

icCSBs 2020**The Annual International Conference on Cognitive-Social and Behavioural
Sciences****THE RELATIONSHIP BETWEEN INTERNET PRACTICES AND
ADOLESCENTS' PSYCHOLOGICAL AND PHYSIOLOGICAL
HEALTH**

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Abstract

The paper explores the notion of PIU among adolescents and young adults and presents results of a pilot experimental research of physiological and cognitive changes influenced by poly-code Internet content. The purpose of the review part of the research is to fit into the scope of PIU conceptualization. The goal of the experimental part is to identify differences in perceptions of different stimuli modalities of poly-code Internet content. The results of the experiment support the idea that the perception of poly-code stimuli, both in the element-wise and in the complex modes, provides significant stress on the psycho-physiological and cognitive systems of the recipients. Differences in dynamics of the electroencephalogram spectral indices during perceptions of different stimuli modalities and in power ranges before and after each experimental probe indicate the fact that auditory and visual stimuli are perceived differently and have a different delayed effect on the state of the cerebral cortex. The results of review part of the research indicate methodological and content lacunae, which can be filled with the findings of a complex research, one of the results of which will be an augmented view of PIU taking into account the multimodal nature of the Internet environments and cognitive functions of web users in the process of multimodal Internet content perception.

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1. Introduction

In modern societies Internet-practices have become everyday social practices. “Theories of social practices are focused on identifying the characteristic trends of modern social development. <...> The study of people’s activities through the prism of social practices is a relationship of theoretical and empirical studies of their usual (routine) actions within the framework of various institutions or organizations” (Shugalsky, 2012, p. 279). Being involved in various social practices allows the individual to socialize. The nomination “social practice”, in our opinion, is applicable to such types of interaction in the Internet environments as scrolling / browsing, chatting, gaming, mailing, etc. In turn, involvement in social practices has a definite influence on the subject of socialization. According to Bochkova (2014), the Internet as an agent of socialization represents additional freedom to express emotions, feelings, attitudes, moods, overcome of various kinds of internal and external conflicts, strengthening the process of mediated communication, and acts as the main source of information for users.

2. Problem Statement

In the framework of the expansive growth in the number of Internet users engaged into various Internet practices (social network communication, Internet games, Internet-mediated participation in social events, Internet voting, Internet commerce, distance learning, Internet marketing, etc.), researchers are increasingly turning to the concept of Problematic / Pathological Internet Use (PIU; Problematic Usage of the Internet; PUI; Maladaptive Internet Use; Compulsive Internet Use) to describe the harmful impact of attachment to such practices, associated with harmful transformations in mental health, psychological state, and social behavior of an individual.

In the Manifesto of the European Internet research network, the umbrella term “problematic Internet use” refers to all kinds of problematic behavior associated with the use of the Internet, including those related to online games, online gambling, online shopping, pornography viewing on Internet sites, streaming video and participation in social networks, cyberbullying, cyberchondria (Fineberg et al., 2018). It is argued that the problematic usage of the Internet is associated with noticeable functional impairments, including a decrease in productivity (educational achievements), as well as consequences for the mental health of users of the Network, including depression and anxiety disorders (ibid).

Problematic usage of the Internet is characterized by cognitive preoccupation with the Internet, inability to control its use, access to the Internet to relieve emotional tensions, and continued use of the Internet despite the negative consequences (Livingstone & Smith, 2014).

3. Research Questions

- 3.1. What is the actual meaning of “Problematic Internet use”? How multimodal poly-code Internet-content influence brain activity of young users?

4. Purpose of the Study

This paper attempts to summarize a number of research papers in order to outline the meaningful content of the notion “Problematic Internet Use” as applied to the research topic of the wider project (see for example (Potapova, Potapov, Komalova, & Dzhunkovsky, 2019; Potapova, Komalova, & Potapov, 2019).

We also provide data of the pilot experimental research conducted by the team of the project. The purpose of the experiments performed at the first stage of the project was to identify differences in the perception of multimodal poly-code Internet content in three conditions: 1) only audio-content, 2) only video-content, and 3) audio-visual content perceptions. We expect that findings of such experiments allows for modeling the perceptual mechanisms of poly-code content and, thus, gaining insights into additive information noise mechanisms impact on the cognitive and psychophysiological states of recipients.

The Manifesto of the European Internet research network (Fineberg et al., 2018, p. 1236) defines nine achievable priorities that will contribute to the development of research on the problematic usage of the Internet over the next ten years. They are the following:

1) reliable consensus-driven conceptualization of PIU (defining main phenotypes and specifiers, related comorbidity and brain-based mechanisms);

2) age- and culture-appropriate assessment instruments to screen, diagnose and measure the severity of different forms of PIU;

3) characterise the impacts of different forms of PIU on health and quality of life;

4) define the clinical courses of different forms of PIU;

5) reduce obstacles to timely recognition and interventions;

6) clarify the possible role of genetics and personality features in different forms of PIU;

7) consider the impact of social factors in the development of PIU;

8) generate and validate effective interventions, both to prevent PIU, and to treat its various forms once established;

9) identify biomarkers, including digital markers, to improve early detection and intervention.

The results of the present paper fit into the scope of the first of these priorities.

5. Research Methods

5.1. Meta-Analysis Procedure

The review part of the paper covers current research in the field of psychology, psychiatry, sociology, linguistics, computer engineering, which examines various factors that associate Internet practices with negative social, psychological and clinical consequences. Cited articles and reviews are extracted of such scientific information systems as *Web of Science* and *Scopus*, and on *Elsevier*, *SpringerLink*, *Wiley Online Library* platforms. The search was conducted among English and Spanish language scholarly content based on combinations of such keywords as “Problematic Internet Use”, “cyberbullying”, “depression”, “suicidal behavior”, “mental health”, “addiction”, “social websites”, “disorder”, etc. Preference was given to publications over the past five years. The acceptance criteria was

that papers should describe researches which subjects were students of secondary and higher educational institutions, that corresponds to the aim of the study to establish a list of the harmful effects made upon youth engaged into Internet practices. A total number of 62 peer-reviewed selected publications form a dataset for meta-analysis.

Conditionally analyzed publications can be divided into the following five categories:

- 1) the relationship between the use of the Internet and bad habits outside the Internet environments (smoking, alcohol, drugs, eating disorder);
- 2) development of dependence based on the involvement in Internet practices (game addiction, dependence on inclusion in social networks, information dependence, etc.);
- 3) the relationship between Internet practices and the occurrence of destructive emotional states (depression, suicidal manifestations) and functional states (hyper excitability, irritability);
- 4) cyberbullying as a special kind of destructive social behavior;
- 5) the overall effect provoked by participation in online social networks.

We should also highlight the realm of research on psychological and sociological questionnaires (test batteries) that determine the degree of involvement in Internet practices. These techniques are mentioned in many papers as a diagnostic tool to determine risk groups.

In the results' section we dwell on the third category "internet practices and destructive behavior", since it most closely corresponds to the goal of a research project.

5.2. Pilot Experiment Procedure

The study group in this research comprises 39 subjects (68% females, $M_{\text{age}} = 20.1$) – university students, all of them are active Internet users.

The stimuli consisted of fragments of multimodal poly-code Internet content, included in the database (Potapova, Potapov, Komalova, & Dzhunkovsky, 2019) collected at the first stage of the project. Each poly-code stimulus was divided in three samples: 1) audio-track without video-track, 2) video-track without audio-track, and 3) audio-visual sample. The duration of each sample fragment was 60 seconds.

Initially the subjects were to listen to the audio-stimulus and fill in experimental questionnaire. Then the procedure repeated with the video-stimulus, and finely the subjects were to perceive audio-visual stimulus.

During the experiment subjects' brain activity parameters were recorded using a portable encephalograph.

6. Findings

6.1. Constructing Theoretical Background of the Research

Kaess et al. (2014) describe the results of a pan-European study of the self-destructive behavior of young people involved in Internet practices. After analyzing the data on 11 356 schoolchildren (4 856 girls and 6 500 boys, $M_{\text{age}} = 14.9$ years, France, Italy, Ireland, Hungary, Slovenia, Estonia, Israel), the authors conclude that suicidal behavior (suicidal thoughts and suicide attempts), depression, anxiety, behavioral problems and hyperactivity / inattention were significant and independent predictors of

problematic Internet use. The correlation between PIU, behavioral problems and hyperactivity / inattention was stronger among female subjects, while the connection between PIU and symptoms of depression, anxiety and problems with peers was stronger among male subjects. The link between PIU, psychopathology and self-destructive behavior was closer in countries with higher PIU and suicide rates. The results confirm that psychopathology and suicidal behavior are closely related to problematic Internet use. This association largely depends on gender and demographic factors.

Data from Chinese research (Mei, Yau, Chai, Guo, & Potenza, 2016) based on a survey of 1 552 adolescents (899 girls and 653 boys, $M_{age} = 15.43$ years) indicate that the subjective assessment of well-being, self-assessment and self-control are inversely correlated with the indicator of the problematic usage of the Internet, which indicate the presence of certain groups of young people who may be particularly vulnerable to problematic Internet use. In (Bernal-Ruiz, Rosa-Alcázar, & González-Calatayud, 2017), a more aged sample (132 boys and 178 girls, $M_{age} = 18.25$ years, Spain) found that the age factor influenced the values of compulsive use of the Internet. The gender factor influenced the levels of PIU: male respondents showed the highest results on the compulsive scale and the negative consequences of using the Internet. A direct correlation between the problematic use of the Internet and the values of the social anxiety parameter and the symptoms of obsessive-compulsive disorder was statistically confirmed. The most significant predictors of problematic usage of the Internet were the influence of the surrounding social environment, social anxiety and the symptoms of obsessive-compulsive disorder. The authors conclude that while young people who are showing symptoms of social anxiety may seek to communicate on the web as a pleasant pastime, young people with symptoms of obsessive-compulsive disorder may abuse the Internet as a means of alleviating anxiety.

Gender peculiarities and associated psychological deviations in relation to the problematic Internet use are described in Baloğlu, Kozan, and Kesici (2018). Based on an analysis of data from 505 respondents (241 girls and 264 boys, $M_{age} = 20.34$ years, Turkey), the authors conclude that the empowerment of women in the education field and the enhancement of their status in society led to an increase in the women social activity and thereby eliminated the gap in level of social anxiety between men and women. It was found that, compared with female respondents, male respondents have more difficulty in solving personal problems. In problem situations men demonstrate an escape strategy, use the Internet more intensively and, as a result, become more at risk of problematic Internet use. The overall conclusion is that there is a significant relationship between social anxiety and the problematic usage of the Internet, which is more pronounced among male than among female respondents.

The goal of the study (Gámez-Guadix, 2014) was to analyze the temporal and reciprocal connections between the manifestation of depression symptoms and various characteristics of problematic Internet use (for example, the preference of online relationships to real relations, using the Internet to regulate one's psychological mood, lack of control and manifestation of outbreaks of anger). The study was conducted in two stages with a difference of one year. The group of subjects consisted of 699 people (427 girls and 272 boys, $M_{age} = 14.77$ years, Spain). The results suggest that depression symptoms recorded at the first stage of the study were predictors of 1) an increase in Internet relationship preferences against real live communication, 2) using the Internet to improve psychological mood, and 3) outbursts of anger – at the second stage of the study (after one year). In turn, outbursts of anger,

recorded at the first stage, were predictors of an increase in the values of depression symptoms, recorded at the second stage of the study (after one year).

Differences between Internet abuse users, taking into account symptoms of depression, anxiety, and stress, are explored in (Odacı & Çikrikci, 2017). Females (n = 378) and males (n = 154) between the ages of 17 and 28 ($M_{age} = 18.49$ years, Turkey) answered the Internet Use Scale and Depression, Anxiety and Stress Scale. The survey results show a positive correlation between the problematic usage of the Internet and the level of depression, anxiety and stress of the respondents. Along with this, it is necessary to take into account that there is likelihood that different age groups (for example, high school students and older teens) may react differently to Internet content and difficulties encountered during Internet use (Pantic, 2014).

However, a researcher should take into account that symptoms of complex psychological disorders, such as depression, diagnosed among users addicted to Internet practices, are more associated with the social position of individuals than with the pathological enthusiasm for the Internet, as evidenced by the results of the study (Block et al., 2014), which was attended by 19 776 subjects (USA) over the age of 18 years, based on the participants' self-reports on the experienced depression. The results show that individuals experiencing economic or physical life failures are much more prone to depression, even without considering their problematic use of the media. Along with this, users of various media (including Internet-mediated) are more often depressed. Thus, the impact of the Internet can have an aggravating effect on the mental health of people prone to depression or other mental disorders (Pantic, 2014). This statement is proved by the results of (Park, Lee, Kwak, Cha, & Bumseok, 2013), in which the authors suggest that the more symptoms of depression a social network user manifests, the more he / she will look for content related to depression.

It should be emphasized that there is still no convincing evidence that the use of social networks causes depression or is one of the symptoms of depression (Pantic, 2014, p. 653). It seems that in the case of Internet-communication with the goal to strengthen and maintain social ties, especially between family members and close friends, the social support received by online means has a beneficial effect on the user's mental health. On the other hand, the widespread use of social networks outside these close circles of communication can weaken the existing close family and friendship relations and increase the feeling of loneliness and symptoms of depression in the user (Bessiere, Pressman, Kiesler, & Kraut, 2010).

Moreover, a qualitative study (Radovic, Gmelin, Stein, & Miller, 2017), speaks in favor of the use of social media by adolescents showing symptoms of depression (18 girls and 5 boys, ages 13 to 20 years, USA), along with the negative consequences of being involved in online practices. The list of positive effects of Internet use include searching for positive content (e.g., for leisure purposes) or maintaining social ties. Negative consequences of the Internet usage implies sharing risk-related behavior, cyberbullying, and building low self-esteem based on comparisons with other users that seem more successful in all respects. The subjects described three types of negative use of the Internet: 1) "unlimited sharing" (oversharing – exchanging updates with high frequency or too much personal information), 2) "posting content that contains stress provoking information" (stressed posting – sharing negative updates) and 3) "post-triggering". In an analytical review of 38 review articles (Das et al., 2016) the authors argue that along with activities carried out within the school, within community activities, and

interventions at the level of interpersonal relationships or family relationships, interventions carried out using digital platforms is another instrument aimed at improving the psychological health of adolescents. The authors conclude that interventions mediated by digital platforms can be used as part of prevention and treatment programs for anxiety and depression.

The positive effect of the Internet-mediated communication within thematic social networking communities is described in (Ajie & Chapman-Novakofski, 2014; Saffran et al., 2016; Sinclair, Chambers, & Manson, 2017). In the mentioned papers authors explore specialized online social network groups whose task is to produce discourses that support the intention of people to recover from alcoholism or to streamline their eating habits. Such kind of communicative interventions are carried out in narrow Internet communities and act as a kind of psychological support groups, in which, during discussions, participants share positive experiences, talk about failures and thereby demonstrate their involvement with other group members.

6.2. Results of the Pilot Experiment

According to the variance analysis of subjects' responses, highest values corresponded with the data obtained during auditory stimulus perception, the lowest – during complex stimulus perception, which apparently indicates an increase in the load on the cognitive system during element-wise perception of multimodal stimuli.

The perception of poly-code stimuli, both in the element-wise and in the complex modes, has a significant stress effect on the psychophysiological and cognitive systems of the recipients. The *auditory perception* of stimulus leads to a *decrease* in the electrical brain activity (accompanied by a decrease in all frequency ranges of power parameters and increase of the peak frequency of theta, alpha, and beta rhythms). During the perception through the *visual channel* or in the *complex* mode perceptions (audio-video channel), an *increase* of the same parameters is observed.

Electroencephalogram spectral indices showed different dynamics during different stimuli modalities. The pure auditory stimulus perception distinguished more than pure visual or complex stimuli perceptions. During pure visual or auditory-visual stimuli perceptions an increase in all rhythms ranges of power was observed, while the frequency rate practically did not change.

At the same time, an analysis of relative changes in ranges of power before and after stimulus perception revealed that after the pure auditory or pure visual stimuli perceptions the rhythms ranges of power decreased and after complex auditory-visual stimulus perception the alpha rhythm ranges of power increased significantly.

Differences in dynamics of the electroencephalogram spectral indices during perception of different stimulus modalities and in power ranges before and after each experimental probe indicate the fact that auditory and visual stimuli (poly-code Internet content) are perceived differently and have a different delayed effect on the state of the cerebral cortex. Moreover during experimental probes the subjects demonstrated signs of fatigue fixed by the electroencephalograph in a significant increase in delta rhythm ranges of power in all leads.

Correlation analysis of response variances between the results of repeated experiments showed the presence of a certain degree of stability ($R = 0.62$ for the auditory, $R = 0.49$ for the visual and $R = 0.65$ for the complex perceptions).

7. Conclusion

Results of review part of the research represent the heterogeneity of the research field in relation to problematic Internet use by adolescents and young adults in different countries of the world. Researchers have documented correlations between PIU and symptoms of depression, anxiety, difficulties in relationships with peers, low self-esteem, anger outcomes, etc.

In general, it can be said that PIU has an adverse impact on the mental health of individuals, but it doesn't produce direct causal ties. PIU is one of the components of a complex of interrelated and mutually determined variables, which together lead to the predominance of a particular trend. For example, PIU with reference to the youth audience (which is of interest in our research) should be evaluated taking into account such factors as respondents' / subjects' age, gender, social status. An important parameter is the type of social and cultural environments in which the individual is brought up, the influence of national traditions and stereotypes that counterbalance with or are supported by various kinds of Internet practices.

We should highlight the lack of Internet content differentiation in the analyzed publications. The authors mention only the type of Internet source such as social network, website, Internet application, etc., while different content (audio, video, text, various combinations of audio-, video-content and text) have different influencing power on perceptions of individuals belonging to different psychotypes (see, Komalova, 2016; Potapova & Komalova, 2016). And the very nature of presentation of the Internet content (e.g., contrasting messages) introduces certain corrections into the reaction towards the stimulus.

Moreover there is obviously a small number of both quantitative and qualitative longitudinal studies of PIU, as well as the almost absence of comparative studies (e.g., of different age groups or representatives of different linguacultures). This may be due to the difficulty to track the life trajectories of study participants over a long period of time. But, perhaps, this also partly testifies the instability of the trends recorded.

Of particular interest is comparative study of problematic Internet use in relation to 1) groups of individuals who are involved in Internet practices during the periods of primary socialization (personal development during upbringing within the family, kindergarten and school) and 2) secondary socialization (period of life principles revision), as well as 3) a group of individuals for which the Internet practices relate mainly to the leisure sphere (people who began to master the Internet in adulthood, being an established personality).

Summarizing, we can say that the results of review part of the research indicate methodological and content lacunae, which can be filled with the findings of our complex research, one of the results of which will be an augmented view of problematic Internet use taking into account the factor of the multimodal nature of the Internet environments and cognitive functions of Internet-users (youth) in the process of multimodal Internet content perception.

Further experiments will be performed with the participation of a larger number of subjects and using a wider range of stimuli, which will help to achieve the level of validity and reliability of the results needed to develop a set of practical recommendations and methods, taking into account the factor of ecological and valeological attraction applied to the transformation of the psychophysiological and cognitive features of Internet users (adolescents and young adults), as well as the prevention against Internet addiction.

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