

Digital Addiction: Negative Life Experiences and Potential for Technology-Assisted Solutions

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Abstract. There is a growing acceptance of the association between obsessive, compulsive and excessive usage of digital media, e.g., games and social networks, and users' wellbeing, whether personal, economic or social. While specific causal relations between such Digital Addiction (DA) and the negative life experience can be debated, we argue in this paper that, nevertheless, technology can play a role in preventing or raising awareness of its pathological or problematic usage styles, e.g. through monitoring usage and enabling interactive awareness messages. We perform a literature review, with the primary aim of gathering the range negative life experiences associated with DA. We then conduct two focus groups to help gather users' perception of the key findings from the literature. Finally, we perform a qualitative analysis of experts and practitioners' interviews and comments from a user survey on DA warning labels. As a result, we develop eight families of the negative life experiences associated with DA, examine the role of software in facilitating the reduction of such negative experiences, and consider the challenges that may be encountered in the process.

Keywords: Digital Addiction, Digital Well-being, Responsible Technology

1 Introduction

As digital media has become an integrated part of our daily lives, people are spending a considerable amount of time using it for various purposes including social networking and gaming. The *overdependence* on such media could be, in some cases, attributed to emotional escapism such as escaping from stress, depression and other real-life problems. The term Digital Addiction (DA) can be described as a high degree of behavioural dependence on software products [1]. Griffiths [2], described six symptoms or characteristics for behavioural addiction, including DA, namely; *salience*: when the use of digital media becomes a vital activity for a user; *mood modification*: when used as a coping strategy for users; *tolerance*: increasing the digital usage over time to achieve the same effect; *withdrawal symptoms*: behaving unpleasantly when unable to access or interact with digital media as wished; *conflict*: inter or intrapersonal issues

caused by digital usage; and *relapse*: quickly falling back to a user's old digital usage habits after a period of abstinence.

DA is becoming a recognised problem globally. For example, 40% of adults in the UK look at their phone within five minutes of waking up, and 37% of adults check their phones five minutes before turning lights out [3]. Also, the UK tops the list of the prevalence of internet addiction among university students at 18.3% followed by Poland at 16.2% and Taiwan at 15.1% [4]. While in Muller et al. [5], a 2.1% internet addiction prevalence rate was found in the German general population. We note here the different, perhaps subjective, metrics used in these tests.

Studies linked DA to various negative life experiences including lower grade point among students [6], marital discord, social isolation, reduced work performance and job loss, [7] and parent-child relationship issues [8]. The last decade has witnessed a considerable increase in the treatment of behavioural addictions including DA and most of which shared approaches similar to the treatment of substance-related addictions including counselling, pharmacotherapy, self-help therapy [9], cognitive-behavioural therapy, psychotherapy [10, 11] and motivational interview [12].

Despite the argument that technology can be designed to sense and react to addictive usage style [13], there is still limited research on how this can be realised. Classic software engineering would fall short here given the special mission of software of changing a user's behaviour. Hence, software requirements here are behavioural and potentially in conflict with the current status, mental and psychological, of their users. Current approaches for digital behavioural change, such as Apple iOS Screen Time (<https://support.apple.com/en-gb/HT208982>) and Google Digital Wellbeing (<https://wellbeing.google>), focus on conscious interaction with technology and help users to avoid seeing repeated content; setting limits, e.g. in terms of time spent and break times; avoid distraction, e.g. muting notification; and health, e.g. advising to take a break after long hours of watching videos. These tools are focusing on the interaction between the users and the device, and they may be seen to a large extent a usage optimisation tools. Behavioural change would require a much more in-depth consideration of both the content of the interaction, not only the amount and frequency, as well as the profound reasons why the person may become over-dependent. This will be vital for correct personalisation and customisation of the tools and their suggestions.

The work in [13, 14] investigated software-based interventions as countermeasures for DA. The work argued the capability of the software to raise awareness and apply a range of persuasive techniques, interactively and in real-time to keep users in control. Still, the content of messages, as well as the various modalities of intervention, are to explore and concretise. For any intervention to be effective it is necessary to first identify the precise nature of the negative harms associated with a problematic behaviour. **In this paper**, we review the literature and conduct qualitative studies and present eight families of negative life experiences associated with DA and then explore what role software could play to help raise awareness and support user to regulate their behaviour in the online space and reduce the prevalence to such negative experiences.

2 Research Method

We performed a literature review on DA as an umbrella term for a range of terms such as internet addiction, online addiction, problematic internet usage, online gaming addiction, etc. Besides searching these relevant avenues, we applied online search using Google Scholar and main digital libraries such as ACM, IEEE Xplore and DBLP. As search criteria we used combinations of keywords related to digital media such as ‘social media’, ‘games’, ‘gaming’, ‘internet use’, ‘smartphone’, ‘social networks’ as well as addiction-related terms such as ‘addictive’, ‘excessive’, ‘compulsive’, ‘addiction’, ‘problematic’, ‘pathological’. We used a snowballing approach to reviewing relevant references from reviewed studies so that we expand our search results [15]. The study was not meant to be a systematic literature review but rather an elicitation of the primary negative life experiences linked to the concept of DA.

After identifying the negative life experiences from the literature, we worked on classifying and categorising them. In some other cases, the findings from the follow-up focus groups informed the process detailing the experiences and introducing additional elements. We come up with eight families of negative life experiences and listed related elements under each family. The findings are presented in Section 3.

The second stage of the study involved two focus group sessions. The focus groups aimed to elaborate and explain our results from the literature review based on the participants experience with DA. The participants (i) were familiar with the research area, and (ii) had prior experience working in the field of digital, internet or behavioural addiction and (iii) were frequent users of social media such as Facebook, Twitter, and LinkedIn so could also comment on the software design aspect. The focus of these sessions was to have participants discuss the various findings from the literature mainly to explain them and help their organisation into categories so that we reduce redundancies and flatness of the literature review outcome. For example, while we initially considered *skipping meals* and *forgetting meals* to be similar, the focus groups highlighted a subtle difference between them, which is around *intentionality*.

The final stage of the study consisted of two activities with the aim of investigating the role of software in combatting DA and reducing negative life experiences. First, we analysed interview data collected from ten experts and practitioners’ in the area of well-being, addiction recovery, social and cyber psychology and human factors in computing. The primary goal of the interviews was to explore the perception of online labelling and warning messages issued by software to reduce or warn against DA with a focus on social networks and games. Also, interviewing experts in one of the main addiction centres in the UK enabled us to develop an understanding of their practices and how we may use it in developing interactive software interventions. In the second part, we built on a survey initially conducted in [13] and extended it in terms of number of the participants and the comments received. The original survey was itself to validate the findings of previous interviews with people self-declaring to have DA, i.e., part of a mixed method approach. In this paper, we only analyse the survey comments on the proposed software intervention techniques including the progress bar, a timer relating to digital media usage and content of feedback relating to negative life experiences and the effect DA may have on the users and their significant others.

The results of the analysis of the interviews as well as the qualitative part of the survey are presented in Section 4 and meant to provide insights on how future software tools can help in combatting DA as a professional responsibility requirement.

3 Digital Addiction and Associated Negative Life Experiences

Existing research associated DA with a wide range of negative life experiences including lowering self-esteem, preoccupation, irregular sleeping patterns, reduced face-to-face communication, invasion of privacy of others and erratic dietary behaviour. Figure 1 presents eight families of such negative life experiences and the elements listed under each family. Main elements from each family are written in *italic* text and underlined>. Due to the space limitation in this paper and given that most of the negative effects are self-explanatory; we will only elaborate on the primary elements from each category and insert a few comments from the users' study.

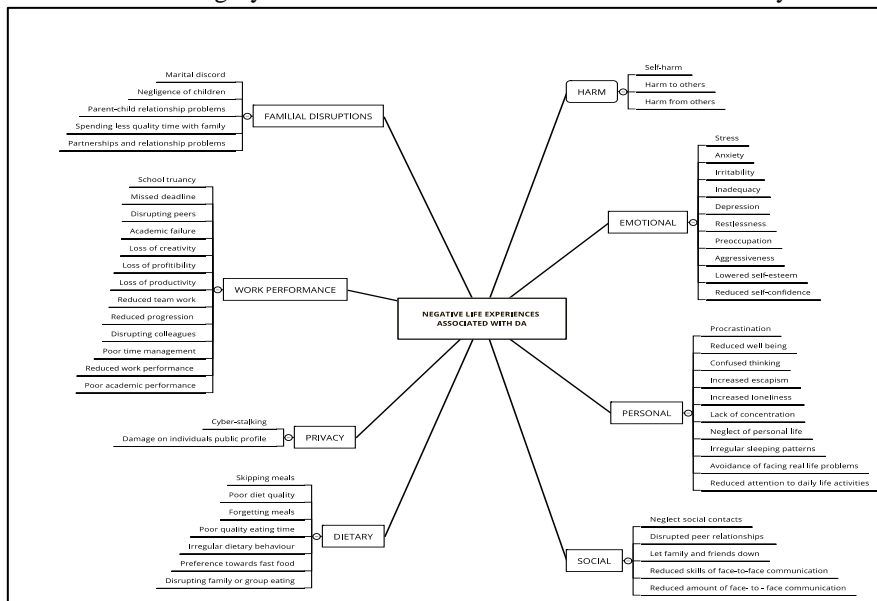


Figure 1: Digital Addiction and Associated Negative Life Experiences

3.1 Emotional Problems

Emotional problems refer to problems that affect the psychological well-being of users. Interaction activities of some contacts could elevate depression especially for those with low self-esteem; “*seeing online contacts posting perfect pictures whether holiday pictures or pictures of a social function could facilitate depression for some users*”. Irritability is another related emotional problem [16], i.e. when a user feels annoyed or impatient when they are unable to engage in an online interaction. Furthermore, users with DA could overly feel *Inadequate* which may lead to reducing self-worth; “*you feel incompetent and inferior when you see posting of an event on social media from your contacts which you were not invited to*”.

3.2 Familial Disruptions

Familiar disruptions resulting from DA can be linked to the disclosure of sensitive personal information online, cyber-stalking and online surveillance of loved ones. For users with DA, this can happen unconsciously and irresistibly. It could lead to family breakdown and partnerships and relationship problems. Partnerships and Relation-

ship problems can be affected when one chooses to spend time online and neglect their partners which may lead to relationship conflict, separation, and divorce in some cases [17]. Parent-child relationship depth and strength can be affected when “*the parent-child communication and engagement in other family activities are overpowered by their engagement in the virtual world, e.g. social networks*”. Online immersion could distract and lead people to spend less quality time with family; “*being on the phone when other members of the family are together catching up after school, work or watching the TV together as a family*”.

3.3 Personal Problems

The continuity and the real-time nature of online interaction, the attractiveness of games and social media features and the unlimited access to these features could lead to neglect of other important aspects of a person’s life. For example, excessive usage reduced attention to daily life activities, e.g. not cleaning the house or doing the needed shopping, and not taking proper care of loved ones. The access to a variety of content online may confuse the way people think; “*disorientation, confusion and anxiety, tunnelling when shopping online and unable to control how one thinks as a result of prolonged usage sessions*”. The lack of concentration while driving resulting from social media usages and notification could cause accidents and annoy other drivers. Another experience is procrastination, e.g. putting off personal chores that need to be completed or delaying the start of a task for other social online activity [18].

3.4 Social Problems

Social problems may be related to situations when users feel the need to be online at all times and therefore neglect their social contacts such as peers, colleagues, family and friends in the physical world. The negligence of such connections could affect the real-life relationships and their face-to-face engagement of users with DA. For example, when a user chooses to spend all their time using online software, their family and friends may feel let down especially during special occasions where their presence is highly expected such as the case when gamers may be “*turning down an invitation from family or friends or not showing up to social events such as birthday parties, weddings ceremonies and other special celebrations*”. Also, spending too much time online may lead to a loss or reduction of social skills required in real-life communication such as confidence and concentration levels needed to engage in a meaningful conversation. As a counter-argument, some users argued that real-life communications are both slow and more inhibitive, hence the difficulty.

3.5 Work Performance Problems

The urge for students or employees to be excessively online for non-academic or non-work-related purposes could impair their academic and work performances [19]. It is also about the preoccupation, e.g. an employee who posts on social media and becomes worried of the reactions of other contacts could have a reduced attention span on work duties which may affect the profitability of an organisation. A user commented that uncontrolled and hasty “*employees’ online software activities might lead to disciplinary, suspension and even job loss in extreme cases leading to a reduction in the workforce*”. A reduction in work performance could reduce one’s work-profile which could reduce the chances of employment progression and this could in turn lower other job opportunities. Also, DA could be contagious where staff with DA

may be putting pressure on colleagues to respond on their online post, and this could *disrupt* colleagues from their routine daily work. Effects on *academic performance* can happen when students cannot complete or focus on a task such as coursework due to their immersive digital media usage. Students multitasking, e.g. joining a conversation on social media while working on an assignment, could affect their performance level causing decreased productivity [20]. *Loss of creativity* could be attributed to “*the variety of content that users can access and the number of activities that can be performed while online*”. The ease of finding and sharing content on social media, rather than creating, can be argued to reduce the creativity level.

3.6 Invasion of Privacy of Others

Online software applications provide the opportunity for users to disclose personal information. This information can be assessed and used by others in a negative way such as the aforementioned *cyber-stalking* [21]. The sharing of sensitive information in a hasty and less thoughtful manner, which is often the case for users with DA, could lead to *damage on individuals' public profile*. For example, sharing pictures and tagging contacts in a post that can be accessed and used by employers and others for judging professional ability could affect one's reputation.

3.7 Harm

Harm could be personal or financial, e.g. gaming addicts buying items and neglecting health and hygiene. Users can suffer a physical injury which is developed over a period, e.g. headaches, pain on the wrist, text-neck or poor vision. The skills users learned and developed as a result of watching or being exposed to a violent game could cause *harm to others* “*if a user practices a fighting scene from an online game on other people*” and when users steal money from their partners to finance their gaming or online gambling addiction. The *financial harm* could lead to issues such as family breakdown due to a divorce or separation resulting from job loss, and this may lead to debts, impairment of assets or even personal bankruptcy. Such harms are more noticeable in the case of online gambling in particular.

3.8 Dietary-Related Problems

Dietary problems refer to those factors that could affect users' diet quality. For example, playing games or using social networks continuously for hours and *forgetting to eat or drink*. The real-time nature of the interaction, continuity of software usage, variety of information content could entice users into spending considerable amount of time using software; this could lead to not having meals or not preparing good quality meals leading to *missing or deliberately skipping meals*, and *poor diet quality*, e.g. the tendency toward eating fast food or junk food in the case of gamers.

4 Software-assisted Digital Addiction Prevention & Awareness

To help people combat the potential negative life experiences presented in Section 3, we argue the need for the tech industry to play a key role and provide tools that may enhance users' online well-being and help prevent unhealthy usage behaviours. To support our argument, we analysed the interviews and survey comments described in Section 2 through the six phases of thematic analysis as proposed in [22]. Below, we present and discuss the mechanisms identified through the data analysis of the inter-

views data and users' comments in the survey. The design of these studies was based on a set of arguments we made about the role of software in monitoring and solving the problem and its unique features of interactivity, reactivity and real-time [13].

4.1 Software as a tool to disseminate educational material

Research evidence has linked excessive digital media usage to an increased level of psychological arousal, which often leads to a lack of sleep, forgetting to eat or drink, psychological harms and reduction in physical activity [23]. There is a growing interest in the possible use of addiction-awareness software solutions to help maintain the mental and social-wellbeing of users [24]. Our analysis demonstrates the need for software to provide educational materials relating to the obsessive and excessive users' online presence and the effects this may have on their psychological and mental health status and also on other aspects of their lives; *"Providing psychological and mental health information could be good and may help some users consider their usage behaviour before it gets serious and turns into something addictive"*.

The participants also emphasised the need for such information to be tailored and personalised based on their needs and preferences. One expert stated that *"education materials should be personalised to the needs of users and only displayed to them at the right time"*. Based on our analysis and our practical expertise in the field, we conclude that such personalisation might be based on four main factors, (i) usage behaviour, (ii) recognition of DA and potential risks of DA, (iii) knowledge of psychological wellbeing and DA, and (iv) stage of change and treatment levels to help planning and relapse prevention. AI techniques could be used here to help predict the future usage behaviours, risks associated with the usage and to deliver appropriate materials at the right point, to reduce its effect early on [25]. Another factor to consider is the nature of the materials, i.e., should they be based on real-life user stories, scientific facts or usage history and context? The challenge here would be on the way to design software to deliver such information in a timely and acceptable manner, specifically: (i) how to monitor users' digital behaviour and intentionality, (ii) how to ascertain users' preferences on the nature of the materials, their presentation and delivery modes given the nature of people with problematic behaviour and their characteristics, e.g. denial and trivialisation of the problem, and (iii) when to design the educational material in a progressive and phased way in response to the change of behaviour. An approach would be to ask input from the users but this may also be challenging given the characteristics of people with problematic behaviour, e.g. subjectivity and ambivalence.

4.2 Software-assisted goal setting

Users reported that they would like the software to provide the opportunity to set usage and style of living goals. The real-time nature, the traceability and tractability of software usage would facilitate goal setting, and the provision of goal performance feedback and this may enable users to make informed decisions about their usage behaviour [14]. Based on our interviews and survey comments, it is evident that users would like some degree of control when setting goals; *"giving users some control would lead to some sense of involvement which can help encourage people and improve their overall acceptance of the goals"*. Others commented that giving control shall be minimal to avoid bias and *"flight-into-health"*. An assessment questionnaire

could be used to determine users' preferences on the level of involvement such as (i) Passive or consultative, (ii) Representative, (iii) Participative or decision-maker [27]. Another option may be to solicit the expertise of a mediator, e.g. a therapist who is an expert in the area, who can assess a user's emotional state and issues and help them to choose the right goal settings and provide data-driven feedback with the help of data analytics tools.

When setting goals, the proximity of the goals needs to be considered, i.e., how far into the future the goals are set [28]. Setting proximal goals may help reduce loss of goal interest, boost motivation and confidence in goal attainment; *“Encourage users to set proximal goals. Users only have main goals and not sub-goals. Having little sub-goals motivates people to keep doing what they are doing and the program can help them set these sub-goals and reward or remind them when they attain the sub goals”*. The software interface to set up the goals should be concise; it should only contain a few questions or options which are easy to interpret *“fast and no-fuss to set up, i.e. clean interface”*. Software can monitor goal achievement in real time and this is a bonus in comparison to human-based counselling.

4.3 Software transparency

Software provides new opportunities for timely, interactive and personalised transparency with users. For example, it could demonstrate to users how the real-time monitoring and traceability of their usage are performed and how goal performance feedback information was determined. A practitioner commented; *“focus on a message that is very clear and genuine for all users. It needs to be transparent with the users on how such information was derived”*. Providing this information at the right time may improve users' belief and trust in the software. Because users exhibit different skills and self-esteem levels, transparency concerning the delivering and sharing of performance feedback collectively should be considered by all parties involved [29, 30] in case group therapy approach or online peer support groups are applied [26]. Delivering such transparency information without consideration of these factors may lower some users' self-esteem and reduce their motivation, commitment towards the goals and, in the worst cases, may lead them to abandon their goals.

4.4 Data sharing for responsible digital media usage

The question that needs to be addressed here is around the party who should be responsible for the implementation of DA awareness and prevention mechanisms. Should it be an in-house job for software companies, i.e., where technology companies think about how their software might affect users during system design and development, and provide tools and support that would help combat any negative effect resulting from its usage, or should the software companies delegate this responsibility to third parties and enable them to do that? In addition, the users should be assured that all ethical considerations have been considered and that the companies will only use data to raise awareness and to alleviate any negative effects that might be linked to addictive software usage. It has been also argued that software companies may choose to democratise the process by enabling users to allow access to their data by their own third party services. With the General Data Protection Regulation (GDPR) in Europe, such data *portability* is a right of citizens where the real-time and automation aspects are still not mandatory for software companies.

5 Conclusion and Future Work

We explored the negative life experiences associated with DA. We then classified and categorised these effects into eight families of negative life experiences. Having discussed these effects, we then advocated the need for tech companies, producing such potentially problematic products, to employ mechanisms that would help users to be aware of their usage patterns, and maintain a healthier online behaviour. As an initial step, from our analysis, we identified three ways that software could adapt to help reduce the negative effects associated with DA, by disseminating user behaviours to them, allowing goal setting and ensuring transparency. We also discussed who should take responsibility for such mechanisms. Our future work will expand on these mechanisms and discuss the major software design considerations that would enhance their successful design and implementation. We will also elaborate further on the challenges discussed and propose ways of countering them to ensure a better implementation.

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