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Examining cognitive variations between gamers and non-gamers

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Abstract. This research aims to examine differences in attention switching, working memory and complex perceptual analysis between people who play computer games and those who do not. The study involved two groups of participants: a group of people who regularly spend time playing computer games and a control group of people who do not play computer games. Both groups were assessed using a series of standardized cognitive tests measuring attention switching, short-term memory and complex perceptual analysis. Computer gamers demonstrated significantly better attention switching ability compared to the control group. This suggests that constant exposure to computer games, which require rapid switching between different tasks and stimuli, may improve this cognitive ability. Computer gamers also scored significantly higher on tests of complex perceptual analysis. Computer games, which often involve quick and accurate identification of objects and visual details in a dynamic environment, appear to help develop this skill. In terms of working memory, no statistically significant differences were observed between the two groups. This suggests that although computer games may improve certain cognitive skills, working memory is not significantly influenced by this activity.

Keywords: cognitive abilities, complex perceptual analysis, attention switching, working memory, video games, working memory

1. Introduction

According to Piaget, cognition develops through the refinement and transformation of mental structures, or schemata (Piaget & Inhelder, 1969 apud Shaffer, D. R. & Kipp, K., 2010). Schemas are the unobservable mental systems that underlie intelligence. A schema is a pattern of thought or action and most simply is viewed as an enduring knowledge base through which children interpret their world. Schemas, in fact, are representations of reality. Children know their world through their schemas. They are how children interpret and organise experience. According to Piaget, cognitive development is the development of patterns or structures. Children are born with reflexes by which they interpret their environment and what underlies these reflexes are schemas. Piaget believed that all schemas, all forms of understanding, are created by the operation of two innate intellectual processes: organisation and adaptation. Organisation is the process by which children combine existing schemata into new and more complex intellectual schemata. Although cognitive schemata may take radically different forms at different stages of development, the process of organization is the same. Piaget believed that children consistently organise whatever schemata they have into more complex and adaptive structures. The purpose of organization is to promote adaptation, the process of adjusting to the demands of the environment. According to Piaget, adaptation occurs through two complementary processes: assimilation and accommodation. Assimilation is the process by which children attempt to interpret new experiences through their existing patterns, the schemata they already possess (Shaffer, D. R. & Kipp, K., 2010).

1.1 Short-term memory

Short-term memory has the role of temporarily storing information, it is limited in terms of the volume of information, thus, the information is retained for a certain period, passing later into long-term memory (Enache R., Giurgiu L., 2017).

Baddeley (1986) proposed substituting the term short-term memory with working memory. In this way he manages to denote three components of it (Zlate, 2009):
- central administrator- an execution control system that can use one of the other two components to release some of its capacity to solve complex cognitive tasks.
- a phonological/articulatory loop;
- a visual-spatial component.

The characteristics of short-term memory are the following (Tudose F., Tudose C. & Dobranici L., 2011):
- Limited capacity: 5-9 items, numbers, or groups.
- Fragile: information can be easily lost
- Very short duration: about 20 seconds
- Retention occurs through repetition
- Encoding is done acoustically
- Test with digit span
- Prefrontal brain areas are involved.

1.2 Attention

Attention is a psychic activity that consists in orienting oneself towards the surrounding objects and phenomena and ensures their fullest and most accurate reflection in the human brain (Zaporojet, 1959).

For Oswald (1962), attention is a phenomenon that has a selective and orientated quality.

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The components that are part of the structure of attention are: the physiological component and the psychological component.

Attention depends on the interaction between 4 processes (Enache R., Giurgiu L. 2017):
- attention capacity
- selectivity of attention
- selected response and execution control
- sustaining attention.

There are three forms of attention:
- involuntary attention - the natural form of human attention, it occurs spontaneously, unintentionally, without special voluntary effort on the part of the individual;
- voluntary attention - the higher form of achieving conscious control over events in the external environment;
- post-voluntary attention - the skill of paying attention.

Mobility is one of the qualities of attention, along with attentional focus, attentional stability, and attentional volume.

Attentional mobility refers to the ability to intentionally or post-voluntarily shift attention from one object to another. This switching varies from person to person, manifesting itself as either mobile attention (quick and easy shifts in focus) or rigid attention (slower and more difficult shifts). It is important to note that attention mobility should not be confused with attention fluctuation, which is involuntary and therefore can be harmful (Enache R., Giurgiu L. 2017).

- Exogenous attentional mobility: this refers to the shift in attention caused by external stimuli, for example, when we hear a loud sound or see an object moving in our field of vision. These shifts are usually automatic and involuntary.
- Endogenous attentional mobility: This involves deliberate and voluntary shifts of attention based on our goals and intentions. For example, when we decide to switch from reading an article to checking email, attention mobility is controlled by our internal decisions.

1.3 Play - the basic activity of child development

Play and fun are more intense in childhood. Play gives children's behaviour a lot of flexibility and, above all, develops their imagination and creativity. Play also expresses the degree of mental development: 'Play as a free development and as an individual pleasure is one of the essential ways of manifesting the human spirit. It is a complex anthropological phenomenon, which in its specific forms and contents is present in all ages, in all civilizations" (Ciolan L., 2008).

1.4 Complex perceptual analysis

Complex perceptual analysis is an interdisciplinary field that examines how organisms' sensory and cognitive systems interpret complex environmental stimuli.

The fundamental concepts of complex perceptual analysis are:

- Multisensory perception which involves integrating information from different sensory systems (visual, auditory, tactile, olfactory) to create a coherent representation of the

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environment (Stein & Standford, 2008). Combining sound and image to perceive a person speaking may be an example.

- Top-down and bottom-up processing: bottom-up processing refers to the analysis of raw sensory information without the influence of prior knowledge, and top-down processing uses knowledge of prior experiences and expectations to interpret complex sensory stimuli (Gregory, 1970).
- Perceptual illusion and ambiguity: perceptual illusions and ambiguities occur when the interpretation of sensory information is distorted or unclear, providing insights into how the brain processes information (Eagleman, 2001).

As research methods we have psychophysical experiments, which measure the relationship between the physical characteristics of stimuli and their subjective perception (sensory thresholds, contrast sensitivity) (Fechner, 1860). Functional MRI (fMRI) and EEG are also used to investigate neural activity associated with perceptual processing. These methods allow real-time localization and monitoring of brain activity (Gazzaniga, 2018).

Computational models that simulate perceptual processes were also discovered in 1982 to understand how the brain processes and integrates complex sensory information (Marr, 1982). These models are useful for testing hypotheses and generating testable predictions.

1.5 Practical Applications in Complex Perceptual Analysis

User Interference Design - In user interference design, understanding human perception is crucial to creating intuitive and effective products. Perceptual principles are applied to optimize the visual and auditory design of interference (Norman, 2013).

Virtual and Augmented Reality - Virtual and augmented reality technologies rely on perceptual principles to create immersive experiences. Proper sensory integration is essential to ensure realism and user comfort (Slater & Sanchez-Vives, 2016)

Clinical Cognitive Neuroscience - Complex perceptual analysis is applied in the diagnosis and treatment of perceptual disorders such as visual agnosia and auditory processing disorders. Interventions are developed to ameliorate these deficits through perceptual training and rehabilitation (Farah, 2004).

Video games have become a ubiquitous part of modern culture, used by millions of people around the world. The question of whether and how these games affect complex perceptual analysis is one of interest to researchers and practitioners in various fields, including psychology, neuroscience, and education.

Studies have shown that action video games can significantly improve visual perceptual and attentional skills. For example, Green and Bavelier found in 2003 that players of action video games show increased contrast sensitivity and a better ability to track multiple moving objects compared to non-players. In addition, these players demonstrated improved spatial visual attention, being able to allocate and distribute attention more efficiently across the visual scene (Green & Bavelier, 2006).

Video games often require the integration of information from different sensory channels, such as visual and auditory. Bavelier and colleagues (2012) showed that video game players are better at multisensory integration tasks, suggesting that video game experience may improve the ability to combine information from multiple sensory sources.

Complex video games, such as strategy games, require planning, problem solving and quick adaptation to new situations. These requirements can train and improve cognitive flexibility and problem-solving skills (Przybylski, 2014). In a longitudinal study, Granic, Lovel and Engels (2014) showed that video games can help develop cognitive skills that are transferable to non-game contexts, such as school or the workplace.

Brain imaging techniques (fMRI and EEG) were used to explore how video games influence brain activity and structure. For example, studies have shown changes in synaptic plasticity and activity in brain regions involved in attention and visual processing (Kühn et al., 2014). Meta-analyses and systematic reviews synthesise the results of several studies to provide a more comprehensive picture of the effects of video games. These have repeatedly confirmed the benefits of video games on cognitive and perceptual functions (Powers et al., 2013).

2. Research Methodology

2.1 Objectives and Hypotheses

The overall objective of the research is to examine the differences in cognitive abilities between gamers and non-gamers.

The specific objectives of this research are the following:

Objective 1: The research aims to analyse the differences between differences in memory, attention switching, cognitive inhibition, and complex perceptual analysis skills as a function of time spent playing games.

Objective 2: Construct a set of recommendations for counterbalancing types of motivation for balance on this plane.

The hypotheses of this research are as follows:

Hypothesis 1: It is presumed that there is a significant difference between the attentional switching of those who spend more than 3 hours in video games compared to people who do not meet this criterion

Hypothesis 2: It is assumed that there is a significant difference between the working memory of those who spend more than 3 hours playing video games compared to those who do not meet this criterion.

Hypothesis 3: It is assumed that there is a significant difference between the complex perceptual analysis of those who spend more than 3 hours playing video games compared to those who do not meet this criterion.

2.2 Sample

The sample of this paper consists of 67 participants, of which 41 are boys (61.2%) and 26 are girls (38.8%). The background is also unbalanced, with only 5 (7.46%) of the participants living in rural areas and the remaining 62 (92.54%) in urban areas. In the case of age, the average is 23.7 years, with scores ranging from 18 to 25 years.

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2.3 Instruments

2.3.1. Attention switching scale

Cognitive flexibility is the speed of adaptation and the flexibility with which this happens in interactions with the environment. Attention switching or mind set shifting is defined as disengaging from an activity that in the meantime has become irrelevant, i.e., shifting to a new task to satisfy the intentions of the moment. Flexible categorization is a component of cognitive flexibility, manifesting itself in the dynamic activation and modification of cognitive processes to address specific situational demands. Thus, attentional switching involves a wide variety of cognitive processes: reactualization, the ability to inhibit a previous stimulus-response association, and flexible switching between different rule systems.

2.3.2. Scale Working memory

Working memory is involved in a wide variety of complex cognitive processes, such as comprehension, problem solving or reasoning.

"Working memory (WM) is defined as the capacity of the human cognitive system to store task-relevant information over a short period of time and to operate in parallel with this information. Accordingly, working memory has two components: a) short-term storage and b) processing of information" (Baddeley and Hitch, 1974; Baddeley, 2007). Thus, both storing and processing information share a unitary amount of cognitive energy. So as the difficulty of one increase, the volume allocated to the other decreases. Inter-individual differences arise according to the efficiency of information processing mechanisms. Having said that, the test aims to analyse both variables through complex span working memory tasks, which are constructed dually, respecting the constraints faced by the cognitive system.

2.3.3. Complex Perceptual Analysis Scale

Complex perception is the ability with which an individual recognises certain figures in the presence of others. The main figure, called the "target", must be recognised among a multitude of other incomplete or other-sized figures, called "distractors", and this represents the level of development of the ability to discriminate between figure and background.

2.3.4. Survey on game typology

For the survey we used questions about time spent playing video games, their genres and frequency of activity. At the same time, we also asked why they prefer this activity over others.

2.4 Ethical requirements

Regarding ethical requirements, this work has been conducted in accordance with the ethical rules and principles applicable to psychological research. The following ethical aspects have been respected:

Informed consent of participants: participants were informed in detail about the nature of the research, its purpose, the duration of their involvement and other relevant issues before participating. By completing the questionnaire, they expressed their consent to participate in the study.

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Data confidentiality: The data collected were treated with the utmost confidentiality and anonymity. Participants were assured that the information provided would be used for research purposes only and that their identity would be protected using a specific code consisting of a few letters relating to their name.

Right of withdrawal: Participants were informed that they have the right to withdraw from the study at any time without negative consequences or sanctions. This right was respected throughout the research.

Presentation of results: Participants were given the opportunity to receive detailed explanations of their results. They had the right to receive feedback and to be informed about the implications of the research findings.

2.5 Statistical and psychological interpretation

2.5.1. Hypothesis 1

Any statistical processing begins initially with the application of the Kolmogorov-Smirnov normality test to check the validity of the first hypothesis.

Table 1. Test of normality of distribution of scores

	Time	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Switching attention	>3 hours	.316	32	.000	.836	32	.000
	<3 hours	.193	35	.002	.916	35	.011

a. Lilliefors Significance Correction

As can be seen from Table 2.1, the normality of the distribution is not respected for both variables. Since Sig. does not pass the .05 significance threshold, a non-parametric method of comparison will be applied, namely the Mann-Whitney Test for 2 independent samples.

The histograms below represent the distribution of Attention Switching scale scores as a function of time spent.

The tables below represent the approach needed to calculate the comparison.

Table 2. Sum of Ranks

	Time	N	Mean Rank	Sum of Ranks
Switching attention	>3 hours	32	38.84	1243.00
	<3 hours	35	29.57	1035.00
	Total	67		

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Table 3. Statistics

	Switching attention
Mann-Whitney U	405.000
Wilcoxon W	1035.000
Z	-2.051
Asymp. Sig. (2-tailed)	.040

a. Grouping Variable: Time

From Table 3. we can conclude that there is a statistically significant difference between people who stay more than 3 hours compared to those who do not. At the same time, from Table 2. we can see that the mean of the first sample is 38.84 compared to 29.57. These aspects tell us that individuals who spend a good amount of time playing show a higher level of attention switching.

Recent studies have shown that people who play computer games demonstrate improved attention-switching ability compared to those who do not engage in such activities. This finding can be explained in terms of several psychological and neurocognitive factors that are trained and developed during video games.

Video games, especially action and strategy games, often require players to engage in multitasking and rapidly shift their attentional focus between different tasks and stimuli. Green and Bavelier (2003) demonstrated that action games significantly improve visual attention and the ability to process information simultaneously from different parts of the screen. This ability to switch quickly between multiple tasks is essential in the context of video games and transfers to other areas of daily life. Neuroplasticity, the brain's ability to adapt and restructure, plays a crucial role in explaining this phenomenon. Video games stimulate areas of the brain responsible for executive functions and attentional control. Imaging studies have shown that video game players exhibit changes in the structure and function of the prefrontal and parietal cortex, regions involved in attention management and cognitive flexibility (Kühn et al., 2014).

Another important aspect is that video games can improve not only attention switching, but also other cognitive functions such as working memory and problem-solving ability. Anguera et al. (2013) demonstrated that a video game-based training program significantly improved working memory performance and cognitive flexibility in young adults. These findings have important practical implications. For example, training in areas that require rapid attention switching and multitasking, such as air traffic control or surgery, could benefit from integrating video games into training programs. Also, controlled, and targeted use of video games could be recommended as an intervention method to improve certain cognitive skills in vulnerable populations, such as the elderly or those with neurocognitive disorders.

2.5.2. Hypothesis 2

For the verification of the second hypothesis, we applied the same method as in the previous one, namely we started by verifying the normality of the distributions.

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Table 4. Test of normality of distribution of scores

	Time	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Working memory	>3 hours	.156	32	.046	.921	32	.022
	<3 hours	.245	35	.000	.751	35	.000

a. Lilliefors Significance Correction

As can be seen from Table 4, the normality of the distribution is not respected for both variables. Since Sig. does not pass the .05 significance threshold, a non-parametric method of correlation will be applied, namely the Mann-Whitney Test for 2 independent samples.

The histograms below represent the distribution of Working Memory scale scores as a function of time spent.

Table 5. Sum of Ranks

	Time	N	Mean Rank	Sum of Ranks
Working memory	>3 hours	32	38.78	1241.00
	<3 hours	35	29.63	1037.00
	Total	67		

Table 6. Statistics

	Working memory
Mann-Whitney U	407.000
Wilcoxon W	1037.000
Z	-1.942
Asymp. Sig. (2-tailed)	.052

a. Grouping Variable: Gamer

From Table 6. we can conclude that there is no statistically significant difference between the working memory of people who stay more than 3 hours compared to those who do not, since Sig. (2-tailed) passes the .05 significance threshold. At the same time, from Table 5. we can see

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that the 2 means are similar. These aspects reveal us those individuals who spend a good amount of time playing do not show a better memory skill. Thus, the hypothesis is suspended.

Video games not only challenge working memory, but also enhance it by continuous and repeated practice of tasks that require this cognitive function. A study by Oei and Patterson (2013) showed that strategy video games, which require planning and resource management, significantly improve working memory capacity in participants. These games train players to maintain and manipulate multiple sets of information simultaneously, thereby enhancing working memory capacity. Findings on the positive impact of video games on working memory have important implications for education and therapeutic interventions. For example, video games could be integrated into educational programmes to improve students' academic performance, particularly in areas that require good working memory, such as mathematics and science. Video games could also be used in cognitive interventions for people with working memory deficits, such as those with attention or learning disabilities. One such program is Kawashima Brain Training.

However, the results in the literature differ. In a meta-analysis by Sala and Gobet (2017), the authors assessed the impact of video games on working memory and other executive functions. They found that while some studies show minor improvements in working memory, the effects are not robust enough to draw general conclusions. Meta-analysis revealed that variability in results is high and that many factors, such as type of game, duration of exposure, and individual player characteristics, can influence results.

Another study by Boot and colleagues (2008) investigated the effects of video game training on various cognitive skills, including working memory. The results showed that although trained players performed better on some visual-spatial tasks, no significant improvements in working memory were observed. The authors suggest that video games, especially action games, do not provide enough specific practice to train working memory effectively.

Also, a study by Unsworth and Engle (2007) showed that working memory is closely related to attentional control and the ability to hold and manipulate information in the mind for short periods of time. Video games can improve visual attention and processing speed, but these skills do not necessarily translate into improvements in working memory, which require specific practice and more complex learning strategies.

As a brief conclusion to this hypothesis, although video games may improve certain cognitive skills, such as visual attention and processing speed, there is no clear and consistent evidence that they significantly improve working memory. This finding highlights the importance of specific and targeted interventions to train working memory, rather than relying solely on video games.

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2.5.3. Hypothesis 3

For the verification of the third hypothesis, we applied the same method as in the previous one, namely we started by verifying the normality of the distributions.

Table 7. Test of normality of distribution of scores

	Time	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Complex perceptual analysis	>3 hours	.154	32	.051	.904	32	.008
	<3 hours	.121	35	.200*	.963	35	.285

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

As shown in Table 7, the normality of the distribution is not respected by the second variable. Since Sig. crosses the .05 significance threshold, a parametric method of correlation will be applied, namely the T-test for 2 different samples.

The histograms below represent the distribution of working memory scale scores as a function ofime spent.

Table 8. Statistics

	Time	N	Mean	Std. Deviation	Std. Error Mean
Complex perceptual analysis	>3 hours	32	7.19	2.250	.398
	<3 hours	35	5.83	2.395	.405

Table 9. T-test for 2 independent samples

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Complex perceptual analysis	Equal variances assumed	.575	.451	2.388	65	.020	1.359	.569	.222	2.495
	Equal variances not assumed			2.395	64.947	.020	1.359	.567	.226	2.492

The tables below represent the approach needed to calculate the comparison.

From Table 9. we can conclude that there is a statistically significant difference between the Working Memory of people who stay more than 3 hours compared to those who do not, since Sig. (2-tailed) does not pass the .05 significance threshold. At the same time, from Table 8. we can see that the mean of those who spend more than 3 hours on video games is 7.19 compared to 5.83. These aspects reveal that individuals who spend a good amount of time playing games have a better ability to visually analyse information.

Research has shown that individuals who play computer games have an improved ability to analyse complex perceptual information compared to those who do not engage in such activities. This can be explained by the challenging and stimulating nature of video games, which involve a range of advanced cognitive processes. Video games, especially action and strategy games, require rapid and complex analysis of the environment. Players need to process visual and auditory information in a very short time to make effective decisions. Green and Bavelier (2003) showed that action video game players perform better on visual attention tasks due to frequent exposure to dynamic and complex environments.

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The constant interaction with diverse and fast-moving visual stimuli in video games trains players' perceptual systems. This improves the ability to discriminate between objects and detect subtle changes in the environment. Dye, Green and Bavelier (2009) demonstrated that players have faster reaction times and are better at detecting peripheral objects, showing superior perceptual analysis. Improving perceptual analysis skills in video game players has significant practical applications. For example, these skills are essential in professions that require close monitoring of the environment, such as pilots, surgeons, or nuclear power plant operators. Bediou et al. (2018) pointed out that video game training can be used to improve professional performance in such fields.

The psychological interpretation that people who play computer games show better complex perceptual analysis skills can be understood through the effects that video games have on cognitive processes and brain plasticity. Studies in the field show that engaging in video games can lead to significant improvements in complex perceptual analysis ability.

The positive effects of video games on complex perceptual analysis are supported by cognitive neuroscience researchers. For example, Green and Bavelier (2003) found that video game players develop a superior ability to analyse visual stimuli and react quickly to changes in their virtual environment. These capabilities are essential in video games, which often require players to react quickly to visual and auditory stimuli and make decisions in real time.

Neurological studies have shown that video games can produce structural changes in the brain, particularly in regions associated with perceptual analysis and visual information processing. For example, Kühn et al. (2014) found that video game players show an increase in grey matter density in brain regions involved in visual perception and associated cognitive processes.

These brain changes may explain the improved complex perceptual analysis skills observed in computer gamers. Through constant exposure to dynamic and complex visual stimuli in video games, gamers develop cognitive abilities that help them analyse and interpret visual information more efficiently and quickly.

Conclusions

In summary, people who play computer games demonstrate better attention-switching ability due to the constant and intense training of cognitive functions required in these activities. Video games stimulate neuroplasticity and the development of brain structures essential for cognitive flexibility, thus providing long-term benefits in managing attention and other executive functions.

Also, individuals who play computer games do not demonstrate improved working memory ability due to the complex and varied demands of video games. Thus, video games provide an intense and repeated training environment that could lead to significant improvements in working memory, with potential benefits in various areas of daily and professional life, but the necessary level of stimulation is not achieved.

Finally, people who play computer games demonstrate an enhanced ability for complex perceptual analysis due to the intense and varied demands of video games. These activities stimulate and develop visual cognitive processes, training players to process information quickly and efficiently. These cognitive enhancements have valuable applications in professional and personal life, highlighting the potential benefits of video games in developing complex perceptual skills.

Bibliography

Anguera, J. A., Boccanfuso, J., Rintoul, J. L., Al-Hashimi, O., Faraji, F., Janowich, J., Gazzaley, A. (2013). Video game training enhances cognitive control in older adults. Nature, 501(7465), 97-101.

Baddeley A.D., 1986, Working memory, Oxford University Press, Oxford.

Bavelier, D., Achtman, R. L., Mani, M., & Föcker, J. (2012). Neural bases of selective attention in action video game players. Vision Research, 61, 132-143.

Bediou, B., Adams, D. M., Mayer, R. E., Tipton, E., Green, C. S., & Bavelier, D. (2018). Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. Psychological Bulletin, 144(1), 77-110.

Boot, W. R., Kramer, A. F., Simons, D. J., Fabiani, M., & Gratton, G. (2008). The effects of video game playing on attention, memory, and executive control. Acta Psychologica, 129(3), 387-398.

Ciolan, L. (2008), Integrated learning. Foundations for a transdisciplinary curriculum. Collegium Polirom Publishing House, Iași.

Dye, M. W. G., Green, C. S., & Bavelier, D. (2009). Increasing speed of processing with action video games. Current Directions in Psychological Science, 18(6), 321-326.

Dye, M. W. G., Green, C. S., & Bavelier, D. (2009). The development of attention skills in action video game players. Neuropsychologia, 47(8-9), 1780-1789.

Eagleman, D. (2001). Visual illusions and neurobiology. Nature Reviews Neuroscience, 2(2), 920-926.

Enache R., Giurgiu L., 2017, General Psychology with Applications in Social Work Practice. University Publishing House, Bucharest.

Farah, M. J. (2004). Visual Agnosia (2nd ed.). MIT Press.

Granic, I., Lobel, A., & Engels, R. C. M. E. (2014). The benefits of playing video games. American Psychologist, 69(1), 66-78.

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. Nature, 423(6939), 534-537.

Gregory, R. L. (1970). The Intelligent Eye. Weidenfeld and Nicolson.

Kühn, S., Gleich, T., Lorenz, R. C., Lindenberger, U., & Gallinat, J. (2014). Playing Super Mario induces structural brain plasticity: Gray matter changes resulting from training with a commercial video game. Molecular Psychiatry, 19(2), 265-271.

Marr, D. (1982). Vision: A Computational Investigation into the Human Representation and Processing of Visual Information. W.H. Freeman.

Norman, D. A. (2013). The Design of Everyday Things (Revised and Expanded Edition). Basic Books.

Oei, A. C., & Patterson, M. D. (2013). Enhancing cognition with video games: a multiple game training study. PLoS One, 8(3), e58546.

Powers, K. L., Brooks, P. J., Aldrich, N. J., Palladino, M. A., & Alfieri, L. (2013). Effects of video-game play on information processing: A meta-analytic investigation. Psychonomic Bulletin & Review, 20(6), 1055-1079

Przybylski, A. K. (2014). Electronic gaming and psychosocial adjustment. Pediatrics, 134(3), e716-e722.

Sala, G., & Gobet, F. (2018). Does video game training improve cognitive abilities? A meta-analysis. Psychological Bulletin, 144(2), 111-139.

Shaffer, D. R. & Kipp, K. (2010). Developmental Psychology. Childhood and Adolescence. Wadsworth, USA.

Slater, M., & Sanchez-Vives, M. V. (2016). Enhancing our lives with immersive virtual reality. Frontiers in Robotics and AI, 3, 74.

Stein, B. E., & Stanford, T. R. (2008). Multisensory integration: current issues from the perspective of the single neuron. Nature Reviews Neuroscience, 9(4), 255-266.

Tudose C., Tudose F., Dobranici L., 2011, Treatise on psychopathology and psychiatry for psychologists. Trei, Bucharest.

Unsworth, N., & Engle, R. W. (2007). On the division of short-term and working memory: An examination of simple and complex span and their relation to higher order abilities. Psychological Bulletin, 133(6), 1038-1066.

Zlate M., 2009, Fundamentals of psychology. Polirom, Iaşi.