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DIGITAL ENTRAPMENT: A SYSTEMATIC REVIEW OF ADDICTIVE DIGITAL TECHNOLOGY AND MITIGATION STRATEGIES*

INTRODUCTION

In our digital age, technology not only has social approval but is also essential. However, its evolution from tools of communication, work, and entertainment to platforms that encourage overuse raises significant concerns. Particularly troubling is the use of addictive technology on digital platforms such as social networking sites (SNS), content-sharing websites, and video games. This trend is evident in interactions with smartphones and other digital devices. Although users often engage with technology for productive purposes, they frequently get caught up in the mindless consumption of low-quality content or endless SNS loops. Rather than being incidental, this outcome is the result of digital media technologies deliberately engineered with addictive features that capture user attention and prolong screen time. In today's digital world, where attention is a valuable commodity, tech companies and marketers have transformed digital technologies to serve not only as frameworks for

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digital interaction but also as powerful tools that keep users glued to their screens, driving excessive use.

In this context, it is crucial to understand the factors that contribute to the addictive nature of digital media technologies. First, technological affordances, such as persistent notifications, continuously draw users' attention back to the platform (Neyman 2017). Goal-setting mechanisms, including achieving higher levels in games (Prasad, Kasi, Shivakumar 2020) or accumulating likes and shares on social media (Montag, Elhai 2023; Pedrouzo, Krynski 2023; Rosenquist, Scott Morton, Weinstein 2021), exploit users' natural drive to reach targets, and thereby reinforce continued use. The public display of metrics, exemplified by the number of likes or views, introduces a competitive element and enhances platforms' emotional impact (Neyman 2017). Social media resonates with the emotional sphere by eliciting such responses as happiness, sadness, fear, or anger through tailored content and interactions. The strategic use of emoticons, participation in interest groups, and personalized content delivery all reinforce users' emotional engagement. Furthermore, algorithms that customize content based on individual personalities and interests amplify this experience. By optimizing the timing and relevance of messages, they capture and sustain users' attention (Lukoff et al. 2021; Montag, Elhai 2023; Pedrouzo, Krynski 2023; Prasad, Kasi, Shivakumar 2020).

Second, psychological engagement on the internet is a powerful factor in the addictive nature of digital technologies. Online platforms allow users to act out fantasies, assume different identities, and engage in types of behavior they might avoid in real life thanks to anonymity and disinhibition (Greenfield 2007, 2021). The internet also provides variable incentives through unpredictable rewards—such as likes, comments, and notifications—which fuel addiction by offering instant gratification and avoiding real-world anxieties (Giraldo-Luque et al. 2020; Neyman 2017; Purohit, Barclay, Holzer 2020; Rosenquist, Scott Morton, Weinstein 2021). Third, social dynamics also play a critical role, since digital platforms create controlled social environments where interactions, comparisons, and competition trigger dopamine release (D'Angelo 2020; Neyman 2017; Pedrouzo, Krynski 2023). The elements of social validation and competition contribute to the addictive appeal of digital media technologies.

The profound impact that technology has on individuals and society is now well recognized, and the complex dynamics of addictive technology that intensify this impact are a major concern. However, the relationship

between the principles behind technology design, the manipulation of user behavior, and broader socio-economic consequences remains unclear. Understanding these factors is crucial for raising awareness of the negative effects of persuasive technology design, both to empower users and to encourage tech companies to minimize the use of manipulative strategies in their products. However, there is a dearth of comprehensive studies that integrate insights from diverse fields such as psychology, computer science, and ethics to provide a holistic understanding of addictive technology. Therefore, this paper makes three contributions to the literature: first, by systematically reviewing research on addictive technology to trace the evolution of scholarly literature; second, by providing conceptual foundations for understanding addictive design techniques and strategies; and third, by proposing a framework to address the issue of addictive technology. To the best of our knowledge, this paper is the first systematic literature review to focus on the topic of addictive technology. This study is driven by the following research questions: (RQ1) How has research on addictive technology evolved over time? (RQ2) How is addictive technology conceptualized in scholarship? (RQ3) What solutions to the problem of addictive technology are proposed?

DATA AND METHODS

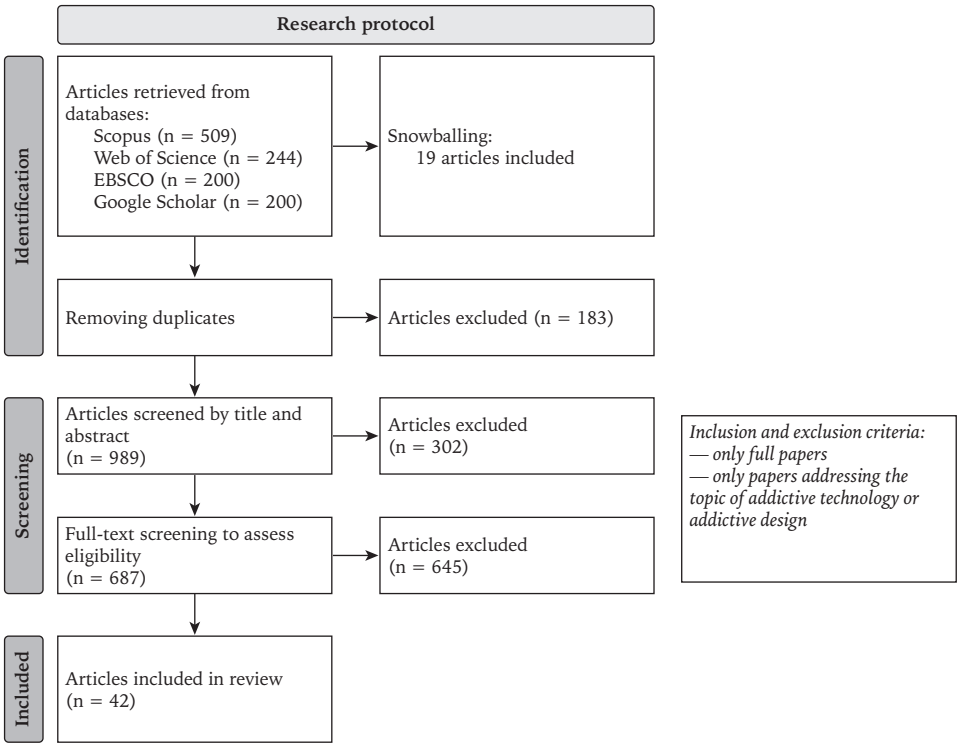
The study involved a systematic review of scholarly literature on the topic of addictive technology, using four databases for the search: Scopus, Web of Science, EBSCO, and Google Scholar. The inclusion criteria encompassed published journal articles, book chapters, and conference papers, while books and book reviews were excluded.

The search strategy was designed to identify articles containing the following keywords in their titles, abstracts, or keywords: *addictive AND* (*technology OR design OR digital OR "human-computer interaction" OR "internet usage"*). Although the language was restricted to English, there were no restrictions on the publication period. Figure 1 presents the study design.

The initial search yielded a total of 1,172 articles, 509 of which were from Scopus, 244 from Web of Science, 200 from EBSCO and 200 from Google Scholar. The selection process had two stages: screening of titles and abstracts, followed by a full-text review. Exclusion criteria included lack relevance to the research topic, duplication, language, and lack of focus on addictive technology or design. Some publications, though

Figure 1

Research design, adapted from the PRISMA flow diagram



mentioning all search terms, did not investigate addictive technology's role in internet addiction. After elimination, a total of 42 papers were selected for final review: 20 from Scopus, 8 from Web of Science, 10 from EBSCO, and 9 from Google Scholar (see Figure 1). The selected articles were thoroughly analyzed to identify and synthesize key findings related to the research topic.

First of all, quantitative analysis was used to investigate publication patterns and trajectories in addictive technology research (RQ1). This was followed by a systematic literature review, which identified the predominant themes and addressed the research questions. Inductive coding was used to categorize the papers, beginning with a set of broad codes derived from a preliminary literature review and the author's expertise. More specific codes were integrated and then grouped according to the aspects they addressed in the articles. The analysis applied a narrative synthesis approach to organize and interpret the findings. Each article was classified as either an empirical analysis or

a theoretical–conceptual contribution. The second set of variables focused on conceptual approaches (RQ2), examining whether the articles provided an explanation of the underlying factors that make technology addictive by design. If they did, we identified the conceptual elements under discussion, such as the responsible actors, strategies, and targets, as well as the focus of the design—whether this referred to the design itself or to its function. Finally, we coded the proposed solutions (RQ3) into four categories: technological innovations, regulatory measures, user empowerment, and educational initiatives. This methodology provided a robust and comprehensive overview of current knowledge on addictive technology and its design, as well as on the solutions offered to address this problem.

The reliability of the review process was ensured through transparent and replicable methods for searching, selecting, and analyzing articles. Using multiple databases enhanced the comprehensiveness and validity of the review. All references were retrieved on July 10, 2023. Content analysis was carried out between July and October 2023. All citation data reflects the status as of July 12, 2023.

RESULTS AND DISCUSSION

In line with the research questions, the results are discussed in three sections. First, we present the findings from the quantitative analysis that trace the evolution of research on addictive technology (RQ1).

The evolution of research on addictive technology

We investigated publishing trends in various publications and the leading outlets for research on addictive technology (Figure 2) as well as the research methods (Figure 3) and techniques (Figure 4).

Research trends show increasing academic interest over the years, with nine papers on SNS and 19 on games. In each of the years 2007, 2008, 2010, and 2011, one publication appeared as a book chapter, journal article, or conference proceeding, suggesting an early but limited awareness of the topic. Most of these were conceptual papers, with one quantitative study on game design and game addiction (Chi-Ying Chen, Shao-Liang Chang 2008). A significant surge in publications in 2020 reflects not only the growing recognition of technology's addictive attributes but also an evolving research interest. This rise in scholarly attention may be attributed to seminal works such as Alter's *Irresistible*

Figure 2

Cumulative growth in the number of papers published, broken down by type of publication outlet

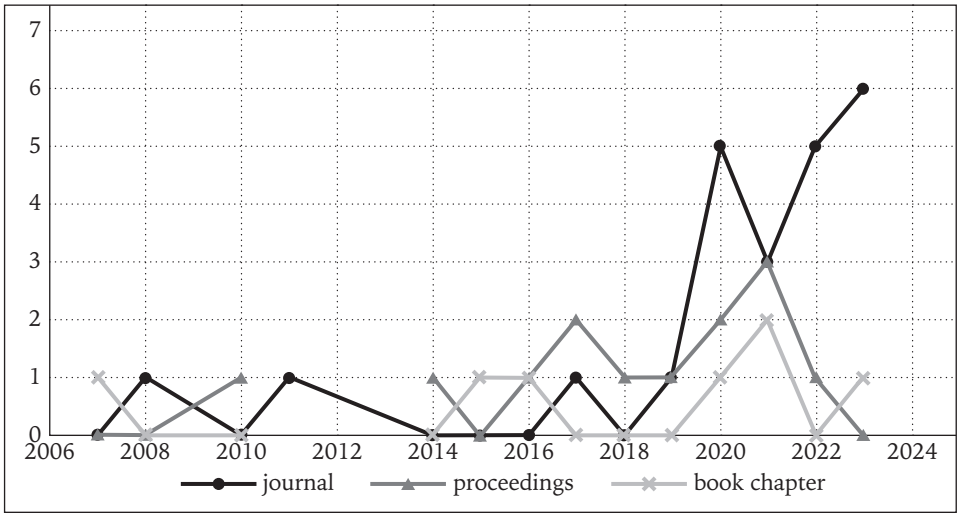


Figure 3

Cumulative growth in the number of papers published, broken down by type of research method used

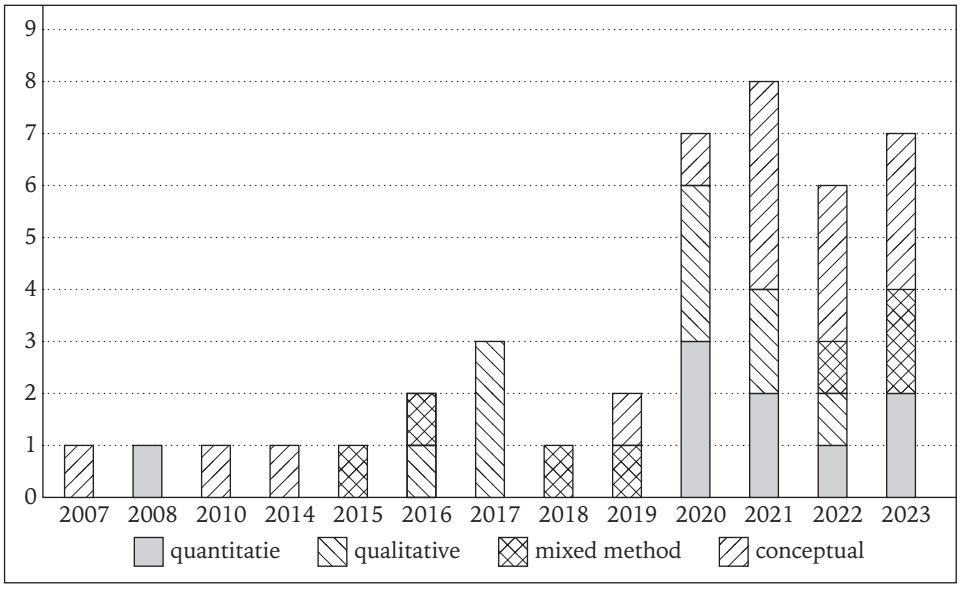
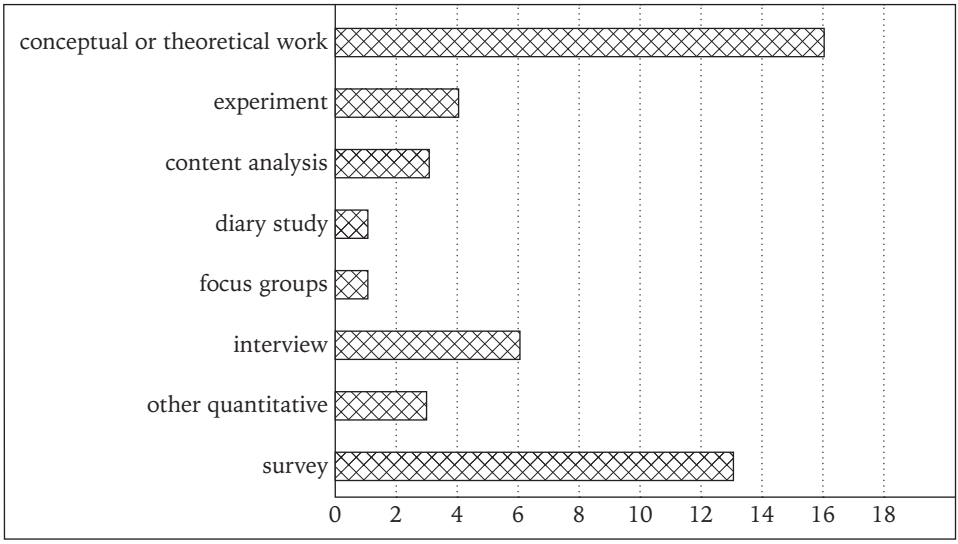


Figure 4

Research techniques applied in literature concerning addictive technology



(2017) and Zuboff's *The Age of Surveillance Capitalism* (2019), as well as attention generated by whistleblowers such as Tristan Harris, a former design ethicist at Google and Jeff Seibert, a former Head of Consumer Product at Twitter.

Publication patterns show a clear contrast between the limited number of journal articles and the greater number of non-journal publications on addictive technology before 2020. There were only three of the former, compared with 16 of the latter. This disparity suggests that high-ranking journals were selective in accepting emerging research on addictive technology. Early studies were largely conceptual, and the shortage of empirical data may explain why they appeared in non-journal outlets. This could indicate that the subject matter did not meet the rigorous standards of reputable academic journals. Furthermore, the prevalence of non-journal publications, such as proceedings and book chapters, implies that researchers preferred these less restrictive outlets for presenting emerging and exploratory research, as well as conceptual work, which may not have aligned with the requirements of traditional journals.

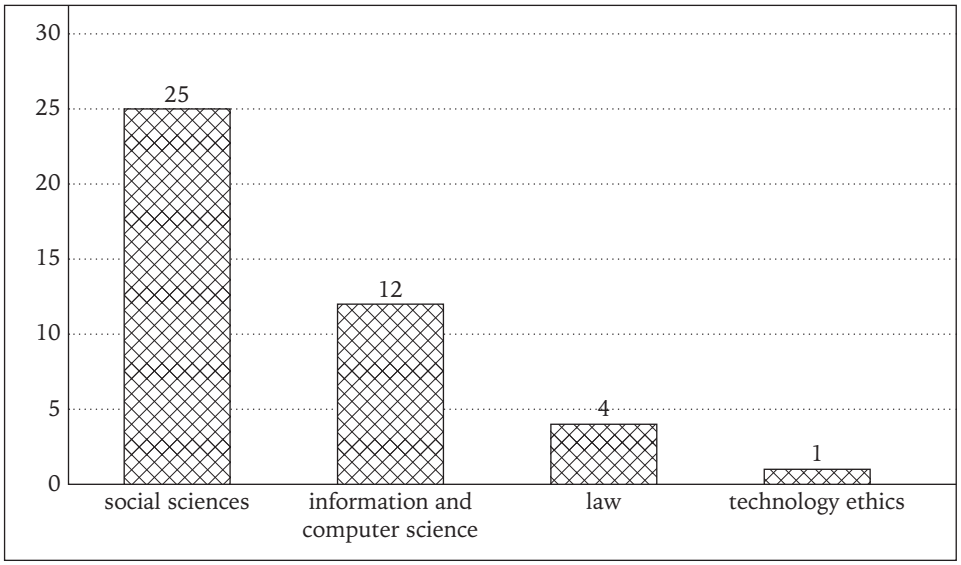
Research on addictive technology is rich and multidimensional. The majority of papers are conceptual or theoretical; however, the considerable number of both quantitative and qualitative studies indicates an increasing reliance on empirical approaches. Surveys are the most common

technique, suggesting a strong preference for structured data collection methods. Interviews and content analysis are the most frequently used qualitative methods, demonstrating how personal narratives and text analyses of online forums (Alrobai et al. 2016), reviews (Alrobai et al. 2016; Mookyung Kwak et al. 2022) and game content (Prasad, Kasi, Shivakumar 2020) are widely used to gain insight into the addictive attributes of technology.

Finally, we investigated the distribution of research on addictive technology across disciplines (Figure 5).

Figure 5

Disciplinary distribution of research on addictive technology



Over half of the papers were published in the social sciences, focusing primarily on studies intersecting sociology and psychology, with fewer including economics. Just over a quarter approached the subject from the perspective of information and computer science. Four offered a legal viewpoint, while one examined technology ethics and responsibility. This distribution shows the multidisciplinary nature and relevance of the topic across various academic fields.

Next, we analyzed the papers' keywords related to addictive technology. The results are shown in Figure 6.

The distribution of keywords reflects a strong interest in addressing addictive technology, with particular emphasis on digital addiction, user

Figure 6

Distribution of keywords pertaining to addictive technology based on the frequency of their use in the selected literature (created with WordItOut)

experience, social media, online gaming, behavior change, and mental health. The keywords appearing most often are "digital addiction (DA)," "user experience (UX)," and "user engagement," suggesting a strong link between technology and digital addiction. This highlights the importance of understanding how user interaction and experience with technology contribute to addictive behavior. The frequent mention of "social media" and "online gaming" as keywords suggests a focus on the role of these platforms in fostering addictive behavior. Keywords such as "behavior change" and "mental health" indicate that the literature emphasizes the impact of addictive technology on behavior and psychological well-being. Hence, effective interventions and policies need to be developed to address the problem of addictive technology and to help individuals better manage and modify their technology-related behavior in healthier ways.

ADDICTIVE TECHNOLOGY

The addictive nature of technology is linked to various elements of its design, all aimed at maximizing user engagement. Captivating

content, high-quality graphics, and immersive sound significantly enhance technology's appeal. When these aspects blend with simplicity, ease of use, and accessibility, they generate a pleasurable experience that keeps users constantly engaged. Many applications, particularly SNS, are intentionally designed to encourage impulsive and habitual use. For instance, certain social media apps strategically place system-recommended features or content in areas users frequently visit. YouTube's homepage, filled with videos tailored to the user's viewing history, exemplifies this tactic. Furthermore, a seamless transition from functional to more addictive components can lure users into engaging with content they had not planned to view. Hence, the design not only captures user attention but also reinforces the app's habit-forming nature and ensures frequent returns (Cho et al. 2021).

Additionally, technology employs sophisticated algorithms to create personalized content tailored to individual preferences. Algorithms, trained on vast amounts of user data, effectively recommend content and customized ads. Personalization not only captures attention but also creates filter bubbles and echo chambers. Users consequently find themselves in a loop of content that echoes their tastes and preferences, making it challenging to encounter diverse perspectives and disconnect from the platform. The design prioritizes user engagement, leading to a curiosity trap of short videos that perpetuate a cycle of endless scrolling, often at the expense of meaningful interaction (Helm, Matzner 2023; Pedrouzo, Krynski 2023).

Frequent, attention-grabbing notifications draw users back to the platform with alerts about new content and social interactions (Griffin 2022; Prasad, Kasi, Shivakumar 2020; Purohit, Barclay, Holzer 2020). A sense of urgency is created that prompts constant device checking driven by curiosity and the fear of missing out (Giraldo-Luque et al. 2020). However, research indicates that although notifications influence user behavior, they are not the primary driver of smartphone use, as most interactions are initiated by users themselves (Chen et al. 2023; Ding et al. 2016).

Infinite scrolling on social media feeds and content platforms provides a seemingly endless stream of content, which encourages users to continue scrolling without a clear endpoint. The absence of natural breaks in content flow keeps users engaged for extended periods, contributing to the addictive nature of the platforms (Neyman 2017; Purohit, Barclay, Holzer 2020; Purohit, Holzer 2021).

Variable rewards, such as likes, comments, friend requests, and other forms of social validation, along with daily challenges and bonuses,

provide powerful motivation for frequent use. Unpredictable and random rewards trigger a more significant release of dopamine in the brain than predictable rewards (Neyman 2017). They not only capture attention and evoke emotional responses but also foster a sense of achievement and progress, thereby promoting sustained engagement (Giraldo-Luque et al. 2020). The mechanism is similar to a slot machine, where the uncertainty of rewards fuels a dopamine-driven feedback loop (Giraldo--Luque et al. 2020; Purohit, Barclay, Holzer 2020; Purohit, Holzer 2021), commonly referred to as a hook cycle (Griffin 2022), potentially leading to habitual use of the technology. The feedback loop operates as a four--stage mechanism driven by: (1) a trigger: an initial cue, such as a push notification, that draws users to the platform; (2) action: upon arriving at the platform, users engage in activities such as liking, posting, or forming new connections; (3) investment: these activities invest users' time and effort, making it more challenging to disengage while also encouraging other users to participate; and (4) variable reward: this is the final stage, marking the culmination of the cycle; users are intermittently gratified with fresh content to view, comment on, share, or like (Purohit, Barclay, Holzer 2020).

Finally, the illusion of control is a significant design feature in many games and interfaces. Users believe they have multiple options, but in reality their choices are in fact limited and guided by the app. This keeps users engaged longer, as they feel they are making autonomous choices, even though their behavior is subtly directed to benefit the platform's engagement metrics (Neyman 2017). Such designs allow users to make decisions about the moves they take in games and to control the outcome, despite significant randomness in the final result. This leads to more engaging and enjoyable experiences. With an element of chance incorporated, there is a balance between skill and chance that keeps the game interesting and encourages players to keep returning. SNS arrange content to create the impression of an unsorted, chronological feed, but in fact, content is tailored and prioritized by algorithms (Neyman 2017).

All in all, design enhances the addictive potential of technology, which emphasizes the importance of understanding the algorithms' impact and considering systematic measures to mitigate their effects.

STRATEGIES FOR MITIGATING ADDICTIVE TECHNOLOGY

The literature review on addictive technology covers solutions such as technological innovations, regulatory measures, user empowerment,

and educational initiatives to address the challenges posed by addictive technology.

Technological design innovations

Technological design innovations aim to create an ecosystem where technology enhances user well-being and discourages compulsive use. Central to this approach is the development of requirements engineering (Alrobai, Phalp, Ali 2014; Alrobai et al. 2016), personal informatics tools, and systemically important platform designation[1] (Griffin 2022). These innovations integrate considerations of digital addiction into software development to ensure products prioritize user well-being from the outset. This involves understanding how software design influences addictive behavior and ensuring that such considerations become the requirements of a software system (Alrobai et al. 2016). The software industry is thus encouraged to adopt ethical guidelines and responsible practices that address the prevalence of "dark patterns"[2] and prioritize design choices to promote user autonomy, self-regulation, and awareness of impulsive behavior. Incorporating user feedback, through methods such as social adaptation and crowdsourcing[3], improves this proactive approach and ensures that software evolves in response to real-world interactions and challenges related to addictive behavior.

Technological solutions to combat addictive technology empower individuals and reshape user interactions with digital platforms. Personal informatics tools are central to this approach. They enable users to engage with behavior change through self-monitoring and feedback. They also foster self-awareness of digital habits and encourage informed decision-

[1] "Systemically Important Platform" (SIP) is analogous to the "Systemically Important Financial Institution" (SIFI) in the financial sector. Social networking sites should be subject to special rules to combat manipulative practices and restore user agency, including the use of middleware technology for more user control (Griffin 2022).

[2] Dark patterns are design elements that encourage users to make quick, less thought--through decisions, often increasing engagement with the app in ways they might later regret. For example, SNS might place system-recommended content or attractive features along paths that users frequently navigate, such as YouTube's front page full of recommended videos (Cho et al. 2021).

[3] Crowdsourcing captures user perceptions, experiences, and insights about addictive aspects of software. Given that digital addiction is often a private and sensitive issue, traditional elicitation methods such as interviews might not be as effective. Crowdsourcing, in contrast, can provide a broader and more anonymous platform for users to share their experiences and give real-time, continually updated information (Alrobai, Phalp, Ali 2014).

making regarding technology use, giving users greater control over their usage (Alrobai et al. 2016). Next, middleware technology serves as an additional layer of intervention, nudging users towards healthier digital interactions. For example, platforms such as X (formerly Twitter) tag digital content to signal controversial or misleading information. Middleware technology can also customize interactions with digital platforms, allowing users to filter content based on personal preferences (Griffin 2022).

An innovative example is the MISFEED Nudge, which provides visual banner notifications about social media consumption, similar to push notifications. Such feedback promotes mindfulness and discourages mindless scrolling (Purohit et al. 2020; Purohit, Holzer 2021). Another method involves screens automatically using grayscale when users access certain apps or websites, making distracting content less appealing and thus less engaging (Nakamura, Tanaka, Arakawa 2022).

Finally, Lukoff et al. (2021), Cemiloglu et al. (2020) and (Cemiloglu et al. 2023) recommend enabling users to tailor their digital experience to their preferences. Users should be enabled to set content preferences, rate recommendations, edit viewing history, and select algorithmic personas to influence future content. Customization enhances user control and agency over interactions with the app.

In addition to user-focused solutions, changes in design and algorithms are also essential. Strategies such as digital curfews[4] and reducing features that encourage compulsive usage are crucial (Ichihashi, Kim 2023). These changes foster digital well-being by promoting balanced and intentional technology use.

Regulatory measures

Addressing addictive technology requires comprehensive regulatory measures to establish a balanced digital ecosystem that mitigates harmful practices and promotes well-being. These measures would encompass both governmental interventions and industry self-regulation.

Governmental actions should include standardizing regulations across platforms and jurisdictions, and simplifying compliance for developers, as regulatory variability can lead to inconsistencies in the quality, safety,

[4] A digital curfew is a restriction on the consumer's platform usage that effectively limits the amount of time a consumer can spend on digital platforms. It works by reducing platforms' incentives to increase addictiveness (Ichihashi, Kim 2023).

and effectiveness of apps available in different regions (Griffin 2022; Khadjesari, Brown, Naughton 2021). Enhanced transparency in digital business models would be crucial for informed consumer decisions (Berthon, Pitt, Campbell 2019; Cemiloglu et al. 2023; Griffin 2022) and responsible business practices (Berthon, Pitt, Campbell 2019; Montag, Elhai 2023). Clear disclosure of economic aspects, such as in-app purchases and data monetization, is vital for understanding the true cost of digital consumption. This understanding is not only essential for consumer empowerment but also aligns with the broader economic and social responsibilities of digital platforms in shaping societal norms and behavior (Berthon, Pitt, Campbell 2019; Griffin 2022).

Legal and policy interventions, however, may not be sufficient on their own. A holistic strategy should integrate mandatory educational programs, especially in public education systems, to boost digital literacy among children and adolescents. The goal of a proactive educational approach is to empower users, especially the younger generation, and to give them greater control over their data and digital engagement (Flayelle et al. 2023).

The industry is encouraged to self-regulate by establishing standards that prioritize user well-being (Giraldo-Luque et al. 2020). This includes identifying and minimizing features that drive addictive behavior and promoting healthier design choices (Flayelle et al. 2023). However, the industry's reliance on user engagement and data collection for profit poses a challenge to effective self-regulation (Berthon, Pitt, Campbell 2019). The revenue model of social media and gaming platforms plays a critical role in shaping the incentives around addictiveness. Unlike platforms that monetize user attention primarily through advertising, services that operate on a subscription model, such as Netflix and YouTube Premium, may opt for lower levels of addictiveness. This approach could offer a more consumer-friendly alternative and a healthier balance between engagement and well-being (Ichihashi, Kim 2023). Another solution is to treat certain online services, such as social media, as a public good funded by tax revenue (Montag, Elhai 2023). Berthon, Pitt and Campbell (2019), on the other hand, suggest imposing taxes on the most addictive digital offerings, similar to taxes on tobacco and alcohol.

It has therefore been suggested that there could be benefits for platforms if they collectively self-regulate the addictive features that degrade service quality. This could involve limiting "likes" or ending infinite scrolling (Ichihashi, Kim 2023). Changing the revenue models from attention-based to subscription-based could reduce the need for

addictive design (Ichihashi, Kim 2023; Montag, Elhai 2023). Alternatively, social media platforms could be treated as a public good funded by tax revenue. The change in business model could push platforms to respect privacy and human rights (Montag, Elhai 2023).

Finally, it is recommended that antitrust measures focus on how consumer welfare is evaluated in the tech industry and prevent market monopolization that hinders the development of safer, less addictive products (Rosenquist, Scott Morton, Weinstein 2021). There should be a critical approach to mergers and acquisitions to prevent platforms that do not prioritize safe and non-addictive products from monopolizing the market. The aim would be to encourage competition and innovation in creating less addictive products. Antitrust enforcement should scrutinize whether dominant firms engage in exclusionary practices that stifle innovation, especially those companies hindering the emergence of less addictive technologies. Rethinking consumer welfare in antitrust analysis is essential, as traditional methods that equate increased consumption with increased welfare are conducive to addictive products (Rosenquist, Scott Morton, Weinstein 2021).

User empowerment and education

Addressing addictive technology requires a comprehensive approach centered on user empowerment, combining personal and cultural strategies for healthier digital engagement (Alrobai, Phalp, Ali 2014; Cemiloglu et al. 2020). This approach would involve providing clear insights into the creation of digital experiences and their influence on behavior, enabling users to better manage their digital habits. More than just offering tools and knowledge, it would aim to shift cultural values towards personal agency and the value of direct, face-to-face interactions (Helm, Matzner 2023).

A key element in this strategy is the adoption of personal IT tools that help users self- regulate, monitor their technology use, and receive feedback for behavior modification (Alrobai et al. 2016). This approach should be complemented by educational initiatives that explain the mechanics of persuasive design in digital technology, empowering individuals to make informed decisions about their digital consumption. Comprehensive information campaigns and digital hygiene education should be integrated into public discourse and educational curricula. Such campaigns should address the psychological, physical, social, and economic effects of excessive digital consumption while promoting

balanced digital habits (Berthon, Pitt, Campbell 2019; Flayelle et al. 2023; Greenfield 2007).

Incorporating digital literacy programs in public education, particularly for children and adolescents, is crucial. These programs would equip young users with the skills to self-regulate and maintain healthy digital habits (Flayelle et al. 2023; Pedrouzo, Krynski 2023). Additionally, training professionals such as IT workers to guide and monitor digital use could further support a healthy digital environment (Berthon, Pitt, Campbell 2019).

CONCLUSION

This study provides a systematic review of literature on addictive technology. It synthesizes the scope of knowledge on addictive properties and strategies for mitigating their impact. This comprehensive analysis fills existing gaps by offering a unified conceptual framework, and addresses three research questions. The first (RQ1) investigates the progression of research on addictive technology over time; the second (RQ2) examines how addictive technology is conceptualized in academic scholarship; and the third (RQ3) focuses on the solutions proposed in the literature.

In response to RQ1, we investigated the patterns and trajectories of publications on addictive technology research, revealing a modest but steadily growing academic interest. The first recorded publication dates back to 2007, followed by several mainly conceptual papers. From 2016 onwards, multidisciplinary research with a mix of qualitative, quantitative, and conceptual studies showed a marked increase in attention to the topic.

For RQ2, we examined how addictive technology is designed to maximize user engagement and encourage habitual use. The findings indicate that addictive technology has been designed with features that aim to capture user attention and encourage habit formation, often leading to compulsive use. These elements include engaging content, personalized algorithms, and attention-grabbing mechanisms (for example, frequent notifications that create a sense of urgency and contribute to the fear of missing out; variable rewards that trigger dopamine release in the brain; an illusion of control offering limited choices that foster a sense of autonomy; and infinite social media feeds). A deeper understanding of such design and its impact on user behavior is crucial.

Finally, RQ3 focused on the solutions proposed in the literature, grouping them into four categories: technological design innovations,

regulatory measures, user empowerment, and educational initiatives. Technological innovations include features such as personal informatics tools, middleware technology, and customization features that facilitate healthier interactions with digital platforms and reduce compulsive use. Integrating these features into design involves considering digital addiction in software development, promoting ethical guidelines, and applying user feedback for more responsible and user-centric designs. Since products will be less engaging, and therefore less appealing to the user, wide-ranging top-down incentives are needed to encourage producers to implement the changes. Regulatory measures, both at governmental and industry levels, are therefore needed—such as standardized regulations, enhanced transparency in business models, and legal and policy interventions. These measures would aim to promote responsible business practices, protect consumer welfare, and mitigate harmful practices. Pressure on big tech companies to change the design of digital platforms and games should also come from the users themselves. That is why raising users' awareness is of utmost importance. This includes user empowerment strategies, which would provide users with the tools and knowledge for self-regulation and better management of digital habits, and shift cultural values towards healthier digital engagement. Wide-ranging educational initiatives, such as digital literacy programs, would then need to be implemented, especially targeting children and adolescents. Educational programs should equip young users with skills to maintain healthy digital habits and understand persuasive digital design. These comprehensive approaches aim to mitigate the impact of addictive technology by fostering more conscious and intentional technology use.

This study contributes to the literature in three ways. First, it offers a historical perspective and shows how research on the topic has developed, thereby giving the study of addictive technology a longitudinal dimension. Second, by exploring various conceptualizations of addictive technology, the study provides a unified framework to help achieve a better understanding of its nature, characteristics, and impact on users, which is crucial for developing effective countermeasures and policies. Finally, the comprehensive categorization of proposed solutions facilitates the development of a well-rounded approach to addressing addictive technology that combines industry-led design and ethical practices, regulatory frameworks that support and enforce responsible technology use, and personal empowerment and education.

The study has several limitations. First, the literature review was confined to articles in English, potentially overlooking relevant research

published in other languages. Second, articles were collected from two main databases, Scopus and Web of Science, supplemented by an additional 200 papers each from EBSCO and Google Scholar. This means that research available on other platforms may have been excluded. Moreover, the focus on the conceptualization and mitigation strategies of addictive technology may not have fully captured the diverse user experiences and contextual factors that influence technology addiction. Notwithstanding these limitations, the study identifies several research gaps for future research. There is a need for deeper investigation into how different demographic groups interact with addictive technology, as current research may not adequately address the varying impacts on diverse populations, such as age groups, cultural backgrounds, and socio-economic statuses. There is also a lack of longitudinal research tracking the long-term effects of addictive technology on users. Finally, while various solutions have been proposed, comprehensive evaluations of their effectiveness are lacking. Addressing these gaps would significantly advance our understanding of addictive technology and lead to more effective strategies to mitigate its impact.

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Abstract

This paper examines the state of research on addictive technology, focusing on the design of such technology and on mitigation strategies. It offers three contributions: a review tracing the evolution of scholarly literature; conceptual foundations for understanding addictive techniques used in technology design; and a proposed framework for addressing this issue. Drawing on a systematic review of 42 studies from major databases (Scopus, Web of Science, EBSCO, and Google Scholar), the study applied quantitative analysis to investigate publication patterns and identify predominant themes in the literature. The analysis reveals growing academic interest in addictive technology, with keywords highlighting concerns about user experience and psychological health. Addictive technology is designed to capture and retain user attention through engaging content, personalized algorithms, and attention-grabbing mechanisms (such as

notifications, variable rewards, illusion of control, and infinite social media feeds), fostering habit formation and, consequently, compulsive use. Mitigation solutions include technological design innovations, regulatory measures, user empowerment, and educational initiatives.

keywords: addictive technology, social media, video games, persuasive design, digital addiction, problematic internet use