
THE NEW GENERATIONS AND THE ADDICTIONS TO TECHNOLOGY

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(Received 9 January 2013)

Abstract

Ever since the embryonic stage and immediately after birth, most of the children are raised in an environment where the TV and loads of electronic devices are a constant. Later on, the always-busy parents or the nannies give the little ones the chance to busy themselves around the TV, which - even when it is not purposely watched - provides them with a sense of security through the sonorous background it creates. Obviously, they should derive security from a viable communication and communion with parents and adults. The same desire to calm their child prompts the parents to present the young one with a new and marvellous toy: the telephone, which at that point is nothing more than a musical device that stirs up interest or serves as a tether. The following few years are spent with the TV as a fixture in the background, and with the mobile phone as a play-mate. With its help, the child is now able to shoot ducks as fast as possible, or 'eat up' falling pies almost instinctively, etc. Then he/she grows up, and the 'pretty limited offer on the TV' starts to go adrift, as the parents are proud of their offspring's performances related to computers and the internet. It is almost 'natural' that every child should own a mobile phone, even when they are in primary school. And as the mobile phones are almost entirely extinct, it's only natural that they should have a smartphone. The results of such upbringing are beginning to show more and more in the contemporary society, both at an educational and a behavioural level, as the performances of youth in schools have suffered alterations, and their violence level has increased.

Keywords: IAD, orbitofrontal cortex, neuroplasticity, synaptic pruning, electro-hypersensitivity

1. Introduction

One may ask if there is such a thing as addiction to internet, computer, or information technology.

Ever since 1996, the idea that the addiction to the internet could be diagnosed as a disease has been researched into and intensely debated.

The studies on the state of mental health in relation with technology need to be done at length in order to produce valid and reliable results. They still do

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not manage to keep up with the technological progresses, the extremely rapid evolution of the online landscape, and the way they infuse one's personal and professional life.

A new edition of the DSM, the catalogue of mental disorders is due to be published by the American Psychiatric Association in May, 2013. The DSM is generally acknowledged as the global standard for the classification of mental disorders. Whereas in the past editions, the addiction diagnosis was only connected to the use of an addictive substance (opiates, alcohol, nicotine, cannabinoids, amphetamines, hallucinogens, etc.), in February 2012, when they made the first draft of the DSM V public, it featured a new diagnostic category, called 'non-substance addictions' [www.dsm5.org/Pages/Default.aspx (accessed 18 Dec. 2012)].

Less than one year after the generic name of I.A.D. (Internet Addiction Disorder) appeared, Dr. Kimberly Young was filing a report with the American Psychiatric Society, presenting the situation of a 43 year old housewife who, although she had no technical abilities, no history of addictions, after discovering the online chat groups, got to the point where she would spend over 60 hours per week on the internet [1].

During the same year, Dr. Kimberly Young established the 'Centre for Online Addiction', through which she offered corporations the possibility to spot those employees who displayed a computer related compulsive behaviour, and to do something to help them.

Dr. Ivan Goldberg who, somehow jokingly coined the name I.A.D. in 1995, would write about the 'pathological Internet-use disorder' one year later, in which context he would also mention that he thought the first name as "a very unfortunate term. It makes it sound as if one were dealing with heroin, a truly addicting substance that can alter almost every cell in the body." [www.psycom.net/iasg.html (accessed 20 Dec. 2012)]

The two specialists have practically opened the field for debates over the pros and cons of the Internet Addiction disease. The debate is now whether the information technology may be considered as a source of addiction.

2. Addiction

Generally speaking, addiction is an extreme phase of substance abuse and thus, it is defined as a set of compulsive dives into certain common activities or into the use of substance, in spite of all the severe individual consequences on a physical, spiritual, social, mental and financial level [2].

The addictive behaviour is characterised by the tendency to escape reality via the mental state. We may classify addictions as chemical and non-chemical.

The chemical (pharmaceutical) addictions are connected to the use of a number of substances on purpose to change one's mental state: opiates, alcohol, nicotine, cannabinoids, amphetamines, hallucinogens, benzodiazepines and barbiturates, etc.

The non-chemical addictions include gambling, kleptomania, pyromania, emotional addictions (sexual addictions), workaholism, compulsive money spending, etc., which are also known as ‘impulse control disorders’.

The main terms used in the case of addictive disorders are: intoxication – a maladaptive behaviour associated with the recent ingestion of drugs. The effects of intoxication may vary a lot from one person to another, as they are also dependent on factors such as dose, circumstances, and personality; withdrawal effects – a syndrome that is specific for the respective psychoactive substance, and that follows after the massive use has ceased; tolerance – the progressive increase in the need for the addiction object in order to obtain the same effect; alienation – the withdrawal from social life, along with the fear of competition, which lead to a severe asocial behaviour.

The dependence represents the psychological or physical need to continue the use of the substance. The dependence may be classified as physical (somatic) or mental (psychological), but in fact, it is both.

The addiction involves the psychological dependence, the physical dependence and tolerance, as well as the associated deterioration of the mental and physical health of the person [3].

Nowadays, the common ground understanding for the most efficient specialists is that, at neuropsychological level, addictions reside in the perturbation of the *modus operandi* of those neurotransmitters that control the affective activation and disposition of the pleasure-pain mechanism [4].

The current literature suggests the involvement of two dysfunctional systems in the addiction: the anterior cingulate and the orbitofrontal cortex (two frontal regions), which are active in the control of behaviour and of the reward-related responses [5].

The descriptions of addictions structured on measurable criteria could serve as phenotypes that would give high level explanations of the effects of the environment in the genetic modifications, which would, in turn, prove useful for the prevention and control actions [6, 7].

DIAR is a useful algorithm used to establish the criteria for dependence, and it unfolds in the following succession: the desire to stop, the inability to stop, the attempts to stop, and the return to the anterior modes - the relapse.

3. Neuroplasticity

Neurologists use the term ‘neuroplasticity’ to express the brain’s ability to modify and develop new models of transmitting the information. This characteristic of the human brain is substantially higher between birth and the end of the adolescence, when a person’s behaviours and abilities are very flexible and prone to developing opportunities, as well as much vulnerability. It is important also to state that neuroplasticity is a characteristic that is preserved throughout a person's whole life, and yet some types of plasticity become more predominant at some point in life, and less dominant in others [8].

Through its neuroplasticity, the brain seeks to find various ways of functioning properly and efficiently, and when certain activities become routine, the connections used for them are strengthened. The recurrent experiences create networks of synaptic connections, which are empowered and made more complex by constant use [9].

The brain develops at a rapid pace during the first years of life. Each mature neuron advances multiple ramifications, thus increasing the number of synaptic contacts and establishing specific connections with various organs or, when it comes to the brain, between neurons.

Right after birth, each neuron of the cerebral cortex has approximately 2500 synapses. Afterwards, when the child reaches the age of about 2-3, the number of synapses grows to approximately 15000 synapses per neuron [10]. This figure is about two times bigger than the average of the synapses in an adult's brain. As the brain grows older, the older and unused connections are removed through the process of synaptic pruning.

The process of learning is defined as the ability to acquire new knowledge and competences via experience or instruction. Memorisation is the process by which all the acquired knowledge is preserved in time. Plasticity gives the brain the ability to change through the process of learning.

In the process of learning, there are at least two types of alterations that occur at brain level [11]: the first one happens at neurons' structural level, with the most important taking place in the synapses area; the second is the increase in the number of synapses between neurons.

In the beginning, the new information is kept in a temporary memory 'working memory' that stores for a while part of the information. Some evidence supports the concept that short-term memory depends upon electrical and chemical events in the brain as opposed to structural changes such as the formation of new synapses. After a while, the information could be moved into another type of memory that has the means to store it for a longer period of time. This relocation could be due to the anatomical and biochemical change that occur in the brain [12].

When an adolescent has a love for music, sports or reading, then the cells and connections that contribute to the acquisition of those skills will be the most developed. If the teen's interests incline towards video games, then only the cells and connections that are activated during them will survive.

The loss of inter-neuronal connections that went unutilised during adolescence is a mechanism that reorganises a few important processes, such as: response inhibition, working memory, the dexterity to handle and operate with more than one concept at a time, the ability to accumulate new information and easily disregard that which is irrelevant, the capacity to follow the logic of other people's arguments, etc.

In the case of proper brain development, this loss is healthy on the long term, as it eliminates the unnecessary networks in order to make room for more efficient and rapid chains of nerve cells, which are responsible for the processing of information in the passage to adulthood.

4. Electronic smog

The energy generated by the electric and magnetic waves 'electromagnetic waves' that emanate from the numberless electronic and electric devices, and from all the domestic appliances form the electronic smog. The electromagnetic fields diminish rapidly with distance.

As early as ten years ago, the concern they had for their co-nationals' state of health made the doctors in Freiburg issue a warning, as they had observed that patients' health was seriously and negatively affected by the exposure to high levels of radiofrequency [<http://freiburger-appell-2012.info/en/home.php> (accessed 21 Dec. 2012)].

The radiofrequency fields are also part of the electronic smog. They are emitted by TV and radio transmitters, mobile phone masts, cellular phones, etc. The World Health Organization 'WHO' defines the electronic smog as one of the most common and fastest growing environmental influences that will continue to increase as technology advances [13].

Despite all the warnings, more and more wireless technologies infiltrate into our daily lives: mobile phone networks, dect phones, Wi-Fi, baby monitors, digital TV and radio stations. All of these interfere with any live structure by increasing the strata and densities of the electromagnetic fields.

The WHO points to the fact that smog could also interfere with the natural electrical currents that help the human body function properly. The brain continually produces cerebral waves that are characterised by amplitude and frequency. The frequency determines the classification of cerebral waves under. 1) Beta waves (14-23 Hz), which are associated with logical thinking, problem solving and active attention. 2) Alpha waves (8-14 Hz) are present during dreaming (REM sleep state), and also when imagination and visualisation are employed. In some cases, the brain produces too many alpha waves, which can come out as frequent states of reverie and a tendency to escape reality. The alpha waves build a bridge between the conscious and the unconscious. 3) Theta waves (4-8 Hz) govern attitudes, beliefs and behaviour. Behind theta waves there are memories, sensations and emotions, as they are all associated with the subconscious. These are active during sleep and profound meditation. 4) Delta waves (0.5-4 Hz) are present during sleep. They are a kind of personal radar, which unconsciously sends and receives messages, yet they can also be present in combination with other types of waves, during waking hours. Each state of consciousness that a man experiences features a mixture of the four categories of brain waves [14]. It is important to note that the brain waves are very low-frequency radio waves that match those emitted by the mobile phones.

Given the fact that the lives of people, animals and plants are controlled by weak intensity signals of electromagnetic fields, it is not surprising that the electronic smog could strongly interfere in their metabolism and disturb the communication between cells.

At first, the self-control mechanism of the body tries to preserve the physiological parameters by correcting the imbalances through very fine

operations of automatic tuning. However, prolonged exposure to electromagnetic fields may lead to a chronic depreciation of the self-control response, thus producing biological negative effects such as: depreciation of brain's sanguine protective barrier, modified activity of brain waves, uncontrolled release of neurotransmitters and hormones, decline of the immune system, genetic alterations, spontaneous abortions, diminished fertility, in particular the increase in oxidative stress at cell level.

The past few years have seen an alarming increase in the number of mental disorder cases like: depression, physical or mental burnout due to fatigue or stress, insomnia, anxiety, panic, as well as a growing number of vascular cerebral accidents among young people, of degenerative neurological conditions, headaches, tinnitus, autism, learning disabilities, attention deficit and behavioural problems (ADHD).

Experimental research has proved that increased exposure to radiofrequency radiation can be considered one of the decisive factors that contribute to the spread of allergies, skin diseases, predispositions towards infections, increase in blood pressure, cardiac dysrhythmia, metabolic and functional disorders.

Spatial and temporal research studies confirm that there is a connection between the moment the symptoms appeared and the moment when the exposure to radiofrequency fields began. The great incidence of leukaemia and brain tumour cases in children and adolescents prove them to be the age category that is the most exposed to the effects of electronic smog.

Countless research studies also acknowledge the connection between the use of mobile and DECT phones and the recent increased number of brain tumours [15-19]. Another side-effect of the electronic smog would be an ever expanding electro-hypersensitivity. Those who are afflicted by it can display severe symptoms instantaneously or within hours after being exposed to electromagnetic fields.

5. TV

If we consider neuroplasticity, then it is obvious that the few hours the infants and children spend daily in front of the TV will certainly and decisively influence the way they perceive and interact with the outside world.

Marshall McLuhan is the one who, in the early 1960s, drew attention to the fact that it is the means of communication itself that is essential, regardless of what is being said [20].

Given the effects of electronic smog on people, it is no wonder that the research studies done as early as the 1970s have shown that the electrical activity 'the electroencephalographic channels' in the brain changes after the first two minutes of watching TV, regardless of the contents of the program that is on.

The brain waves slow down until the alpha and theta waves become dominant. Hence, instead of training the active attention, the TV seems to suspend it [21].

When the cortical processes were monitored during the TV viewing activity, the researchers detected a neurologic anomaly - the obstruction of the left hemisphere of the brain, which was reducing its activity in an acute way, thus letting the right hemisphere take over all the brain's cognitive pursuits.

The left hemisphere is in charge with the linear, analytical and successive processes, mediates the logical and deductive thinking, and is responsible with the critical analysis and evaluation of the input data.

The right hemisphere governs those processes that require a global and simultaneous perception (imagination, emotions, colours), which treat the input data in a non-critical way. It does not decompose or analyse the information, but processes it as a whole, thus generating responses that are emotional rather than rational. So, the impact TV shows have on viewers is more emotional than rational.

Neuropsychologists have also noticed that the communication between the two cerebral hemispheres, which happens via the corpus callosum, is almost completely severed during TV viewing. The transfer of brain activity from the left hemisphere to the right, simultaneously with the partial interruption of the connection between them, creates an unnatural situation: the brain is in a passive state, exposed to a massive volume of information, and unable to interpret that data in a rational manner.

Yet, the most serious consequence of prolonged TV viewing, from early childhood even, is the negative effect it has on the development and performance of the prefrontal cortex. This is the executive centre of the human brain, home of all the superior mental processes, of the attention, motivation, behaviour control and emotions [21, p. 12].

Like any other device that produces pleasure almost effortlessly, besides its multiple negative effects on the human brain and behaviour, the TV also causes the addiction phenomenon to settle in. The American psychologists Kubey and Csikszentmihalyi talk about the diagnosis criteria [22].

6. Video games

During the last century, some of the first conscious contacts the children have with technology have been the mobile phones, which granted the highly appealing possibility of playing games off-line.

In a typical game, the points earned depend upon the players' reaction speed. And, as their conscious thinking is rather a slow process, they have to react without thinking [21, p. 100].

The satisfaction of earning as many points as possible enhances the desire to have more, and thus paves the way for an addictive behaviour very early in life. Given that the players are very active emotionally, the electronic game developers use this to their advantage - they pack the games with situations that have a strong emotional appeal, and then inevitably insert some violence and challenges after them.

Again, electronic games may create dependence, may determine automatic, instinctive reactions, and may predispose to violence.

Considering that the children's individual thinking and the development of their conscience are barely at their inception, and that their cerebral neuroplasticity is very high, we may safely conclude that their daily access to games, at such an early age and with such a prolonged exposure, can and will lead to a serious decrease in their focusing and decision-making abilities. There is already much evidence in the adolescents today, that their instinctive reactions are heightened to the maximum and seasoned with altered conscious states that are disconnected from reality.

Multiplayer games require an active connection. The ones that use an internet connection seem to give a higher degree of dependency. The internet is always extremely convincing and alluring, due to its higher degree of unpredictability and novelty.

The majority of multiplayer online games feature enticing elements of social interaction, real-time competitions, challenges, achievements, social hierarchisation, which are all endowed with sophisticated reward patterns. The actual content of the games can be very stimulating and attractive, but mixed with the online communication it may produce experiences that are much stronger and more addictive [23].

7. Internet

The classifications made by the Internet World Stats last year, showed that, by June 30, 2012, China was on top, with 538 million internet users - 40.1% of its population, on the second place was USA, with 245 million used - 78.1% of its population, and on the third place India, with 137 million users - 11.4% of its population. In Europe, the percentages are very high, with Monaco and the Nordic countries occupying the first places. In Romania, there were close to 10 million internet users at that point, and that meant 44.1% of the population [www.internetworldstats.com (accessed 23 Dec. 2012)].

Generally, we can say that it seems that the prevalence of Internet addiction is the lowest among adolescents, with ranges of 4.6 to 4.7%. That number goes up among the general population of Internet users, with ranges of 6 to 15% of the general population fitting the signs of addiction; and it goes up to 13 to 18.4% among college students, who appear to be the most at risk. These numbers estimate the scope of the problem and suggest that a significant proportion of online users may suffer one or more signs of Internet addiction [2].

David Greenfield defines 5 factors that are characteristic to the likely internet and media technology addictions:

1. *Content factors.* The most common contents consumed on the Internet include music, information, sports, shopping, financial and other news, gambling, games, sexual content and so on. Many, if not most, of these content areas are inherently pleasurable; gaming, gambling, shopping, and sex are perhaps at the top, and have a history of being overused, abused, or addicted.

When content is consumed online and through other digital media technologies, it in essence becomes the psychoactive raw material for Internet addiction. We know that the Internet medium itself has addiction-enhancing properties and the content that is consumed on the Internet is typically fun and desirable [24]. "If content is the raw material, then the Internet medium is the psychological syringe that delivers the content into our nervous system for consumption. There has never been a more efficient and direct input into our minds and nervous systems than the Internet." [23, p. 140]

2. *Process and access/availability factors.* Much of the Internet use pattern operates on a subconscious level well below awareness. Greenfield found three main factors that seem to account for a good deal of the Internet addiction variance: 1) availability and 2) affordability: relative low cost of accessing Internet content areas is the fact that the Internet is always open and this is a highly compelling feature. We know that the brain seems to enjoy the ability to have what appears to be unfettered access without constraints of time or space and it is easier to abuse things that are cheaper. 3) Anonymity: It is particularly notable in the areas of sexual behaviour, gambling, shopping, gaming etc. There appears to be less restriction of inhibition during lexagraphic communication, e-mail, chat, instant messaging, compared with the verbal modality [23]

3. *Reinforcement/reward factors.* Internet technology operates on a variable ratio reinforcement schedule (VRRS). The reinforcement/reward factor seems to be the most significant element in contributing to the addictive nature of the Internet and other digital media technologies. The saliency and desirability of the targeted online content, as well as the time and frequency when that content might be obtained, all affect the addictive experience of the content [23]. It is known from behavioural science research that the VRRS is highly resistant to extinction, and because the Internet frequently provides variable rewards, this extinction resistance further reinforces the addiction cycle. Combining this reinforcement system with highly stimulating content found in gaming or pornography will likely yield an even greater positive charge and an even greater resistance to extinction, thus reinforcing an addictive cycle [23].

4. *Social factors.* No technology has ever existed before that connects us socially while simultaneously disconnecting us. This is the first time in recorded history that the capacity to express and broadcast oneself is literally in the hands of anyone with access to the Internet.

The ability to efficiently social network is supported by the popularity of social networking sites such as Facebook, MySpace, Twitter, Friendster, and other social networking/consumer integrations. All of these sites support the social efficacy of the Internet and represent some of the Internet's greatest strengths in its ability to efficiently distil and enhance social interaction in an instant. In addition, the type of social interaction accomplished virtually seems to be quite different from other types of real-time social interaction; and it may not provide the same positive and health-enhancing benefits that real-time social interaction does [23].

5. *Gen-D factors.* Today's children and adolescents have been raised with

technology. They are Generation-Digital, or Gen-D. They are highly familiar with the computer, the Internet, and most other digital devices, and they often have more comfort and confidence with this technology than their adult parents have. It is more typical for the parent to impart knowledge and experience downward toward the younger generation. For the first time in modern history, the generational knowledge and power hierarchy has been reversed. This increased familiarity and comfort, along with high levels of use, creates a power imbalance in the family system. Parents often don't know what is normal or what is reasonable, this lack of knowledge and lack of technological power further contributes to abuse and addiction to these technologies [23].

8. Mobile telephony

The gadget explosion of the past few years comprises just about all the amenities of media technology. To all intents and purposes, the new mobile phones, smartphones, iPods, iPads, iPhones are thus conceived, so as to incorporate services such as TV streaming, captivating on/offline video games, increasingly rapid internet surfing, even spatial navigation in the real world, and to make them available to the public.

The media technology developers capitalise on children's and adolescents' wishes and preferences, in order to create new and more attractive models. These digital communication and entertainment technologies (Internet, e-mail, cell phones, PDAs, iPods, gaming devices) are fun and can be helpful in our lives, but they all have addictive and abusable properties that can alter our mood and consciousness, distract us, and provide an exit from living in the present. These devices have the capacity to numb us and time-shift, thereby moving our attention from the present to somewhere else [23].

Considering the high degree of freedom in using these devices (parents have no way of controlling the children), and the fact that all the amenities of the new media technologies are ideal grounds for addictions, it is difficult to predict what challenges lay ahead.

9. Conclusions

Ever since the embryonic stage and immediately after birth, most of the children are raised in an environment where the TV and loads of electronic devices are a constant. It has been emphasized that the electronic smog is all around and affects us, more or less, on a biological level, yet the devices and appliances that produce it spare us of some efforts, and thus give us various degrees of pleasure.

Later on, the busy parents, who feed their sense of fulfilled duty towards their children by over-providing for them materially, give the little ones the chance to busy themselves around the TV, which - even when it is not purposely watched - provides them with a sense of security through the sonorous

background it creates. Yet security should be built interactively, via a real communication and communion between children and parents or adults.

The desire to 'calm' their child makes the parents to present the young one with the telephone, which at that point is nothing more than a musical device that stirs up interest or serves as a tether.

The following few years transform the TV into background props, and the mobile phone into a play-mate. With its help, the child is now able to shoot ducks as fast as possible and 'eat' falling pies almost instinctively. It is at this point that the effects of the child's contact with media technology start to show up, during the same time that he/she goes through the most significant physical, mental and emotional developmental challenges. To any child, this is a time for acquisition and learning, a time of high neuroplasticity.

The absence of communication is now alarmingly heightened at individual level. Parents are still very busy. Due to economical reasons, the rather large work-groups in classroom settings are regulated and dictated by political agendas. The kindergarten teachers are financially demotivated and the groups of children become larger and larger. At primary and secondary school level, the situation is replicated, but with a *bonus* - the 'after-school rescue program', which reduces to zero the time the parents should spend in helping their children do their homework and grow up. All of the above factors are characterised by a lack of interactivity that leaves the child in an almost continuous passive state. After a tiring eight hour schedule, most of the children go back home exhausted, and with all their homework already done "in a joint effort", they abandon themselves to their TVs or video games until late in the night.

The lack of personal mental exercise, doubled by the state of high reactivity owing to the games, leads to an increase in the child's attention deficit and an abnormal brain development.

The child grows up, and the rather limited offer on the TV goes adrift, as the parents are proud of their offspring's performances related to computers and the internet. It is almost natural that every child should own a mobile phone, even when they are in primary school. And as the mobile phones are almost entirely extinct, it's only natural that they should have a smartphone. Thus the children become possessors of some objects that give them effortless satisfactions, but the pleasure 'at hand' creates dependency, which generates imbalance at all levels.

The results of such upbringing are beginning to show more and more in the contemporary society, both at an educational and a behavioural level, as the performances of youth in schools have suffered alterations, and their violence level has increased.

Acknowledgement

I would like to thank Ana-Maria Ilieş for providing the English translation of this article.

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