Experiencing deep immersion in computer games is associated with autotelic engagement and leads to addiction

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Research Article

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Abstract

Study aim

The aim of this study is to explore the differences and relationships between immersion and autotelic engagement of problem gamers and esports players. Research on addiction to computer games suggests that autotelic engagement in gamers, on the one hand, allows them to experience deep immersion while playing, but on the other hand, autotelic immersion can cause one to lose control over what is not real and lead to computer game addiction.

Material and Methods

Experimental group 1 (N = 29) of gaming addicts aged 19–25 years, experimental group 2 (N = 29) of esports players aged 19–25 years, control group (N = 29) of students aged 19–25 years. The respondents completed 3 questionnaires: The FLOW Engagement Questionnaire, the Immersiveness of Games Questionnaire (ING), and the NEO-FFI personality inventory.

Results

To a greater extent than esports players, problem gamers experienced while playing: interaction with the virtual environment, a sense of control, a balance between ability level and challenge, clear goals, focus on the current task, autotelic experience, and higher levels of agreeableness, while they experienced awareness of the real world to the least extent. Associations between autotelic experience and interaction with the virtual environment ($r = 0.699$) and sense of control ($r = 0.899$) revealed the vulnerability of players with autotelic engagement to gaming addiction.

Conclusion

Autotelic engagement may be a direct facilitator of experiencing deep immersion leading to computer game addiction.

1. Introduction

Computer gaming, which provides a sense of visual presence, tends to be immersive, whereas the sensations that gamers experience while playing if they act with a total internal commitment to the activity itself ¹, are usually autotelic. Autotelic engagement is understood to mean engagement in itself, giving pleasure in facing the challenge, while immersion is a state of mind accompanied by full engagement, joy, and loss of sense of time and space ². It can enhance the susceptibility to immersion in computer gaming because the elements of the games, although they do not exist actually, are some representation of objects produced in the player's imagination. The researcher ³ suggest that specific conditions must be met for autotelic engagement to occur: a balance between ability level and challenge, clear goals, and immediate feedback. These conditions are specific in terms of cognitive abilities ⁴. A

study conducted on computer gamers identified the experience of three sources of attention: visual, auditory, and mental ⁵, and it was observed that the level of immersion experienced by gamers is correlated with the number and degree of these experiences. It should also be noted that the combination of attention and sensory stimulation can lead to focus and continued activity, inducing a sense of detachment from the real world. At this point, the gamer feels disconnected from reality to the point that the only thing that matters is the action performed. The ability to focus attention viewed as an ability to control a person's own actions, and wakefulness, as an ability to remain aware of real-world surroundings ⁵, reduces susceptibility to immersion in computer games but at the same time allows to control reality. This sense of reality control is related to the intention of the gamer: initially, he or she can influence what is communicated through the game interface and on the expected outcomes. The researcher ⁶ found that intense focus and concentration on the action in the here and now, is one of the main prerequisites for entering the subjective space and that a sense of challenge is critical. To achieve the immersion experience, it is also important to achieve a number of possible goals ⁷ so that the activity is satisfying. Deep immersion can be interdependent with autotelic personality ^{4,8}, termed autotelic immersion, i.e. (personal communication), a sense of autotelic engagement and a creative sense of being absorbed by virtual reality.

Experiencing immersion and exotelic v/s autotelic engagement

Awareness of the real world and lack of autotelic engagement, exotelic personality may cause the player not to shut out external distractions, and, in such a case, deep immersion becomes impossible. For the novice player, the new reality engages their attention to the extent that they may have a threshold experience as a transition between everyday experience ² and the fantasies of his or her mind. Obviously, with increasing familiarity with the game interface, the gamer can automate his or her attention and trigger engagement, in which case immersion will increase, but only to a certain extent. Initially, the gamer is aware that he or she is dealing with a virtual reality they are creating ⁹, but the question is whether this reality is real enough for them to lose the sense of control and dealing with a product of digital technology. Unsurprisingly, it takes more effort to play when gamers have to pay attention to the visual and audio stimuli at the same time. Virtual reality ¹⁰ with autotelic engagement ¹ is given full trust by the player from the beginning, which makes him or her want to be in this reality. As in any activity, the autotelic personality makes the distrust barrier disappear, making it effortless to play and the person's consciously forcing himself or herself to ignore signals that the reality the gamer mentally resides in is virtual. Initially, the gamer may pretend ¹¹ that what he or she is experiencing is real, especially when they derive great pleasure and other cognitive benefits from playing. However, during frequent and prolonged playing, the gamers with autotelic engagement experience especially deep immersion that can affect control over the virtual experience and cause it to become indispensable to them. Then, due to the desire to experience immersion that triggers the expected mental experience, the gamer, focused on the virtual reality, uses his or her autotelicity to support rather than question the reality of their own experience, which consequently makes them emotionally dependent.

The phenomenon of computer game addiction, esports, and problematic gaming

The phenomenon of computer game addiction ¹² explains the interplay of such factors as internal (mood regulation, decision-making), external (family support, socio-economic indicators), and social skills of young people. According to this author, individual preferences such as seeking immediate pleasure, immediate gratification, and difficulty in controlling one's impulses are also conducive to the development of this type of addiction. Problematic gaming can be a factor that adversely influences the development of relationships with the environment and other symptoms of addiction ¹³ that can consequently lead to negative effects. It is also speculated that one of the side effects of digitization is a lower prevalence of risk behaviors ¹⁴, whereas with the changes brought by modern civilization and rapid technological development, the way young people communicate, meet other people, learn, and spend their leisure time has changed. Addiction to computer games occurs if over a period of 12 months, a player manifests at least 5 behavioral patterns. The researcher ¹⁵ indicate that playing computer games, especially intense and with symptoms of addiction, is associated with the occurrence of psychomotor hyperactivity, irritability, aggressive behavior, high social anxiety, and lower self-esteem. The phenomenon of computer game addiction in esports is less common because esports players, despite spending many hours a day in front of the computers, avoid addiction by acting to achieve the goal of winning sports rather than acting for the sake of acting. However, immersion with autotelic engagement can be compelling to the extent that the sporting goal is transformed into action for the sake of acting.

2. Material And Method

Participation in the study was anonymous. The participants trained several days a week and participated in esports competitions. All participants gave written informed consent to participate in the experiment. Experimental group 1 (N = 29) of gaming addicts aged 19–25 years, experimental group 2 (N = 29) of esports players aged 19–25 years, control group (N = 29) of students aged 19–25 years. The most common gaming platform used by participants was a computer, web browsers, mobile phones, Xbox, and PlayStation. Participants played a variety of game genres (action, racing, fighting, and sports games). The number of years of playing also varied widely, from 1 to 12 years. The typical duration of the game was 15 to 60 minutes, with one to two sessions per day. The respondents completed 3 questionnaires: ING Questionnaire Immersiveness of Games Questionnaire (ING) ¹⁶, FLOW Engagement Questionnaire ⁸, NEO-FFI *personality inventory* questionnaire ^{17,18}.

ING Questionnaire

The Immersiveness of Games Questionnaire (ING) was proposed by L. Kent Norman and was translated from English. It is used to measure subjectively perceived immersion, with particular emphasis on the characteristics of the parameters of the computer-generated environment. The psychometric values of the questionnaire, collected during the procedure using virtual reality seem promising, but it is necessary to evaluate the tool's accuracy. Taking into account the results of the factor analysis conducted during the experiments based on the use of virtual reality, the interface awareness scale was integrated with the

environment awareness scale, thus obtaining a stable structure. The questionnaire consists of 27 items divided into two main scales: positive, which includes four dimensions: Interaction with the environment (IE), Sense of Control (SC), Auditory Presence (AP), Sensory Presence (SE), and negative scale, concerning Awareness of the Real World (AW), with its high score indicating a low level of immersion. A high score achieved on the positive scale indicates a high level of experienced immersion.

Flow State Scale-2 FSS-2, (Engagement questionnaire) is used for evaluation of subjective feelings of the state of engagement. There are nine dimensions of this state on a scale of 1 to 5. Each scale has four statements assigned. The individual dimensions are: Challenge-Skill Balance (balance between ability level and challenge – BA) – adjustment of your own abilities to the challenge; Merging of Action and Awareness (loss of the feeling of self-consciousness – LF) – deep engagement in action so that it becomes spontaneous and automated; Clear Goals (clear definition of goals – CG) – and tasks that rises no doubts; Unambiguous Feedback (unequivocal understanding information, intrinsic rewarding – IR) – the information provided is clear to an individual and allows for evaluation of the highest possible goals and achievements; Concentration on the Task at Hand (concentration and focusing – CF) – on current tasks or signal in order to exclude insignificant tasks; Control (potential ability of control – C) – during experiencing the state of engagement, the individual knows that the control is possible and has a feeling of potential control and effect on your own activities; Loss of Self-Consciousness (lack of confusion feedback – F) – the task performed engages the attention of the individual so that they cannot think of the future or accept other disturbing stimuli; Transformation of Time (distorted sense of time – DS) – objective, external time flow becomes insignificant compared to the rhythm of a particular activity; Autotelic Experience (action awareness merging – AA) – experiencing flow as a state which is satisfactory in itself so that performing the task becomes a reward and positive reinforcement. The raw results on each scale equals the number of points from individual statements (4 to 20).

The personality inventory NEO-FFI is used for evaluation of five personality factors treated as a continuum: Neuroticism – Emotional stability (NEU) i.e. from high emotional sensitivity and tendency to experiencing stress through to resistance to the hardship of life, internal peace and relax; Extroversion – Introversion (EXT) i.e. from being sociable, active, optimistic through to seriousness and reserve in contacts with others; Openness to new experiences – Lack of openness (OPE), i.e. from wide interests and vivid imagination towards traditionalism and practicality; Agreeableness – Disagreeableness (AGR) i.e. from nice, friendly and non-confrontational attitudes through to skepticism and competitive attitudes towards others; Conscientiousness – Lack of Conscientiousness (CON) i.e. good organization, thoroughness, reliability, strong will and consistency in striving for achievement of goals through to spontaneity, lack of organization, the comfort of life and laziness. The questionnaire contains 60 questions, statements (12 for each factor). Each statement is evaluated on a scale of 1 to 5. A maximum score of 60 points can be achieved for each of the factors. High scores suggest a high level of the “left pole” of a particular factor.

Procedure

After signing the consent form, participants completed an online demographic questionnaire (age, gender, education, experience, and gaming activity), and then they completed 3 questionnaires: The Immersiveness of Games Questionnaire (ING) FLOW Engagement Questionnaire, and NEO-FFI personality inventory. All questionnaires were completed in a web browser window.

Methods of analysis and preparation of the results

Based on the parameters entered, a computer program (implemented into an Excel spreadsheet) assigns the individual participants so that each group contains the same number of people with the set parameters. Analytical tests were performed using Statistica software, version 13. After categorizing the data, the following parameters were calculated depending on the measurement: mean, standard deviation, and between-group differences using the ANOVA Kruskal-Wallis H-test and Cohen's d test. Cohen's $d = (M_2 - M_1) / SD_{\text{pooled}}$ where: $SD_{\text{pooled}} = \sqrt{((SD_1^2 + SD_2^2) / 2)}$. Next, correlation coefficients were calculated using Spearman's rank-order test. The research problems were verified by ANOVA analysis of variance.

3. Results

Shown the results (Table 1) describing the levels of dimensions autotelic engagement, immersion experience, and the level of personality dimensions of gamers. Large variation was observed in the results describing all dimensions.

Table 1

Mean, standard deviation, and between-group differences H (df = 2, N = 87) and effect size (Cohen's d) in autotelic engagement, immersion, and personality factors between problem gamers (N = 29), esports players (N = 29), and control group (N = 29).

Variables	Problem gaming		Esport		Control group		H	p	Cohen's d
	M	SD	M	SD	M	SD			
BA	17.31*	2.63	15.69	3.41	15.00	2.71	.996	.006	0.86
LF	15.66	4.58	14.90	3.42	15.24	2.87	1.148	.563	0.10
CG	17.45*	2.72	15.62	3.19	15.48	3.21	8.145	.017	0.66
IR	16.72	3.60	15.17	3.72	15.62	2.98	4.100	.128	0.33
CF	18.03*	2.11	15.93	2.79	15.97	2.96	10.415	.005	0.80
C	15.93	3.60	15.17	2.98	15.31	2.89	1.995	.368	0.18
F	14.76	3.80	14.00	3.25	15.17	3.04	1.893	.388	0.11
DS	13.52	5.79	14.52	4.11	15.10	3.90	.406	.816	0.32
AA	17.59*	2.90	15.83	3.34	15.62	3.51	6.015	.049	0.61
IE	38.41*	6.04	33.69	6.39	34.76	5.12	9.261	.009	0.65
AW	16.72	4.46	15.17	3.65	15.38	3.02	5.607	.060	0.35
SE	24.07	6.72	24.52	3.85	22.76	3.90	2.394	.302	0.23
SC	39.41*	6.20	35.66	7.43	34.48	5.12	9.115	.010	0.86
AW	14.45*	7.23	19.17	6.85	18.34	6.12	9.958	.006	0.58
NEU	22.38	9.49	22.41	8.32	25.28	7.79	1.124	.569	0.33
EXT	27.72	8.86	27.93	4.49	29.17	8.26	.660	.718	0.16
OPE	27.34	7.54	24.07	4.94	25.62	5.14	3.517	.172	0.26
AGR	17.31*	2.63	15.69	3.41	15.00	2.71	5.300	.050	0.86
CON	15.66	4.58	14.90	3.42	15.24	2.87	2.573	.576	0.10
* correlation coefficient $p < 0.050$									

Significant differences in autotelic engagement, immersion experience, and personality factors (Fig. 1) between problem gamers (1), esports players (2), and the control group (3) reveal that while playing computer games, problem gamers experience more interaction with the environment (IE), sense of control (SC), balance between ability level and challenge (BA), clear goal (CG), concentrating and focusing (CF), and action awareness merging (AA). Furthermore, the problematic gaming group reveals higher levels of agreeableness (AGR), while they experience the least Awareness of the Real World (AW).

Relationships between immersion experience and autotelic engagement in problem gamers

In the group of people with problematic gaming (Fig. 2), twenty very strong correlations of immersion with autotelic engagement were observed across almost all dimensions. It was also found that feedback (F) and distorted sense of time (DS) were not significantly associated with any dimension of immersion. Among the significant correlations, it was noted that Awareness of the Real World (AW) significantly negatively correlates with the dimension of clear goals (CG), which confirms that this group experiences very deep immersion.

The one-way ANOVA performed for the factor of autotelic experience in relation to two dimensions of immersion: Interaction with the environment (IE) and Sense of Control (SC) (Wilks' Lambda=,009; $F(45, 70) = 2.887$; $p=,000$; Eta squared=,649; alpha power=,999), shows (Fig. 3) the degree of autotelic immersion. Interaction with the environment and Sense of control increases proportionally with autotelic experience.

Relationships between immersion experience and autotelic engagement in esports players

Twelve strong correlations of immersion on two dimensions (Fig. 4): Interaction with the environment (IE) and Sense of Control (SC) with the dimensions autotelic engagement: loss of the feeling of self-consciousness (LF), clear goals (CG), intrinsic rewarding (IR), concentrating and focusing (CF), and control (C) are likely to be direct facilitators of experiencing deep immersion in esports players. In terms of sense of control (SC), there is a strong relationship with the seven dimensions of autotelicity: balance between ability level and challenge (BA), loss of the feeling of self-consciousness (LF), clear goals (CG), concentrating and focusing (CF), potential control (C), feedback (F), and action awareness merging (AA).

The one-way ANOVA performed for the factor of autotelic experience in relation to two dimensions of immersion: Interaction with the environment (IE) and Sense of Control (SC) (Wilks' Lambda=,059; $F(40, 72) = 1,657$; $p = .030$; eta squared=,477; alpha power=,984), shows (Fig. 5) the degree of autotelic immersion. Interaction with the environment and Sense of control increases proportionally with autotelic experience.

4. Discussion

The statistical analyses presented in this study suggest that autotelic engagement in gamers, on the one hand, allows them to experience deep immersion while playing computer games, but on the other hand, deep immersion can cause one to lose control over what is not real and lead to addiction. This is because in problematic computer gaming, autotelic engagement triggers and sustains acting for the sake of acting. The opportunity for esports players to avoid this problem is seen in the objective of winning rather than acting itself. A study by ^{19,20,21} found that computer games that generate high levels of immersion also lead to high levels of social presence and are positively related to users' perceived utility and hedonistic motivation, which may result in a high level of participation and autotelic engagement. Many researchers ^{22, 23, 15, 24, 13} have indicated that intensive playing computer games, showing symptoms of

addiction, is associated with the occurrence of psychomotor hyperactivity, irritability, aggressive behavior, high social anxiety, depression, and lowered self-esteem. Bójko et al.²⁵ also pointed to problematic gaming as an adverse factor in the formation of certain emotional competencies, but also a marker of existing disorders in social relationships. However, teachers are increasingly willing to use a tool in the form of computer games, and the "Media School" Foundation implemented in 2016 the project "Gamedactics, or education through games", which ended with a scientific study²⁶ on the use of computer games in school education. It is impossible to resist the notion that although didactic games which in order to convey knowledge in an innovative way²⁷ make extensive use of gamification-based mechanisms²⁸ can hardly be compared to advanced and graphically elaborated entertainment projects, they may cause more harm than good. Although there are no reliable prevalence rates of *Internet Gaming Disorder* - IGD in many populations due to limitations in the assessment and comparison, findings from studies by^{29, 22, 30, 31, 32, 33} showed that the IGD rate is very high in many countries. Bójko et al.²⁵ argue that the demonstrated percentage of problem gamers may be related to the significant increase in adolescent mobile media use in recent years. Recognizing the importance of IGD as a phenomenon and the need to classify the related health risks^{34, 35, 36, 37}, also included *'hazardous gaming'* (QE22) and *Disorder games* (6C51) in the latest version of the International Classification of Diseases (ICD-11). A definition of IGD proposed by the American Psychiatric Association (APA)³⁸ provides a good starting point for the diagnosis of this problem.

Conclusion

Autotelic engagement may be a direct facilitator of experiencing deep immersion that leads to computer game addiction.

Declarations

Ethics approval and consent to participate

Participation in the study was anonymous. All participants gave written informed consent to participate in the experiment. All procedures were approved in accordance with the standards of the Senate's Research Ethics Commission of the University of Physical Education in Warsaw and the standards specified by the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and material

<https://data.mendeley.com/drafts/hs6hx56rpz?folder=f07e29f2-77cb-4df9-af71-4a1d449a9b6b>

Competing interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

These data have not been published before and are not submitted elsewhere.

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Authors' contributions

M.M created the research project, performed the statistical evaluation and the interpretation of data. Wrote the manuscript draft, which was critically revised and finally approved.

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Figures

Figure 1

Significant differences in autotelic engagement, immersion experience, and personality factors between problem gamers (1), esports players (2), and the control group (3).

Figure 2

Spearman's rank-order correlation coefficients, showing the relationship between immersion experience with the sense of autotelic engagement. Significant correlations ($r > 0.50$) in the group with problematic gaming. $N=29$.

Figure 3

The autotelic immersion curve, relationships between autotelic experience and Interaction with the environment (IE) and Sense of Control (SC) in problem gamers. N=29.

Figure 4

Spearman's rank-order correlation coefficients, showing the relationship between immersion experience with the sense of autotelic engagement. Significant correlations ($r > 0.50$) in the esports group. $N = 29$.

Figure 5

The autotelic immersion curve, relationships between autotelic experience and Interaction with the environment (IE) and Sense of Control (SC) in the esports group. N=29.