Sony, Nintendo, Sega, Microsoft, and Xbox were all making different consoles that supported different types of video games. All the while, the youth, adults, and anyone older were having a much wider access to a variety of games.

Of all above factors, the growth of both the video game industry and its accessibility is most likely a factor that has a positive impact on the decline of dementia compared to hypertension diabetes or stroke, supported by supporting evidence from mentioned studies (Figures 2 and 3).



**Figure 2:** Dementia Incidence and Video Game Growth (videogame growth and accessibility to young and older adults over decades as possible factor toppling down the dementia incidence).



**Figure 3:** Dementia Vs Diabetic, Hypertension and Stroke.

## Discussion and Conclusion

“Jane McGonigal, world-renown game designer and author wrote “A video game is an opportunity to focus our energy, with utmost optimism, at something we are good at and enjoy.” Video games seem to fulfill more than just enjoyment to a player as per recent research findings.

Over decades the economic cost of dementia has been significant. The cost for a person with dementia over a lifetime was \$184,500 (86% incurred by families) more than for someone without dementia.

The 2016 Framingham study suggests something encouraging; decline of dementia incidence over decades. Hypertension and diabetes, which have large negative effects on brain health, has been ascending over decades. Stroke prevalence on other hand has somehow improved. But in same study by Framingham, the adjustment of stroke risk profile score and its components, did not explain the decline in Dementia Incidence.

Video games and their cognitive benefits have been studied since 2013. Multiple studies have showed video games’ positive effects on cognitive function in different age groups evidenced by functional imaging. The recent one published was by Chaarani, et al. as part of Adolescent Brain Cognitive Development (ABCD) study. Exergames, Mario, Angry Bird, and Minecraft have been studied with subjects in a middle and older aged population and have already proved to have a positive effect on memories and cognition.

One can pinpoint the negative effects of videogames like promoting violence and increasing isolation, but cannot ignore its capability for positive impact in decision making, memory consolidation, conflict management and overall working memory.

The decreasing incidence of dementia might not be solely explained by one factor. The factors (Hypertension, Diabetics, Stroke) negatively affecting brain health are ascending over decades simply should take dementia incidence well along with them. Instead, dementia incidence has been improving. Some positive environmental factors might be playing a role in down trending of dementia incidence. Looking at the correlation between the evolution of the video game alongside several studies proving the positive impact of certain video games on cognitive function, make us inquire the video games, public accessibility and consumption of them, could have certainly played a role in the decline of dementia over decades.

Early video games “Pong by Atari, Pac Man, Mario” likely have some contribution in this decline based on evidence from studies using these video games and many others like them.

Video games are complex digi-social microcosms, carriers of complex layers of meaning that can induce hormetic health benefits [14]. A player’s imagination and simulation of an experience prepare them to tackle problems in real life situation. Elements of novelty and creativity help with strategic problem solving, learning new skills can help the aging player develop

cognitive capabilities which could be essential throughout the course of their life.

Several action videogames like “Call of Duty” and “Battlefield” have been found to shrink the hippocampal gray matter. This in turn would have a negative impact on cognitive function. This should be studied in depth to conclude definitive findings [15,16].

Nevertheless, several newer video games like “Roblox Platforms, Terraria, Trove, Dragon Quest Builders2, No Man’s Sky, Subnautica, Conan: Exiles,” which have similar game mechanics to Minecraft might have positive impact on memory. However, those are yet to be studied.

Further Longitudinal studies will be beneficial and are needed using different videogames on long term memory with cohorts like exposure times, duration, Education status of subjects, for a clearer understanding of how videogames and dementia incidence may coincide.

## References

1. Satizabal CL, Beiser AS, Chouraki V, Chêne G, Dufouil C, et al. (2016) Incidence Of Dementia over Three Decades in the Framingham Heart Study. *N Engl J Med* 374: 523-532.
2. Chaarani B, Ortigara J, Yuan D, Loso H, Potter A, et al. (2022) Association of Video Gaming With Cognitive Performance Among Children. *JAMA Netw Open* 5: e2235721.
3. Kyriazis M, Kiourti E (2018) Video games and Other Online Activities May Improve Health in Ageing. *Front Med (Lausanne)* 5: 8.
4. Hajjar I, Kotchen JM, Kotchen TA (2006) Hypertension: trends in prevalence, incidence, and control. *Annu Rev Public Health* 27: 465-490.
5. CDC’s Division of Diabetes Translation (2017) Long-term Trends in Diabetes.
6. Walker KA, Power MC, Gottesman RF (2017) Defining the Relationship Between Hypertension, Cognitive Decline, and Dementia: a Review. *Curr Hypertens Rep* 19: 24.
7. Kühn S, Gleich T, Lorenz RC, Lindenberger U, Gallinat J (2014) Playing Super Mario induces structural brain plasticity: gray matter changes resulting from training with a commercial video game. *Mol Psychiatry* 19: 265-271.
8. Clemenson GD, Henningfield CM, Stark CEL (2019) Improving hippocampal Memory Through the Experience of a Rich Minecraft Environment. *Front Behav Neurosci* 13: 57.
9. Stark CEL, Clemenson GD, Aluru U, Hatamian N, Stark SM (2021) Playing Minecraft Improves Hippocampal-Associated Memory for Details in Middle Aged Adults. *Front Sports Act Living* 3:685286.
10. West GL, Zendel BR, Konishi K, Benady-Chorney J, Bohbot VD, et al. (2017) Playing Super Mario 64 Increases Hippocampal Grey Matter in Older Adults. *PLoS One* 12: e0187779.
11. Ramnath U, Rauch L, Lambert EV, Kolbe-Alexander T (2021) Efficacy of interactive video gaming in older adults with memory complaints: A cluster-randomized exercise intervention. *PLoS One* 16: e0252016.
12. NCD Risk Factor Collaboration (NCD-RisC) (2016) Worldwide trends in diabetes since 1980: a pooled analysis of 751 population-based studies with 4.4 million participants. *Lancet* 387: 1513-1530.

13. Muntner P, Garrett E, Klag MJ, Coresh J (2002) Trends in stroke prevalence between 1973 and 1991 in the US population 25 to 74 years of age. *Stroke* 33: 1209-1213.
14. Kiourti E, Kyriazis M (2018) Interactions with technology as a cognitive healthy ageing hormetic stimulus. In book: *The Science of Hormesis in Health and Longevity* (pp.285-292) Publisher: Elsevier-Academic Press.
15. Cooper R, Sempos C, Hsieh SC, Kovar MG (1990) Slowdown in the decline of stroke mortality in the United States, 1978-86. *Stroke* 21: 1274-1279.
16. Mills KT, Stefanescu A, He J (2020) The global epidemiology of hypertension. *Nat Rev Nephrol* 16: 223-237.