HUOM! Tämä on alkuperäisen artikkelin rinnakkaistallenne. Rinnakkaistallenne saattaa erota alkuperäisestä sivutukseltaan ja painoasultaan.

Käytä viittauksessa alkuperäistä lähdettä:

Dirin, A., Alamäki, A. & Suomala, J. (2019). Digital Amnesia and Personal Dependency on Smart Devices: A Challenge for Artificial Intelligence. Teoksessa Ketamo, H. & O'Rourke, P. (toim.): Proceedings of Fake Intelligence Online Summit 2019, May 7, Pori, Finland, ss. 31–36.

PLEASE NOTE! This in an electronic self-archived version of the original article. This reprint may differ from the original in pagination and typographic detail.

Please cite the original version:

Dirin, A., Alamäki, A. & Suomala, J. (2019). Digital Amnesia and Personal Dependency on Smart Devices: A Challenge for Artificial Intelligence. In Ketamo, H. & O'Rourke, P. (eds.): Proceedings of Fake Intelligence Online Summit 2019, May 7, Pori, Finland, pp. 31–36.

The final version of the publication is available online: http://urn.fi/URN:NBN:fi-fe2019051315372

Digital Amnesia and Personal Dependency on Smart Devices: A Challenge for Artificial Intelligence

AMIR DIRIN

Haaga-Helia University of Applied Sciences, Ratapihantie 13, Helsinki, Finland amir.dirin@haaga-helia.fi

ARI ALAMÄKI

Haaga-Helia University of Applied Sciences, Ratapihantie 13, Helsinki, Finland

JYRKI SUOMALA

Laurea University of Applied Science, Vanha maantie 9, Espoo, Finland

The terms "digitalization" and "artificial intelligence" have become buzzwords in contemporary society. We read and hear these terms in the media on an almost daily basis. Digitalization has affected modern life significantly, allowing for faster access to information, the possibility to be continuously connected with peers, and the facility for social networking. This article, however, focuses on the negative impact of digitalization, which is experienced by all sectors of society, from children through to the elderly. For example, children as young as three years old now spend many hours each day staring at mobile phone or tablet screens. Similarly, their parents are often engrossed in various applications, for example, messaging, Facebook, or WhatsApp. The authors believe that the forthcoming artificial intelligence (AI)-based applications, including social media, entertainment, and gaming applications, will increase this digital dependency even further. The aim of this paper is to elaborate on the consequences of digital dependency for individuals from the psychological and sociological perspectives. This paper is based on a literature review, and its main contribution is to raise awareness of the individual impact of digitalization.

1. Introduction

The technological revolutions that have taken place over recent decades have resulted in increasing levels of comfort and peace for humanity in general. Additionally, human life expectancy has now increased significantly worldwide when compared to life expectancy during the previous century. Yet, despite these benefits, the various technological revolutions have also had negative impacts on individuals' lives and on society as a whole. For example, the growth in car ownership has led to an increase in pollution and hence to an increase in environmental degradation. Moreover, the process of digitalization has prompted different kinds of individual behavioral changes.

The popularity and the penetration of smart devices in people's daily life have been substantial, albeit arguably unconsciously so. People nowadays have no need to actually remember their loved ones' phone numbers or to memorize their schedule for the following day, since they can access such information via their smartphones, which serve as a kind of personal assistant. This dependency on smart devices has already resulted in behavioral changes [1] [2], as well as in physiological impacts, such as digital amnesia [3] and digital fiction [4]. The alteration in our lifestyle is already visible, and it is particularly obvious among children who play with gadgets for many hours on a daily basis. The main concern here is that members of the younger generation are losing their human touch [5], sympathy, and empathy [6], which develop during childhood and have historically always been promoted as positive human characteristics. The development trends indicate that digital dependency will continue to increase significantly, especially as advancements in artificial intelligence (AI) and neural psychology better engage users emotionally and more accurately anticipate users' needs.

This personal digital dependency is not limited to the use of smart devices as a kind of personal assistant. The vast amount of information that such devices produce through mobile applications represents yet another challenge. The resultant information can be useful, but it can also be harmful [7], especially for children. People are now confronted with unwanted and misleading information on a regular basis via social media sites [8], including Facebook, WhatsApp, Telegram, Twitter, and Instagram. This information has become another source of people's dependency [9] on smart devices, which has led to additional behavioral changes [10].

In the remainder of this paper, we elaborate on relevant studies in the field and then explain how dependency on smart devices has occurred, while the same phenomenon has not occurred in relation to personal computers (PCs) and tablets. Additionally, we argue the significance of AI-based digitalization at an individual level from the psychological,

sociological, and physiological perspectives.

2. Research Questions and Methodology

The overarching research question that this study seeks to answer is:

- Does digitalization result in digital amnesia?

This main research question will be addressed by answering the following three sub-questions.

- Does digitalization result in personal dependency on external stimuli, such as devices or virtual environments?

Through this question, we seek to investigate the changes in the ways in which people experience dependency on reading material.

- Does digitalization render people more secure in, and more trusting of, their surroundings?

With this question, we aim to determine whether the digital generations enjoy a more secure environment, a more secure life, and a heightened general feeling of security.

- Does digitalization result in a social disconnect?

This question is designed to help us explore, at an individual level, the extent to which people withdraw from society and hence become rather isolated.

This is an introductory study concerning the impact of digitalization at an individual level. Despite the relatively long period in which smart devices have featured in our lives, no in-depth studies regarding the physiological impacts of such devise have yet been conducted. This is a literature-review-based study, and we seek to define the problem domains in relation to digitalization from an individual perspective. The results of this study will help to identify gaps in the literature, and therefore, areas for further research in the field.

3. Literature Review

Having existed as a potential solution for over four decades, AI has now become a buzzword across industries, academic disciplines, and the political spectrum. The aim of AI is to make computers think and behave in a way that mimics how humans think and behave [11]. For example, making a decision as and when required, or learning new ways to handle a specific task or situation. The first computer-learning program was written in 1952, while the pattern recognition algorithm was developed in 1967 using the nearest neighbor algorithm. AI has continued to evolve ever since. AI is intended to perceive, reason, and act based on a pre-defined algorithm. The subsets of AI are continually expanding alongside the advancement of technologies, including processing powers, memories, and programing capabilities. The most widely used subsets of AI are machine learning, computer vision, robotics, expert systems, and neural networks. Machine learning is an AI solution that allows machines to learn to perform a task without being specifically programed to do so in a specific context. To be able to perform a given task, a machine needs to analyze relevant data and then to train itself accordingly.

3.1 Personal dependency and PCs

The benefits and disadvantages associated with PCs also apply in relation to digitalization and smart devices. The first programmable computer was introduced in 1936, and following the invention of the transistor in 1947 by the Bell Telephone Company [12], computers become more powerful than ever before. The development of computers continued until 1953, when the International Business Machines Corporation (IBM) launched the first PC. The popularity of PCs reached to its peak when IBM and Apple introduced a series of new PCs from 1974–1977. The main users of these devices were professionals in the field of computing during the early phase and then expert users such as programmers. Finally, PCs were adopted by ordinary people who did not have any education in the field. Personal dependency was not a key concern, since people tended to use PCs for specific and dedicated tasks. Yet, the usefulness of PCs in people's everyday life has been questioned by many researchers. For instance, Yoon [13] highlighted three potential issues in relation to the use of computers: usefulness, usability, and productivity. Although some researchers, for example, Subrahmanyam [14], have noted the negative impact of computer use on the development of children and adolescents, only rarely, if ever, has the concept of addiction or dependency been viewed as a significant concern.

3.2 Personal dependency and tablets

Tablet computers have been around since the 1970s, for example, the Dynabook. They also continued to evolve over the years, reaching a peak in 2010 when Steve Jobs surprised the market with the launch of Apple's iPad [15]. The iPad quickly captured the attention of consumers, especially young people, due to its enormous entertainment capabilities. This popularity encouraged other manufacturers to develop new tablet product lines.

3.3 Personal dependency and smart gadgets and the internet

Due to the popularity and penetration of smartphones, as well as the accessibility and affordability of the internet on such devices, people utilize them for various purposes. Unlike the other two major smart devices (i.e., PCs and tablets), people seem keen to extend their usage of smartphone and more likely to develop an emotional bond with their device [16], which may lead to addition [17]. Internet addiction has become a major concern due to the many social and psychological challenges associated with it. However, there remains a certain degree of ambiguity in terms of the definition of internet addiction. For example, some researchers believe that the excessive use of the internet should be considered a behavioral addiction, while others believe that the concept of addiction is not applicable to social networking and chat applications on mobile devices and the internet. In this paper, the term "internet addiction" (IA) is used to refer to excessive internet usage.

4. Discussion

Smart gadgets such as the smartphone, smart table, smart TV, smart classroom, smart society, and many other smart appliances surround us in contemporary society. Such devices have certainly had numerous positive impacts on modern life. For instance, smart devices have improved our quality of life and enhanced both the health system and medical offerings, such as personalized medicine [18].

However, many researchers remain skeptical as to the new trend of digitalization. For example, Rintala and Suolanen [19] have expressed concern regarding the rapid development of such technology, which impacts experts' competence development. Technologies have entered our lives faster than people expected, meaning that they have not had sufficient time to digest the impacts and implications of such technologies.

4.1 Does digitalization result in personal dependency on external stimuli, such as devices or virtual environments?

Personal dependency is a natural phenomenon that is considered to be a human behavior essential for survival, for example, the dependency of a child on his/her parents. However, when comes to external stimuli, excessive use and dependency are considered to represent addiction. Cerniglia et al. [20] defined internet addiction as a non-chemical, behavioral addiction that involves human-computer interaction. Lee et al. [21] showed that both smartphone dependency and anxiety have increased significantly in South Korea in recent years. Their study demonstrated that smartphone dependency is correlated with anxiety.

Smartphone dependency also results in behavioral changes. For example, Harun et al. [22] demonstrated that smartphone dependency has an influence on purchasing behavior. Further, it is important to recognize that every type of psychological and sociological addiction is harmful.

Although prior research has shown that a significant proportion of individuals are addicted to, and dependent on, their mobile devices, there does exist an opposing trend. In the field of tourism, for example, there is a growing trend of "no smartphones allowed," which requires tourists to leave their smartphones with tour organizers who safeguard them. In return, the tourists receive basic phones without cameras or internet access [23]. This helps the tourists to concentrate and to focus on the beautiful views, emotional experiences, and novel situations at their destination without the continuous need to interact with social media applications. Thus, the tourists both enjoy a rest from their everyday duties and also take a break from their regular smartphone usage.

A study conducted in the USA [24] involving 1605 adults aged between 18 and 54 years revealed that 21% of participants woke up in the middle of the night to read updates on their mobile devices, with 39% identifying themselves as Facebook addicts.

The impacts of IA are on the rise, including divorce, reduced task performance in the workplace, loneliness, concentration difficulties, and physical problems such as obesity and eye strain.

4.2 Does digitalization render people more secure in, and more trusting of, their surroundings?

Despite the wealth of positive impacts of digitalization, it has also resulted in a significant number of negative issues, such as fraud, criminal acts, cyberbullying, spying, pornography, gambling, and cyber racism, which have been painful experiences for individuals and for society as a whole. Criminal activities conducted on the internet [25] are big business nowadays, with criminals particularly targeting vulnerable people who lack competence and awareness with regard to internet danger. Furthermore, it has become much harder to maintain personal privacy in the digital world [26].

4.3 Does digitalization result in a social disconnect?

There is a huge tendency among people to communicate and socialize using social media, for example, Facebook [27], and other digital means rather than engaging in face-to-face meetings. This has led to a growing sense of disconnection from the human touch as well as to additional isolation from peers. However, King et al. [28] demonstrated that virtual environments have become safe zones for psychiatric patients to interact with other people.

Salehan and Negahban [29] showed that the size of an individual's mobile social network correlates with his/her usage activity in terms of social media applications, thereby predicting a higher level of mobile usage intensity. Users want to be connected to their social networks, and the larger those social networks are, the more time users spend on their smartphones. However, the researchers also found that the usage of mobile social networking applications significantly correlates with mobile device addiction. This suggests that users experience a closer connection to their social networks when using mobile devices. Yet, it does not indicate anything about the quality of the involved social interactions. It simply shows the extent to which users make use of smartphones to connect with friends. Nevertheless, it shows a relationship between addiction and smartphone usage activity. Ahluwalia [30] reported on a survey of 2000 social media users conducted by an insurance company. The survey indicated that 73% of respondents considered others' holiday posts to be annoying. These studies reveal that although users want to keep their own social media sites updated and also want to share their experiences with friends and followers, the majority actually consider such behavior to be irritating. This kind of interaction via social networks does not necessary generate positive emotions, but rather makes users feel jealous, annoyed, or frustrated. In psychological terms, holiday posts on social media deliver audio-visual information that causes unintentionally negative feelings in those who view such posts. Rather than sharing positive emotional experiences, users might inadvertently share negative cues via social networks.

It is important to discuss the role of subjective norms in the context of digital amnesia and addiction. For example, Arpaci [31] found that subjective norms significantly affect students' attitudes toward the use of mobile cloud services. The relevant subjective norm here is a variable that affects the usage behavior of smartphone users. It is also a kind of social pressure to use digital devices and their applications. Further, it probably influences social media usage and the sharing of holiday posts, since friends and other followers behave similarly.

4.4 Does digitalization result in digital amnesia?

The present literature review revealed that, among all the digital devices available over the past three decades, smartphones and the associated applications are the only ones to which people have become emotionally attached. Korucu and Usta [32] demonstrated that such attachment and dependency result from applications and features such as social media, calendars, and banking capabilities. The identified dependency often occurs over time. These features and applications give users instant access to necessary (and otherwise) information at any time and in any place. Such instant access has resulted in information being stored in smart devices rather than in the short-term memory in the brain. Certainly, it is considered much more convenient to have information regarding an arranged meeting or a phone number stored in a smartphone. In addition, people now tend to spend time using smartphones to chat via social media, to browse Facebook, or to share videos via Instagram, which has led to social dependency [32].

Greenwood and Quin [3] demonstrated that digital amnesia has important implications for the tourism industry, since people need to recall their experiences based on their digital reimagining of the visit. Furthermore, Başaran [33] demonstrated that digitalization has brought about a new communication culture and language, for example, terms such as "ruok" (or "are you ok?"). Additionally, the resultant cultural and communication transformations pose a significant challenge to the collaborative practices of young people.

It is clear that digitalization has brought about a certain degree of emotional bonding and dependency, specifically in relation to smartphones. The key question remains how AI could serve to overcome the resultant language, cultural, and emotional dependency. Could AI provide a means for raising awareness of the problem of digital dependency and the need to rely on memory rather than smart devices? The latest trend concerning existing applications such as Facebook, Instagram, and WhatsApp indicates that people's dependency on such devices and applications will continue to increase. Furthermore, the neural psychology principle has been, and will likely continue to be, employed to ensure that dependency.

5. Conclusions

This study shows that prior research concerning digital amnesia is only very scarce. The present study hence extends the available literature review by considering the downside of digitalization, namely the negative consequences of the usage of smartphones and their applications. An individual can experience negative feelings as a consequence of someone's smartphone usage, even if that other person is one of his/her friends. However, it is impossible to determine in advance whether an experience will be negative, neutral, or positive, since all experiences are situational and contextual phenomena.

In addition to digital amnesia, this study considered the concepts of personal dependency, addiction, and negative social outcomes. Personal dependency causes addiction, which becomes negative dependency if it is harmful in relation to the practice and management of everyday activities. Examples of harmful consequences in this context include social disconnection, vulnerability in terms of security, or unintentionally delivering irritating social cues via social media.

AI is still in its infancy with regard to affective computing and emotional recognition. A challenge for AI concerns its ability to behave intuitively when recognizing psychological patterns [34]. Smartphones already serve as excellent personal assistants in many areas of life, although we are still far from being "augmented humans," who are used to living in peaceful symbiosis with the digital world. It is possible that this situation will never occur due to the continually increasing production of addictive audio-visual content as well as humans' primitive motives and behavior models. This suggests several future research themes, including how to develop AI and machine learning to recognize the negative consequences of the usage of digital solutions and their content. Affective computing, wherein AI has the ability to adopt the principles of intuitive psychology when recognizing emotions and creating reliable analyses based on various biometrics and behavioral models, will require significantly more research.

References

[1]   J. Harwood, J. J. Dooley, A. J. Scott, and R. Joiner, "Constantly connected - The effects of smart-devices on mental health," *Comput. Human Behav.*, 2014.

[2]   C. V. Priporas, N. Stylos, and A. K. Fotiadis, "Generation Z consumers' expectations of interactions in smart retailing: A future agenda," *Comput. Human Behav.*, 2017.

[3]   C. Greenwood and M. Quinn, "Digital amnesia and the future tourist," *J. Tour. Futur.*, 2017.

[4]   A. Bell, A. Ensslin, and H. K. Rustad, *Analyzing digital fiction*. 2013.

[5]   J. D. Elhai, J. C. Levine, R. D. Dvorak, and B. J. Hall, "Fear of missing out, need for touch, anxiety and depression are related to problematic smartphone use," *Comput. Human Behav.*, 2016.

[6]   E. T. Vieira and M. Krcmar, "The Influences of Video Gaming on US Children's Moral Reasoning About Violence," *J. Child. Media*, 2011.

[7]   Royal Society for Public Health (RSPH), "Social media and young people's mental health and wellbeing," 2017.

[8]   E. W. T. Ngai, S. S. C. Tao, and K. K. L. Moon, "Social media research: Theories, constructs, and conceptual frameworks," *Int. J. Inf. Manage.*, 2015.

[9]   X. Han, W. Han, J. Qu, B. Li, and Q. Zhu, "What happens online stays online? —— Social media dependency, online support behavior and offline effects for LGBT," *Comput. Human Behav.*, 2019.

[10]   T. T. Goh, Z. Xin, and D. Jin, "Habit formation in social media consumption: a case of political engagement," *Behav. Inf. Technol.*, 2019.

[11]   A. Dirin and M. Linnaalmi, "Valtaako tekoäly tunteet?," *ESignlas*, 2019. [Online]. Available: https://esignals.haaga-helia.fi/2019/03/19/valtaako-tekoaly-tunteet/.

[12]   R. A. Allan, *History of the Personal Computer: The People and the Technology*. 2001.

[13]   Y. J. Yoon and T. K. Landauer, "The Trouble with Computers: Usefulness, Usability, and Productivity," *South.*

Econ. J., 2006.

[14] K. Subrahmanyam, P. Greenfield, R. Kraut, and E. Gross, "The impact of computer use on children's and adolescents' development," *J. Appl. Dev. Psychol.*, 2001.

[15] D. A. Norman and J. Nielsen, "Gestural Interfaces: A Step Backward In Usability," *interactions*, 2010.

[16] C. A. Hoffner, S. Lee, and S. J. Park, "'I miss my mobile phone!': Self-expansion via mobile phone and responses to phone loss," *New Media Soc.*, 2016.

[17] A. Dirin, "Internet Addiction, new challenges for educational institutes," *eSignals*, Helsinki, 2017.

[18] L. Hood, R. Balling, and C. Auffray, "Revolutionizing medicine in the 21st century through systems approaches," *Biotechnol. J.*, 2012.

[19] N. Rintala and S. Suolanen, "The Implications of Digitalization for Job Descriptions, Competencies and the Quality of Working Life," *Nord. Rev.*, 2017.

[20] L. Cerniglia, F. Zoratto, S. Cimino, G. Laviola, M. Ammaniti, and W. Adriani, "Internet Addiction in adolescence: Neurobiological, psychosocial and clinical issues," *Neuroscience and Biobehavioral Reviews*, vol. 76. pp. 174–184, 2017.

[21] K. E. Lee *et al.*, "Dependency on smartphone use and its association with anxiety in Korea," *Public Health Rep.*, 2016.

[22] A. Harun, L. T. Soon, A. W. Mohd Kassim, and R. S. Sulong, "Smartphone dependency and its impact on purchase behavior," *Asian Soc. Sci.*, 2015.

[23] M. Abadi, "Business Insider Nordic," *Business Insider Nordic*, 7AD. [Online]. Available: https://nordic.businessinsider.com/millennials-travel-cell-phone-off-the-grid-2018-3.

[24] N. Abhijit, "Facebook Addiction," 2012. [Online]. Available: http://www.buzzle.com/articles/facebook-addiction.html.

[25] FBI, "2014 Internet Crime Report," *Fed. Bur. Investig. Internet Crime Complain. Cent.*, 2014.

[26] Bélanger and Crossler, "Privacy in the Digital Age: A Review of Information Privacy Research in Information Systems," *MIS Q.*, 2017.

[27] G. Seidman, "Self-presentation and belonging on Facebook: How personality influences social media use and motivations," *Pers. Individ. Dif.*, 2013.

[28] A. L. S. King, A. M. Valença, A. C. O. Silva, T. Baczynski, M. R. Carvalho, and A. E. Nardi, "Nomophobia: Dependency on virtual environments or social phobia?," *Comput. Human Behav.*, 2013.

[29] M. Salehan and A. Negahban, "Social networking on smartphones: When mobile phones become addictive," *Comput. Human Behav.*, vol. 29, no. 6, pp. 2632–2639, 2013.

[30] R. Ahluwalia, "Two thirds of people find holiday selfies and 'hot dog legs on the beach' Instagram posts annoying." [Online]. Available: https://www.independent.co.uk/travel/news-and-advice/holiday-selfies-annoying-instagram-facebook-photos-hot-dog-legs-vacations-a7816386.html.

[31] I. Arpaci, "Understanding and predicting students' intention to use mobile cloud storage services," *Comput. Human Behav.*, 2016.

[32] A. T. Korucu and E. Usta, "The Analysis of New Generation Mobile Device Dependencies of Students in Faculty of Education," *Particip. Educ. Res.*, 2016.

[33] G. Başaran İnce, "Digital Culture, New Media and The Transformation of Collective Memory," *Galatasaray Üniversitesi İleti-ş-im Derg.*, 2017.

[34] B. M. Lake, T. D. Ullman, J. B. Tenenbaum, and S. J. Gershman, "Building machines that learn and think like people," *Behav. Brain Sci.*, 2017.