AIS Transactions on Human-Computer Interaction

Volume 13 | Issue 4 Article 5

12-31-2021

Adaptive and Personalized Gamification Designs: Call for Action and Future Research

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Recommended Citation

Schöbel, S., Schmidt-Kraepelin, M., Janson, A., & Sunyaev, A. (2021). Adaptive and Personalized Gamification Designs: Call for Action and Future Research. *AIS Transactions on Human-Computer Interaction, 13*(4), 479-494. https://doi.org/10.17705/1thci.00158
DOI: 10.17705/1thci.00158

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DOI: 10.17705/1thci.00158

Available at http://aisel.aisnet.org/thci/vol13/iss4/5

Transactions on Human-Computer Interaction

Research Commentary DOI: 10.17705/1thci.00158 ISSN: 1944-3900

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Abstract:

Gamification refers to the use of game-like elements in non-entertainment contexts to make activities more engaging and enjoyable to improve utilitarian outcomes. The gamification literature and the use of gamification in practice suggest that gamification can be a useful tool to support behavioral and psychological changes. Recent developments show that there is potential for new waves of gamification research. Therefore, we conducted a workshop at the International Conference on Wirtschaftsinformatik (WI) 2021 to discuss the future of gamification with interested scholars. The discussion with 25 gamification experts led to a research agenda that supports the need for adaptive and personalized gamification designs. Together with the experts, we identify three clusters for future research: 1) the personalization of gamification concepts, 2) theories and concepts for gamified human-computer interaction, and 3) the "dark side" of gamification (e.g., addiction). We also address what the gamification concept means. Aligned with the three clusters, we provide valuable starting points for future research inquiries to help researchers better understand the nature of gamification. We also discuss the capabilities and limits of gamification.

Keywords: Gamification, Personalization, AI, Future Research, Gamification Designs.

Fiona Nah and Paul Lowry were the accepting senior editors for this paper.

1 Introduction

In the last decade, gamification has become a major practice and research trend in the information systems (IS) discipline, especially in the human-computer interaction (HCI) area. Following a general proliferation of games in culture, society, and technology (Hamari, 2019), gamification refers to the use of game-like elements to make activities more engaging, effective, and efficient to improve outcomes (Liu, Santhanam, & Webster, 2017). Research has shown gamification, which originates from the digital-media domain (Basten, 2017), to have the potential to positively influence people's behavior in various application areas, such as education (Schöbel, Saqr, & Janson, 2021), healthcare (Schmidt-Kraepelin, Thiebes, Tran, & Sunyaev, 2018; Kankanhalli, Xia, Ai, & Zhao, 2021; Li, Wang, Wu, & Liu, 2021), crowdsourcing (Morschheuser, Hamari, Koivisto, & Maedche, 2017), and marketing (Nah, Eschenbrenner, & DeWester, 2011; Wang, Gunasti, Shankar, Pancras, & Gopal, 2020). Gamification pertains to not only individuals but also groups (Fernandes et al., 2012; Wiethof, Tavanapour, & Bittner, 2021) and organizations (Nah, Eschenbrenner, Claybaugh, & Koob, 2019). Many practitioners have reported successful gamification implementations, and research has predominantly shown an optimistic stance toward its possible benefits (Warsinsky, Schmidt-Kraepelin, Thiebes, & Sunyaev, 2021). However, prominent gamification failures exist. For example, Netflix decided to remove a gamification approach targeting children in its video-on-demand service after receiving major backlash from concerned parents via social media due to privacy-related issues (Liao, 2018). Gamification involves certain risks and represents a challenging area in software engineering because it requires deep knowledge and structured processes to realize its potential benefits (Morschheuser, Hassan, Werder, & Hamari, 2018).

When IS and HCI scholars first started to engage with gamification, many faced severe skepticism from other researchers who felt that gamification research did not constitute "real science" or sweepingly claimed that gamification is "bullshit" (Lowry, Petter, & Leimeister, 2020; Bai, Hew, & Huang, 2020). Times have since changed and publications on gamification have found their way into the most prestigious outlets of IS (Liu et al., 2017; Santhanam, Liu, & Milton-Shen, 2016) and HCI (Treiblmaier, Putz, & Lowry, 2018; Christy & Fox, 2014). Some well-established journals, such as the *European Journal of Information Systems*, have even published distinct special issues on the topic (Lowry et al., 2020).

Ten years' worth of exponential increase in gamification research has transpired since Deterding, Sicart, Nacke, O'Hara, and Dixon (2011) published their seminal paper on gamification. Currently, other innovative concepts and technologies have also begun to make significant advancements, such as artificial intelligence (AI), which can substantially alter the design of gamification to better adapt gamification to users' needs and interests. From our point of view, it is time to review achievements in gamification research and discuss the most urgent and promising research questions.

To do so, we conducted a full-day workshop titled "Above & Beyond Gamification—Adaptive and Intelligent Concepts to Support User Motivation and Engagement" at the International Conference on Wirtschaftsinformatik (WI) in February 2021. We publicly announced the workshop on social media, through the conference committee, and via international mailing lists. Twenty-five experts from various disciplines such as information systems, human-computer interaction, and informatics participated. Participants had the opportunity to either submit research papers or position papers before the workshop. While designing the workshop, we reviewed both types of papers to derive an initial thematic structure that guided the workshop procedure.

In this research commentary, we report on the main findings of the group work sessions and discussions that emerged during the workshop. We present a research agenda for gamification in IS and HCI organized into three major categories: 1) the personalization of gamification concepts, 2) theories and concepts for a gamified HCI, and 3) the "dark side" of gamification.

2 The Current State of Gamification Research

Gamification has gained increasingly widespread recognition from researchers and practitioners from various domains since 2010 when Bunchball (2010) presented gamification as a concept that could make work tasks more engaging and, thus, more effective. Today, many different applications in various areas such as health, marketing, sustainability, and education, incorporate gamification concepts (Alcivar & Abad, 2016; Arai, Sakamoto, Washizaki, & Fukazawa, 2014; Conaway & Garay, 2014; Kari, Frank, Makkonen, & Moilanen, 2016). However, the term gamification itself remains controversial and ambiguous, and researchers continue to discuss its efficacy, potential, and limits extensively (Liu et al., 2017; Santhanam et

al., 2016). To define gamification, most researchers have aligned how they understand the term with Deterding et al.'s (2011) conceptualization of gamification as "the use of video game design elements in non-gaming contexts to improve user experience and user engagement". Others have described gamification as enhancing IS with motivational affordances to invoke gameful experiences (Koivisto & Hamari, 2019). Some researchers have started to realign their conception of gamification and define it more broadly by distinguishing between two types of gamification: 1) intentional gamification (i.e., a planned transformation of a system to afford more gameful experiences), and 2) emergent gamification (i.e., a general cultural and societal transformation that resulted from an increased engagement with games and gameful interactions) (Hamari, 2019).

Just as the gamification concept has been subject to constant evolution, the actual research dealing with the phenomenon has similarly passed through various phases. According to Nacke and Deterding (2017), the first gamification research wave predominantly included industry and conference papers that 1) provided definitions, frameworks, and taxonomies for gamification and game design elements; 2) described systems, designs, and architectures from a technical perspective; or 3) empirically focused on answering whether gamification works or not (Hamari, Koivisto, & Sarsa, 2014). To address whether gamification works, researchers tested various aspects of gamified systems, such as game design elements in myriad combinations and various dependent variables and constructs (e.g., engagement, motivation, and fun). While these studies have helped to establish gamification as a scientific research stream in IS and HCI, researchers subsequently called for more theory-driven studies. For example, in their editorial, Nacke and Deterding (2017) called for research to further analyze the effects, moderators, and mediators of individual game design elements, which resulted in the second wave of gamification research. Although researchers from various domains have begun answering these calls, such as Treiblmaier et al. (2018), Liu et al. (2017), as well as Schöbel, Janson, and Söllner (2020b), more empirical and theory-driven research is needed to widen understanding about the underlying working mechanisms of gamification.

Although the quest for theory-driven gamification research and native gamification theories continue (Lowry et al., 2020), new developments that have the potential to mark the starting points for new waves of gamification research have also emerged. We discuss three such potential gamification research waves in Section 3.

3 The Future State of Gamification Research

The workshop focused on identifying avenues for future research on intelligent and adaptive gamification designs. Due to new trends and recent technological developments (e.g., AI), new possibilities emerge that can change or redefine the nature of gamification, how we use gamification, and how we conceptualize gamification in the context of new theories and technologies. In the workshop, we identified three directions for advancing gamification: 1) the personalization of gamification, 2) theories and concepts for a gamified human-computer interaction, and 3) the dark side of gamification.

3.1 The Personalization of Gamification

One of the most pressing issues in gamification research concerns the design and development of personalized gamification concepts considering that being confronted with game design elements leads to widely differing individual perceptions and actions (Klock, Gasparini, Pimenta, & Hamari, 2020). Personalization describes a process of collecting user information during interaction with the user, which is then used to tailor appropriate services to the user's needs (Bonett, 2001). Personalized gamification can lead to more successful outcomes in user performance (Passalacqua et al., 2021). With AI's increasing ability to individualize IS, future efforts to design gamification can personalize the gameful experience based on user preferences, motivation, state of engagement, and mood. To adapt selected gamification elements to users' needs and interests, researchers need an open-minded outlook to explore what aspects of personalization are most useful in different contexts. Additionally, it would be worth considering how *removing* gamification elements from an information system changes user behavior. Studies have found that removing gamification from information systems has both positive and negative effects, which suggests that the phenomenon warrants future research (Seaborn, 2021).

Overall, we know that gamification can be a useful mechanism to support individual user needs by providing a more engaging and productive user experience. We see two main perspectives for research on how and what to personalize:

- First, the way we individualize systems often depends on the *task* that one uses for gamification. We can find a good example in the digital learning context where gamifying individual versus group or collaborative learning differs. One could also customize gamification to different collaborative processes, such as collaborative writing (Wiethof et al., 2021).
- Second, a user's *characteristics* matter and can determine if and how designers individualize gamification concepts. For instance, in digital learning, we can consider how learners behave and react to gamification based on their goal orientation (i.e., whether they constitute performance-oriented learners who need competition with others or mastery-oriented learners who are only interested in their achievements) (Super, Keller, Betts, & Roach Humphreys, 2019). Based on self-determination theory, Marczweski (2015) suggested that different player types exist, which provide opportunities to better support individual user needs and adapt a user experience based on the user's preferences. Using AI techniques, such as machine learning (ML), also allows researchers to work with data on another level (e.g., by clustering groups or types of rewards to better predict and understand resulting user behavior or psychological reactions). Additionally, researchers can use AI to provide personalized feedback to users based on their achievements or tasks (Liu et al., 2017). Gamification can support and increase the motivation of users. With AI, we can identify how motivation develops and differs between users to better support both intrinsic and extrinsic motivations (Barber, Petter, & Barber, 2021).

By tracking a user's activity and leveraging AI mechanisms, researchers may be able to detect if user motivation or concentration goes off track and to better understand motivation, such as by evaluating and training an algorithm to determine and identify causes of demotivation. Researchers need to explore what intrinsic and extrinsic motivations mean in more detail to not only better understand the effect that gamification has on user motivation but also to understand what decreases motivation as might occur when one removes gamification from an information system (Seaborn, 2021). We need to address gamification's long-term effects since we do not know whether gamification's positive effects persist in the long term (Mekler, Brühlmann, Tuch, & Opwis, 2017) and whether it is possible to prevent negative effects from emerging when gamification is removed at some point (Seaborn, 2021). Analyzing how the use of gamification can support certain outcomes over time could help researchers develop a framework for effective use (Burton-Jones & Grange, 2013). To make the gamification concept more useful, researchers need to look beyond motivation and use, and consider perceptions, disturbances, and consequences of gamification (Burton-Jones & Grange, 2013). Research that involves digital learning still struggles to explain how gamification influences behavioral outcomes of interest (Super et al., 2019). Therefore, it is important to understand and evaluate which variables support which behaviors when using gamification and to explore the relationships between variables. In most situations, researchers develop a gamification concept that they then present to users without considering their interests and ideas; combining a user-centered approach (Iivari & Iivari, 2011) with AI could allow them to better support personalized gamification designs.

3.2 Theories and Concepts for Gamified Human-Computer Interaction

Recently published research supports the relevance of integrating existing and evolving theoretical perspectives into gamification designs (Lowry et al., 2020). Typically, gamification researchers ground their work in a limited number of established theories, such as the well-known technology acceptance model, flow theory, self-determination theory, cognitive load theory, or information processing theory (Treiblmaier et al., 2018). For an overview of the theoretical basis of gamification, readers may refer to Krath, Schürmann, and von Korflesch (2021). Integrating the various theoretical perspectives can be useful because gamification ostensibly has its foundations in fun and entertainment by using game design elements to support and enhance users' motivation and engagement. However, considering other theories in developing gamification concepts and explaining their effects could assist research and practice in taking the research area to the next level (Lowry et al., 2020). For example, researchers have arguably used self-determination theory more than any other theory to design gamification concepts (Krath et al., 2021). Ryan and Deci's (2000) self-determination theory describes three perspectives on users' inner needs—autonomy, competence, and relatedness—that result in intrinsic motivating effects that one could incorporate into an artifact's design. At this point, we agreed in our workshop that some game design elements can support specific needs better than others. Elements such as avatars that represent a user often allow for autonomy (in that users can design their own), whereas other elements such as a progress bar can show the progress but do not allow for autonomy. Additionally, addressing user needs does not automatically lead to the intended outcomes or user reactions. More precisely, adding a gamification concept to an information system does not necessarily lead to positive effects. For example, the Duolingo language learning app

features an owl that operates as an avatar, but users could perceive it as supportive or as disturbing and annoying.

Besides rethinking the ways researchers use theory to guide the design of gamification, it could be worthwhile to rethink the way designers present game design elements to a user. As an illustration, assume that a point system is used where users earn points for completing each activity. When points are given to users, they may feel positively rewarded and continue pursuing this or another activity. However, in some contexts, these reward mechanisms might not provide enough feedback to assist users in understanding why they received points. Although gamification profits from the element of surprise (Schöbel et al., 2020b), one could improve its effectiveness by combining it with digital nudging. A nudge refers to "any aspect of the choice architecture that alters people's behavior predictably without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2009, p. 6). Digital nudging can provide guidance to individuals when navigating in the online environments and can support their interactions or influence their actions in a certain direction (Kroll & Stieglitz, 2019), such as to reach a certain goal through gamification (Krath et al., 2021). Combining digital nudging with gamification elements, such as in the privacy context (Schöbel, Barev, Janson, Hupfeld, & Leimeister, 2020a), could allow practitioners to better guide users' behavior by rewarding specific activities. Involving digital nudging also raises questions about how we can avoid the manipulation of users.

The workshop participants also discussed how communication and interaction are changing. Accordingly, we need to investigate when and how changes are needed in gamification design. Users increasingly make decisions with help from so-called "smart personal assistants" (SPAs), an umbrella term for technological artifacts that operate with voice, vision, and contextual information to interact with individuals (McTear, Callejas, & Griol**,** 2016). These interactions, however, often run ineffectively and inefficiently (Benner, Schöbel, & Janson**,** 2021b). In general, SPAs adopt a technology-based approach to assist users in completing tasks (Knote, Janson, Söllner, & Leimeister, 2021). SPAs use AI—which includes ML and natural language processing (NLP)—to interact with humans in a mostly conversational way (Guzman, 2017). SPAs appear in many contexts nowadays; for example, organizations use them as chatbots to arrange customer service interactions (Maedche et al., 2019). Unfortunately, academic studies and practitioner reports confirm that users often become demotivated due to bad SPA design (Pricilla, Lestari, & Dharma, 2018). A bad SPA design can result in an unsatisfactory experience (Adam, Wessel, & Benlian, 2020) or poor user performance. Using a "conversational gamification" approach could overcome resulting barriers in interactions between smart assistants and users. Based on this perspective, we need to think about processes and concepts that suffer from poor user motivation to identify potential information systems that could be gamified to increase user motivation and engagement.

3.3 The "Dark Side" of Gamification

Until now, HCI research on gamification has primarily focused on investigating the intended affective, cognitive, and behavioral outcomes of gamification, such as higher levels of engagement or fun (Schmidt-Kraepelin, Thiebes, Stepanovic, Mettler, & Sunyaev, 2019). More design-oriented research provides a plethora of different frameworks for successful gamification (Mora, Riera, González, & Arnedo-Moreno, 2017; Morschheuser et al., 2018; Nah, Eschenbrenner, Zeng, Telaprolu, & Sepehr, 2014a). We acknowledge the value that these approaches provide to understanding the psychological mechanisms of game design elements in non-game contexts, which ultimately helps designers create more effective gamified systems. However, our workshop participants pointed out that future research should seek to lay a stronger focus on investigating unintended negative or adverse effects of gamification (Bai et al., 2020; Behl et al., 2021), which we refer to as the "dark side" of gamification. Similarly, researchers need to explore the limits of gamification. Extant research has predominantly dealt with gamification's risks or negative effects as a side note, if at all (Johnson et al., 2016; Thiebes, Lins, & Basten, 2014). Gamification has been used on a variety of devices such as mobile phones (Mattke & Maier, 2021), where gamification elements are used to reduce users' screen time—a phenomenon that is better known as digital detox (Purohit, Barcley, & Holzer, 2020).

Furthermore, ethical issues in applying gamification, such as the potential for manipulation and exploitation (Marczewski, 2017), have begun to emerge in the literature. Only a few studies have focused on exploring the potential negative outcomes of gamification (Schmidt-Kraepelin et al., 2019; Hyrynsalmi, Smed, & Kimppa, 2017) or the potential project risks in designing and developing gamified IS (Warsinsky et al., 2021). These studies have yielded interesting initial insights. For example, researchers have claimed that, when gamification relies too much on extrinsic motivation from typical reward systems, it risks undermining users'

intrinsic motivation for a certain desired behavior (e.g., exercising) (Ryan & Deci, 2000), which will ultimately lead to a negative impact on users' motivation in the long run. Others have expressed concerns that gamification can have demoralizing effects when users have negative experiences, such as when they experience unfair behavior ("cheating") or face exaggerated punishment in the gamified system. Researchers must also question whether gamification results in diminishing returns at a certain point; that is when it loses any impact it may have had in the beginning.

4 Conclusion and Critical Discussion

To conclude the workshop, we presented three major areas for moving research on gamification forward. First, we acknowledge that research involving AI enables researchers to explore existing gamification from a novel perspective. Combining gamification and AI with HCI research helps researchers explore and understand how we can design gamification concepts in a more user-centered way. Second, it is critical to incorporate a thorough theoretical perspective. Third, by considering the two aforementioned issues, we should avoid and/or understand the unintended consequences of gamification. Table 1 presents an overview of our guiding research questions. We discuss some of them in more detail below.

Table 1. Concluding Research Questions

Technology
• How can we use technology to design personalized gamification? • How should we use AI-based technology to personalize gamification?
Task/job
• How can we use personalized gamification to support a user's tasks? • How can gamification foster optimum behavior (e.g., efficiency, effectiveness, and creativity)?
Human
• How does dynamic AI-based personalization of gamification help users more effectively use information systems? • At what point does gamification cause fatigue among users? • What effects does real-time personalization have on users' motivation to use gamified information systems? • What factors lead to demotivation with gamification and how can they be reduced? • What negative effects does gamification have (e.g., addiction and technostress) and how can they be reduced? • How can we avoid fighting fire with fire in employing gamification elements to reduce negative effects of usage and achieve healthier information system usage behavior? • Alongside existing theories such as self-determination theory, what novel ideas can we use to redesign gamification concepts and to change researchers' perspectives on gamified information systems? • Which theories can we use to better explain the mixed results concerning the effectiveness of gamification?
Domain and context
• How can we use gamification to design a conversation with smart personal assistants that will be more efficient and/or effective for users? • How do we elicit important constructs to help personalize gamification concepts? • What ethical guidelines help researchers develop gamification concepts and design better gamification elements? • How can we effectively use gamification for organizational purposes, and do the concepts in use that help educate younger users also work for users in organizational contexts?
Interaction
• How can we use gamified nudge designs to better guide user behavior and, at the same time, motivate them to change their perspective or interaction with an information system? • How can we avoid negative aspects such as user manipulation driven by gamification or gamified nudges? • What new game design elements can we establish to broaden our perspective on motivating users while supporting user behavior? • What personalization clusters are useful for developing individualized gamification concepts?

Zhang and Li (2005) developed a framework to present HCI issues that relate to the following entities: technology, tasks/job, human, domain/context, and interaction. To better describe and group the research questions that we have developed, we discuss these questions about each of these entities.

Technology will need to advance further to take gamification to the next level. Technology includes hardware, software, applications, data, information, knowledge, services, and procedures (Zhang & Li, 2005). Researchers need to understand if and how existing technologies can be improved to develop personalized and individualized gamification concepts. Additionally, researchers need to examine how they can better utilize technology to design personalized gamification concepts. This adaptive approach differs fundamentally from previous deterministic approaches to gamification. Further, researchers and practitioners need to understand the limits of gamification. Research should critically reflect on the capabilities and power of gamification in general.

Additionally, another question relates to which **tasks** are suitable for gamification, such as the tasks that Nah et al. (2019) have identified in the enterprise context. Extant research has often emphasized the importance of contextual factors (e.g., target group, targeted behavior) when it comes to designing meaningful gamification (Liu et al., 2017). For example, one needs to consider different factors in different contexts—whether in a work setting or an education setting. Our gamification experts also discussed "optimum behavior" and what it means in different contexts. Similar to what we know as the uncanny valley about avatar designs (Seo, Kim, Jung, & Lee**,** 2017), research should try to identify the optimum behavior in different application contexts. We typically use gamification to boost motivation to achieve or foster certain behaviors. However, simply encouraging increased technology use does not always lead to beneficial outcomes; under some circumstances, it may lead to health-related risks such as technostress (Tarafdar, Cooper, & Stich, 2019) or even addiction (Nah et al., 2014a). Hence, questions arise about how gamification can positively support motivation and not lead to harmful effects due to overuse (Gong, Cheung, Zhang, Chen, & Lee, 2021).

Furthermore, future research needs to explore in more detail how **humans** experience gamification. In this light, we need to investigate users' motivations for using a gamified solution, their resulting emotions, and how we might cluster users based on certain characteristics. For example, clustering users based on demographics or their gaming preferences enable tailored gamification solutions (Barber, 2021). In our workshop, we intensively discussed how AI could support research and practice by allowing a more personalized gamification experience (e.g., by changing and replacing elements when decreasing motivation is detected). We discussed the need to explore what users perceive as demotivating in the gamification context. Therefore, we need to more fully understand what specific elements or factors can create demotivation.

Another research stream has started to use gamification not to increase usage but to decrease it. The concept of digital detox describes a period during which an individual refrains himself or herself from using electronic devices such as smartphones or computers, which provides an opportunity for them to reduce stress or focus on social interaction in the physical world (Schmuck, 2020; "Digital detox", 2020). Gamification elements have been widely used to support digital detox behavior (Lee, Lee, Kim, & Cho, 2017). Typically, gamification elements are used to boost a behavior, but digital detox uses gamification to reduce a behavior. Lastly, considering how users experience gamification, our workshop experts discussed the need to alter the theoretical perspectives on gamification in scientific inquires. Most research has used self-determination theory (Krath et al., 2021). Connecting gamification to a need-supportive theory seems pretty obvious—self-determination theory discusses how gamification can support individuals' needs for autonomy, relatedness, and competence and, thus, foster intrinsic motivation (Deci & Ryan, 2008). With new developments such as digital detox or AI, we could also consider other theories such as social cognitive theory, which describes the influence that individuals' experiences, others' actions, and environmental factors have on individuals' health behaviors (Bandura, 1991). In particular, our workshop participants emphasized that we require theoretical perspectives to better understand the mixed empirical results about the effectiveness of gamification and to develop native gamification theories in the IS discipline (Lowry et al., 2020; Straub, 2012).

If we use AI to create a more engaging gamification experience, ethical and legal questions about data arise that warrant research into the role and meaning of **domain** and **context**. Researchers should consider the ethical role of gamification and persuasive designs in general (Benner, Schöbel, & Janson, 2021a). Overlooking the ethical aspects can produce counterproductive effects (e.g., gamification concepts that do not encourage the intended behavior but rather the opposite, such as procrastination or ignorance) (Diefenbach & Müssig, 2019). Gamification can also be grounded in competition and rivalry. Games typically feature competition, but using it in a professional context has potential risks. In such a situation, employees may feel undesired or even exploited in their job (Humlung & Haddara, 2019). Hence, research will need to assess whether specific gamification elements are useful in enterprises or company settings (Khan,

Boroomand, Webster, & Minocher, 2020; Silic & Lowry, 2020). Driven by AI, new SPAs still lack the capabilities to interact effectively with users, and hence, gamification could play a role in making SPAs more helpful, engaging, and meaningful (Benner et al., 2021b).

Researchers also need to examine whether gamification can act as an effective instrument over time. Research has shown gamification to be an effective instrument to boost user motivation; however, we should also analyze at what point gamification leads to fatigue among users. While users might find some game design elements unpopular, others might lose their effectiveness after a while and, thus, diminish gamification's effects over time.

Given that individuals **interact** with and via technology, we need to pay attention to how we design intelligent and personalized information systems to ensure they promote effective usage. Interacting with technology does not only involve supporting motivation. Generally speaking, gamification can be considered a form of persuasive systems design (PSD). A comprehensive framework for PSD has been developed to provide guidelines on the design and evaluation of systems that influence users' attitudes or behaviors (Oinas-Kukkonen & Harjumaa, 2009). Among other persuasive design concepts, digital nudging, which refers to the use of design elements to guide users' behavior, may use a progress bar or feedback, which are elements that we also use in gamification (Nah, Zeng, Telaprolu, Padmanabhuni Ayyappa, & Echenbrenner, 2014b; Thiebes et al., 2014). Like gamification, digital nudging is an approach based on behavioral economics that applies interface design elements to affect the choices that users make in digital environments (Acquisti et al., 2017). Combining gamification research with insights from research on digital nudges can help researchers better understand the effect that gamified nudges have on user behavior.

Together with international experts who carry out research on gamification, we identified areas for future research to make gamification concepts more effective and efficient. With our work, we summarize different research avenues that researchers can follow to explore how we can make gamification concepts more "intelligent" in improving user experiences.

Acknowledgments

We thank our reviewers, Stacie Petter, Jan Marco Leimeister, and Jeanine Krath, for their valuable feedback. Special thanks to our accepting editors, Fiona Nah and Paul Lowry, for their comments, recommendations, and assistance. The third author also acknowledges funding from the Basic Research Fund (GFF) of the University of St. Gallen.

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