Two Sides of the Same Coin?

Insights on Motivational Information Systems and Goal Achievement From a User and Firm Perspective

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"In every job that must be done there is an element of fun."

—Mary Poppins—

"This is about fun and games but the stakes and learning could not be more serious."

—James Doyle—

1. General introduction

1.1. Relevance

The extensive proliferation of smartphones (3.5 billion users in 2020; Statista, 2020c) drives the digitization of people's everyday life. This development provides consumers with access to up to 3 million mobile applications from anywhere and at any time (AppBrain, 2020). These opportunities are highly embraced by consumers and among the most popular types of apps are those that seek to motivate users in achieving their self-set goals (Statista, 2020a) — these belong to and are often subsumed under the umbrella term *motivational information systems* (MIS). Because people frequently lack the own willpower to pursue their goals, the demand for such systems is exponentially growing (Devezer et al., 2013; Huang, 2018).

To keep users motivated, MIS not only contain utilitarian but also hedonic components. More precisely, MIS utilize design principles from hedonic services (i.e., games and social networks) and thereby seek to support utilitarian goals via hedonic means (Koivisto & Hamari, 2019). For example, people use the MIS Fitocracy to lose weight. By sharing their goal with other users, earning points by reaching sub-goals (e.g., going to the gym three times in a week), or climbing up in performance rankings depending on their goal progress, the unpleasant and effortful pursuit of losing weight should be more enjoyable and therefore increase the probability of goal achievement.

MIS are widely established in many contexts such as education (e.g., Codecademy, Duolingo), fitness (e.g., Fitbit, Fitocracy), healthcare (e.g., MySugr, Mango Health), nutrition (e.g., Yazio, MyFitnessPal), or self-organization (e.g., Todoist, Habitica).[1] Firms expect to help users achieve their goals with MIS by motivating them to continuously engage (Liu et al., 2017; Wolf et al., 2018). In doing so, engagement should take on a dual role in the context of MIS by supporting users to perform more goal-oriented activities and likewise fostering firms' financial success through more frequent service use (Kumar & Pansari, 2016; Pansari & Kumar, 2017). Accordingly, MIS promise to create a win-win situation for companies and users in that they fulfill the goals of both stakeholders (Wolf, Jahn, et al., 2020).

Although today MIS are part of most people's everyday lives, they have only become increasingly common in the last several years (Statista, 2020b). Moreover, the scientific community has only hesitantly begun to pay attention to MIS and their downstream effects in 2011 (Deterding et al., 2011). Although many papers on the subject have been published in the meantime, fundamental questions have not yet been adequately answered (Hofacker et al., 2016; Koivisto & Hamari, 2019; Liu et al., 2017). More precisely, previous literature provides conflicting results as to whether MIS actually help users and firms to achieve their goals (Attali & Arieli-Attali, 2015; Hanus & Fox, 2015; Mekler et al., 2017; Zimmerling et al., 2019). These inconclusive results could stem from a lack of consideration of different MIS designs and the facilitated user experiences which cause user behavior (Huotari & Hamari, 2017; Leclercq et al., 2018; Lopez & Tucker, 2017; Sailer et al., 2017; Xi & Hamari, 2019). Furthermore, the psychological processes

[1] It should be noted that although most MIS exist in the above-mentioned fields, there are also MIS in areas such as sales, production, and logistics. Likewise, those systems aim to achieve utilitarian goals through hedonic means, but the origin of the goals may be extrinsic (e.g., employer). However, they also represent MIS since they combine utilitarian and hedonic aspects and make use of game and social network design principles.

triggered by MIS are still a "black box", as most of the prior research could not empirically confirm their theoretical assumptions about the processes underlying MIS use (Hanus & Fox, 2015; Landers et al., 2019; Mekler et al., 2017; Mitchell et al., 2017), leading to the following questions:

(1) *Whether* MIS support the achievement of (a) user and (b) firm goals.

(2) *How* MIS drive user behavior in terms of which (a) system design and (b) MIS-facilitated user experiences trigger user-beneficial and firm-beneficial behavior and (c) which psychological processes can explain these relationships.

The aim of the present dissertation is to address these reach gaps by adopting a user-centered perspective on MIS use and their downstream consequences. The included articles in this dissertation shed light on these questions by examining the impact of different types of system design (e.g., social interdependence structures) and MIS-facilitated user experiences (e.g., self-development, social comparison) on user-beneficial (e.g., engagement) and firm-beneficial behaviors (e.g., willingness to pay more, word-of-mouth) and their outcomes (e.g., performance, well-being) under the consideration of different psychological processes. Accordingly, this research offers new insights on *whether* and *how* MIS drive user behavior and therefore support users' as well as firms' goal achievement. Hence, this dissertation contributes to research and practice alike.

For research, the dissertation delivers insights into the impact of MIS on users and firms by establishing a more fine-grained view on MIS' psychological and behavioral consequences. More precisely, the investigation of different MIS designs and MIS-facilitated experiences, opposing but simultaneously triggered psychological processes and several behaviors clarifies MIS' impact on their users as well as the firms providing these systems. The findings across various service contexts reveal that while MIS mostly support user and firm goals, unexpected downside effects can reside with MIS use such as lower engagement intensity and reduced users' willingness to pay.

Furthermore, the articles contribute to the understanding of motivational repercussions of technologies. While tools such as MIS represent external stimuli, which are likely to make activities "fun" by satisfying users' inherent human desires, they can also "pressure" their users to perform. Overall, the dissertation shows that adopting a user-centered perspective is key to understanding the impact of MIS on users, user-beneficial, and firm-beneficial behavior.

For marketers, the findings can explain the rising popularity of MIS and the inclination to embed game and social network features in services. The articles offer guidance on how to design MIS to maximize users' firm-beneficial behavior (e.g., willingness to pay, word-of-mouth) and how different user goals (e.g., performance, well-being) can be supported best. Further, the results spotlight that some MIS-facilitated experiences are double-edged swords as they can promote certain behavior but suppress others. Therefore, managers have to prioritize their objectives to optimally leverage MIS design. Likewise, policy makers can adopt the insights and utilize them to nudge people towards desired and pro-social behavior. The next chapter addresses the MIS phenomenon and its conceptual underpinning in detail.

1.2. Conceptualization of motivational information systems

MIS is an umbrella term for digital services which combine utilitarian and hedonic aspects (Koivisto & Hamari, 2019). The term evolved from the design approach of gamification, which is defined as the use of game features in non-game contexts in order to evoke game-like experiences (Deterding et al., 2011; Huotari & Hamari, 2017). The understanding of this concept becomes problematic as most game features are not strictly unique to games and people had game-like experiences in non-game contexts long before the introduction of gamification. For example, while being one of the most used game features (Koivisto & Hamari, 2019), badges also have a long tradition in the military/ in a military context. Also, one of the most popular loyalty programs in

Germany—PAYBACK—awards points for purchases with the bonus card, which can later be exchanged for monetary rewards. Therefore, the term MIS was introduced to clarify and to focus on the essential idea underlying gamification.

MIS are digital services which combine instrumental aspects (i.e., the use of the service fulfills an ulterior purpose) with hedonic aspects (i.e., the use of the service is "fun"; Hassan et al., 2019; Koivisto & Hamari, 2019). Thus, the aim is to make activities which are beneficial for achieving utilitarian goals but at the same time rather boring and unmotivating, more entertaining and pleasant. This implies that MIS do not only include the use of game design principles but also incorporate all other fields that allow giving a hedonistic touch or "twist" to utilitarian activities. Therefore, besides gamification, sociofication (i.e., the use of social network features in non-social contexts) is one of the most popular design approaches that can be found in MIS (Hassan et al., 2019). Next, both design approaches are explained in more detail.

As described above, gamification leverages on game design principles so that performing an activity feels more gameful (i.e., like playing a game) by adding game features to a non-game service (Deterding et al., 2011; Huotari & Hamari, 2017). Among the most common game features in gamified services are points, badges, and leaderboards (Koivisto & Hamari, 2019). Such game features are used to transfer the fundamental principles of games (i.e., goals, rules, structure, and feedback) to a non-game service context (McGonigal, 2011; Schell, 2014). These principles appeal to the inherent tendency of people to grow and develop (Ryan & Deci, 2002). People want to be challenged and improve themselves (Csikszentmihalyi, 1990; Deci & Ryan, 2000). Gamification provides users with SMART goals (i.e., specific, measurable, achievable, relevant, and time-bound goals) and informational feedback and thereby aims to make users feel challenged and competent (Hamari et al., 2018; Huotari & Hamari, 2017; Wolf et al., 2018).

Corresponding to gamification, sociofication, can be defined as the use of social network features in non-social services to evoke experiences of belonging. Social networks "are applications that enable users to connect by creating personal information profiles, inviting friends and colleagues to have access to those profiles, and sending e-mails and instant messages between each other" (Kaplan & Haenlein, 2010, p. 63). Therefore, social networks focus on the communication between users and include the opportunity of high self-presentation. One of the largest social networks is Facebook with over 2.5 billion active users worldwide (Statista, 2020c). Prominent social network features of Facebook are user profiles, friending, groups, chats, and social feedback (e.g., likes and emoticons). Fundamental principles of social networks are self-presentation (i.e., personal profiles), the connection between users (i.e., friending), and communication (i.e., content sharing, comments and private messaging; Boyd & Ellison, 2007; Thelwall, 2009). Therefore, social networks exploit the social nature of human beings. People have an inherent desire for belonging and relatedness (Ryan & Deci, 2002). Social feedback is necessary to define oneself and ones' position in the community and society (Festinger, 1954; Liu et al., 2013; Ryan & Deci, 2002). By using social network features, firms aim to provide a space for social interaction and support to build relationships between users who share similar interests, activities, and backgrounds (Boyd & Ellison, 2007; Weiger et al., 2018).

As mentioned before, features used in MIS often cannot be clearly linked to a specific design principle. Although the same features are often used within digital games and social networks, their origin is difficult to locate. Long before social networks—in today's sense—existed, games included social components, which today are characterized as social networks features. For example, the first digital games already offered the possibility to create user profiles or avatars and to communicate with other players via private messaging. Vice versa, the first online forums already included game features. Members of forums got points for their posts, were assigned to

user levels demonstrating their knowledge, and got ranked in a leaderboard based on the number of posts they had created. The author of the dissertation would like to emphasize that the thesis does not focus on assigning MIS features to a specific design principle but on the impact of MIS on users and their behavior. For this purpose, MIS are defined as digital services which aim to support users to pursue utilitarian goals via hedonic means such as gamification and sociofication (Koivisto & Hamari, 2019). In the following chapter, I will provide an overview of the relevant literature on the influence of MIS on users and user behavior.

1.3. Literature review

The following literature overview is divided into three parts: MIS and their impact on (1) user-beneficial behavior and outcomes, (2) firm-beneficial behavior, and (3) the psychological processes that lead to those behaviors. In addition to previous literature from the fields of marketing and management, further studies from related areas such as human-computer interaction and information systems will also be included since MIS and gamification research originates from those fields.

1.3.1. MIS and user-beneficial behavior and outcomes

In the context of MIS, user-beneficial behavior can be any activity which helps users to make progress towards their initial goal (i.e., the goal users seek to achieve by using the MIS). Since MIS are designed in a manner that activities performed with them are goal-oriented, user-beneficial behavior includes any behavior related to service engagement. Therefore, the section includes studies which investigated (intention to) service use, community participation, behavioral engagement, and MIS activity (Koivisto & Hamari, 2019). Qualitative studies in the contexts of brand communities (Harwood & Garry, 2015), healthcare (Hammedi et al., 2017), and co-creation platforms (Leclercq et al., 2017) indicate that MIS include different design principles which could

lead to enhanced service use and engagement. Further, a few quantitative studies show that MIS positively affect behavioral engagement intention (Eisingerich et al., 2019; Leclercq et al., 2018, 2020). More precisely, Eisingerich et al. (2019) found in the contexts of health and dating that design principles of MIS enhance system use intention while Leclercq et al. (2018, 2020) demonstrated in several experiments that depending on the MIS design, the intention to participate in co-creation communities increases or is not influenced at all. Furthermore, a field experiment revealed that MIS can increase the active participation in crowdsourcing platforms (Morschheuser et al., 2019). Additionally, Zimmerling et al. (2019) have found experimental evidence that MIS design can enhance quantitative output in an idea contest, but not the quality of contributions.

Next, previous literature on user-beneficial outcomes, understood as the results of goal-oriented behavior, will be compiled. This includes task performance, goal achievement, and user well-being (Koivisto & Hamari, 2019). Based on findings of user interviews, Harwood and Garry (2015) concluded that game features can increase task performance in communities. These findings are in line with the results of Mekler et al. (2017) who observed an increase in performance when employing MIS design principles in an image annotation task. However, studies in the context of education found inconclusive effects of MIS on performance (Attali & Arieli-Attali, 2015; Christy & Fox, 2014; Hanus & Fox, 2015). While Attali and Arieli-Attali (2015) found no performance increase in three experiments with mathematic tests, Christy and Fox's (2014) results showed positive and negative effects of MIS on math performance depending on MIS design. In a field experiment across 16 weeks, students showed even lower scores when using MIS compared to conditions without MIS use (Hanus & Fox, 2015). Regarding MIS and user well-being, only a few studies have been conducted and they only focus on physical activity. While most studies came to the conclusion that MIS can enhance physical activity in the short term (Allam et al., 2015; Maher et al., 2015; Mitchell et al., 2017), Zuckerman and Gal-Oz (2014) found no differences in

performance by adding MIS design principles to a pedometer app. Results from an experiment propose that the physical activity can increase or even decrease depending on the design (Lopez & Tucker, 2017).

In summary, the literature overview first suggests that several studies already investigated the impact of MIS on user behavior and predominantly found a positive relationship. However, those studies only consider behavioral intentions and some researchers question whether MIS can promote actual continued engagement behavior, or whether it fades quickly after the initial attraction (e.g., Etkin, 2016; Liu et al., 2017; Wemyss et al., 2019). Regarding user-beneficial outcomes, only a few studies exist, and they revealed mixed results. The findings indicate that for understanding the impact of MIS on users, it is important to know how to implement the design principles of MIS as this, in turn, determines how MIS are experienced by users which is key for unfolding desirable impact (e.g., Christy & Fox, 2014; Lopez & Tucker, 2017). The literature does not yet clearly state *whether* and *how* MIS support users' goal achievement.

1.3.2. MIS and firm-beneficial behavior

Firm-beneficial behavior includes all user behavior that can improve the financial success of a firm. This encompasses behavior already mentioned in the previous chapter like (intention to) service use, brand community participation, and behavioral engagement—but also product adoption, purchase, user commitment, loyalty, willingness to pay, and word-of-mouth, to name a few (Koivisto & Hamari, 2019). In marketing, studies found positive effects of MIS design on the adoption of product innovations and self-brand connection (Berger et al., 2018; Müller-Stewens et al., 2017). Furthermore, quantitative studies in the contexts of dating, health, and sports showed that MIS can increase purchase behavior (Eisingerich et al., 2019; Jang et al., 2018). Additionally,

findings of studies in the areas of sustainability and fitness are suggesting a positive relationship between MIS and word-of-mouth (Hamari & Koivisto, 2015b; Mulcahy et al., 2020).

Overall, the previous research indicates that the relationship between MIS and firm-beneficial behavior is positive. However, extant studies take a somewhat "static" perspective in that only immediate effects of MIS in terms of intention to service use and engagement were examined. No study investigated whether MIS unfold persistent consequences in terms of continued engagement or service use and whether these effects are still positive or whether unfavorable effects can arise. Especially, indicators concerning the influence of MIS on the firm-customer relationship and customer lifetime value (e.g., commitment, willingness to pay more) have been neglected in prior research. Thus, in the same vein as for user goals, previous literature cannot satisfactorily answer the question of *whether* and *how* MIS support firms' goal achievement.

1.3.3. MIS and its psychological consequences

Concerning the question of *how* MIS influence user behavior, in terms of the psychological processes that are initiated when using MIS, most of the literature initially assumed that the behavior is triggered by an increase in intrinsic motivation (Mekler et al., 2017; Seaborn & Fels, 2015). This originates from employing design principles of essentially hedonistic services, such as games. The underlying assumption is that these services are only used for their own sake and that the use itself is fun (Ryan et al., 2006). Thus, MIS use should also be pleasant and intrinsically motivating. However, this presumption has rarely been investigated empirically and the studies showed different results (Hanus & Fox, 2015; Landers et al., 2019; Mekler et al., 2017; Mitchell et al., 2017; Sailer et al., 2017; Xi & Hamari, 2019). While some studies show that MIS foster psychological need satisfaction (e.g., Sailer et al., 2017; Xi & Hamari, 2019), others find no effect on intrinsic motivation (e.g., Landers et al., 2019; Mekler et al., 2017; Mitchell et al., 2017) and

suggest that MIS rather trigger extrinsic motivation. This assumption is reinforced by the results of Hanus and Fox (2015), who even found a reduction in intrinsic motivation when using MIS design. Due to the one-sided consideration of psychological consequences of MIS, prior research cannot clarify *how* MIS drive user behavior in terms of which psychological processes can explain these relationships.

1.4. Positioning of this work

As discussed in the previous chapter, prior literature cannot conclusively and comprehensively explain the influence of MIS on users and user behavior (Hofacker et al., 2016; Liu et al., 2017). Therefore, the objective of this dissertation is to first investigate empirically *whether* MIS influence users and user behavior in a way that benefits user and firm goals. Secondly, it also aims to find out *how* MIS influence user-beneficial and firm-beneficial behavior. In order to answer these research questions, it must first be clarified which perspective on MIS (e.g., MIS design, MIS features, MIS-facilitated experiences) should be used to examine MIS before the influence of MIS on downstream consequences can be investigated. This necessity is confirmed by the various conflicting results of previous research, which revealed that MIS design greatly influences the impact on user behavior. While different MIS features lead to different behaviors, the design of one and the same feature can also vary substantially leading to various results (Koivisto & Hamari, 2019; Mekler et al., 2017; Sailer et al., 2017; Sheffler et al., 2020). Therefore, using a perspective that focuses on MIS features does not seem appropriate. For this reason, the author decided to examine MIS and its' downstream consequence by focusing on design structures (i.e., patterns that determine how MIS features are designed and implemented) and facilitated user experiences. While the first approach is based on a more design-centered perspective from existing game research (Liu et al., 2013), the second approach is rather user-centric and follows Huotari and

Hamari's (2017) service perspective on MIS. Their perspective is in line with the original idea of MIS design to stimulate game-like and social experiences through the utilization of game and social network principles (Huotari & Hamari, 2017; Koivisto & Hamari, 2019; Wolf, Weiger, et al., 2020). This approach also seems promising and contributing beyond the existing design-centered approach, as the comprehensive marketing literature highlights that user experiences ultimately determine user behavior, and the environment or other interventions can only nurture those experiences (Holbrook, 2006; Lemon & Verhoef, 2016). However, the existing literature provides only limited knowledge about MIS-facilitated user experience. Thus, a study had to be first conducted to identify a comprehensive portrait of MIS user experiences. The developed concept of MIS experiences was then paired with the design structure approach as a basis for some of the included studies of this dissertation to investigate the effects of MIS. The next chapters describe the initial study[2] that was conducted in 2017 together with Welf H. Weiger and Maik Hammerschmidt to identify the dimensions of MIS experiences.

1.4.1. Initial study – Discovering MIS experience dimensions: Research goal

Based on a user survey, this study aims to reveal the MIS user experiences that occur while interacting with game and social network features within MIS. As different user experiences may trace back to the same feature, or one user experience may be associated with multiple game or social network features, it is necessary to first identify common features and experiences in the context of MIS before linking them in order to find a holistic concept of dimensions of MIS experiences.

[2] This study was presented at the 51st Hawaii International Conference on System Sciences and published as part of an article in the respective proceedings: Wolf, T., Weiger, W. H., & Hammerschmidt, M. (2018). Gamified Digital Services: How Gameful Experiences Drive Continued Service Usage. Proceedings of the 51st Hawaii International Conference on System Sciences, 1187-1196.

1.4.2. Initial study – Discovering MIS experience dimensions: Methodology

Pre-studies. First, to identify the state-of-the-art features used to implement game and social network design principles, we draw on features identified in prior literature and compare them to features integrated into real-life MIS. Prior research reports a diverse set of game and social network features (e.g., Hamari et al., 2014; Matallaoui et al., 2017). The initial literature review including existing literature overviews (e.g., Matallaoui et al., 2017), quantitative research (e.g., Sailer et al., 2017), and qualitative research (Lucassen & Jansen, 2014), yielded 22 at least partially different features (see Appendix A). We then randomly selected 50 real-life MIS (e.g., MyFitnessPal, Babbel) with more than 500,000 downloads. In preparation, we trained two research assistants who were blind to our research goal, to conduct a search in the Google Play Store and Apple App Store to identify MIS. We next compared the set of features identified in the prior literature with the features implemented in the 50 apps. Consequently, we extracted eleven state-of-the-art game and social network features appearing in at least three of the 50 real-life apps (see Table 1 for an overview and descriptions).

Table 1. State-of-the-art game and social network features embedded in MIS

Feature	Description
Avatars	Images of users that visually represent them in the service community
Badges	Signs of attainment awarded to users after successful completion of a quest or task, or attaining a milestone
Chats	Enables users to message each other in real-time
Friending	Enables users to add other users to their social network (e.g., friend list)
Leaderboards	Rankings of users based on their relative performance in focal activities
Points	Units that measure user performance through completion of specific tasks
Quests	Predefined goals that users should reach by performing activities
Social feedback	Enables users to react to other users' activities (e.g., thumbs up)
Teams	Groups of users formed to achieve a common goal
User levels	Representation of users' current skill levels
User profiles	Personalized virtual identities of users in the service community

Second, we determined the most common user experiences that occur during MIS use. We did so by relying on previous research and focus group evidence. To select distinctive user experiences, we extracted 18 at least partially different experiences discussed in prior literature (e.g., Suh et al., 2015; see Appendix B). We validated our selection with insights from a focus group discussion. Specifically, we invited ten experienced users of MIS, who had used at least one MIS (e.g., Runtastic, Duolingo) two times a week for at least six months. Guided by our pre-selection of MIS-facilitated experiences, the focus group debated which of the 18 experiences usually occur during MIS use. Next, they discussed whether these experiences are common across various MIS or merely occur while using one specific MIS. The focus group discussion yielded nine user experiences common across MIS (see Table 2 for an overview and descriptions).

Table 2. Common user experiences during MIS use

User experience	Description
Achievement	Experience of reaching one's own goals
Challenge	Experience of being claimed by a task
Choice perception	Experience of having the possibility to do things the own way
Competition	Experience of rivalry with other users
Cooperation	Experience of working together with other users
Progress	Experience of own development
Self-expression	Experience of expressing the own identity in the service community
Social interaction	Experience of communicating with one another
Status	Experience of presenting the own social rank within the service community

Data Collection. After these pre-studies, we conducted the main survey to examine how MIS users relate the identified user experiences to the extracted game and social network features. A sample of 148 respondents completed the survey (57% female; M_{age} = 26.96, SD_{age} = 7.52). First, we asked participants to recall and report on their recent encounters with mobile apps. Next, the respondents selected up to five game or social network features with which they are familiar (unrestricted context). We excluded participants who were not familiar with any feature from the survey. Participants rated the extent to which they associate each of the nine experiences with each selected feature. Because each participant evaluated up to five features, we ended up with 397 ratings of game and social network features in regard to user experiences for all participants.

Measures. To capture user experiences, we used single items developed based on pre-study results (e.g., "Points help me reach my objectives," see Appendix C for the item list). The items were rated on seven-point Likert scales (1 = "strongly disagree" and 7 = "strongly agree"). Table 3 provides the descriptive statistics.

1.4.3. Initial study – Discovering MIS experience dimensions: Results and discussion

We conducted an exploratory factor analysis to identify the underlying user experience dimensions and extracted four factors (variance explained = 78%; see Table 3).[3] Each experience loads higher on one of the factors than on the others, supporting the discriminant validity of the extracted factors. The four factors allow a straightforward interpretation of the underlying dimensions of MIS-facilitated user experiences. Factor 1 relates strongly to achievement, challenge, and progress. Taken together, this factor summarizes experiences related to the advancement of participants' own capabilities. Thus, we refer to this factor as *self-development*. Factor 2 relates strongly to competition and status. Since these experiences are characterized by comparing oneself to others, we call this factor *social comparison*. Factor 3 is strongly associated with cooperation and social interaction, representing the experience of being connected to others. We thus refer to this factor as *social connectedness*. Finally, Factor 4 is strongly associated with choice perception and self-expression, and we consequently refer to this factor as *expressive freedom*.

This initial study confirms the existence of distinct dimensions of user experiences in the MIS context. By revealing that the various game and social network features relate to different aspects of user experience, we show that a set of fundamental experiential dimensions should be considered in order to fully grasp the impact of MIS on downstream consequences.

[3] The initial factor analysis suggests a three-factor solution with eigenvalues greater than 1 (variance explained = 61%); however, a scree plot suggests that a four-factor solution should be preferred (Brakus et al., 2009).

Table 3. Descriptive statistics of MIS-facilitated user experiences and factor loadings

User experience	M	SD	Factor 1 (Self-development)	Factor 2 (Social comparison)	Factor 3 (Social connectedness)	Factor 4 (Expressive freedom)
Progress	3.76	1.87	**.84**	.17	-.15	.17
Achievement	4.02	2.00	**.82**	.12	.18	-.02
Challenge	3.39	1.92	**.80**	.19	.18	-.14
Status	3.74	2.08	.13	**.89**	-.08	.11
Competition	3.69	2.02	.24	**.87**	-.06	-.09
Cooperation	3.39	1.92	.32	-.03	**.87**	.06
Social interaction	4.11	2.22	-.17	-.15	**.77**	.42
Self-expression	3.36	1.94	-.16	.05	.08	**.86**
Choice perception	3.08	1.76	.25	-.02	.29	**.73**
Eigenvalue			2.31	1.66	1.53	1.51
Variance explained			25.71%	18.46%	17.04%	16.81%

Notes: Principal component analysis with varimax rotation was used. Bold values indicate the factor on which each item predominantly loads (n = 397 game and social network feature ratings with regard to users' experiences).

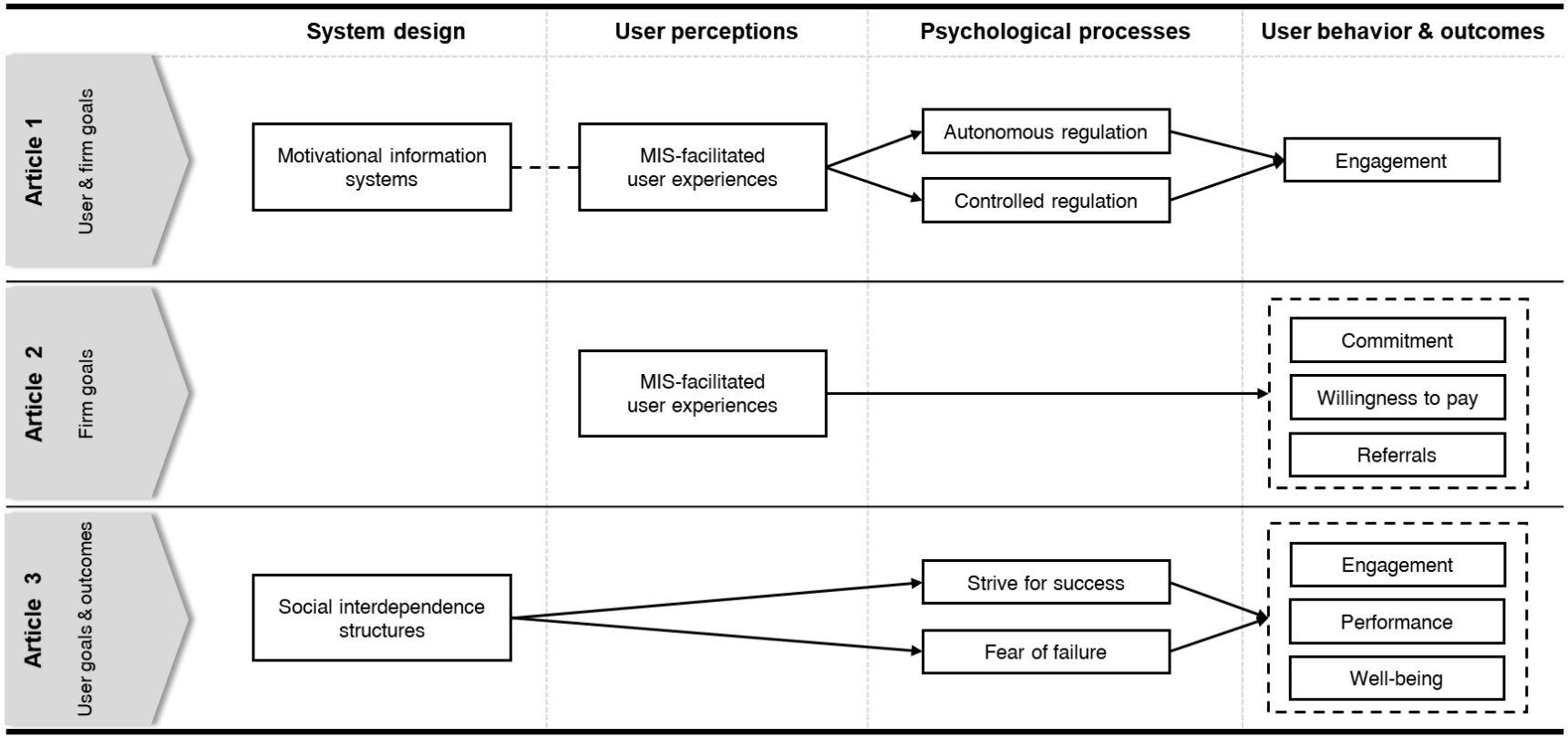
1.5. Research outline

This dissertation includes three articles in which the influence of MIS on users and user behavior is examined. Overall, the articles investigate both user-beneficial and firm-beneficial behavior while considering psychological processes which are triggered during MIS use.[4] Thus, the dissertation contributes to answering the questions of *whether* MIS support the achievement of user and firm goals as well as *how* MIS drive user behavior. Figure 1 provides an overview of the dissertation's framework. First, the framework shows that MIS are examined by considering the system design as well as their user perceptions. Second, it displays the consideration of opposing and simultaneously triggered psychological processes and third, the framework incorporates the investigation of user-beneficial as well as firm-beneficial behavior and outcomes.

Article 1 examines the effect of MIS on user-beneficial and firm-beneficial behavior. The article includes two studies which complement each other to investigate the impact of MIS on continued user engagement. More precisely, while the first study examines whether MIS is able to increase user engagement more than non-MIS (i.e., information systems with no game or social network features), the second provides insight into how MIS achieves this effect by focusing on the facilitated user experiences during MIS use. Furthermore, drawing on self-determination theory allows for the consideration of opposing but simultaneously triggered psychological paths that explain the relationship between MIS and engagement. The studies contribute to previous literature by examining continued engagement over several weeks instead of merely focusing on the intention. In this way, the article can overcome the concerns about non-recurring effects and

[4] The individual articles do not always refer directly to MIS, but rather to gamified services (Article 2) or self-improvement technologies (Article 3). However, these terms can be combined under the umbrella term MIS and the use of the different terms can be explained by the time of origin and the different positioning of the articles in the existing marketing literature.

Figure 1. Dissertation Framework



manages to show the diversity of MIS effects by investigating those effects in terms of a user-centered perspective (i.e., MIS-facilitated experiences). Hence, the article reveals which MIS-facilitated user experiences trigger the opposing psychological paths and thus, different behavior. Therefore, the article addresses both questions, *whether* MIS support the achievement of user and firm goals as well as *how* MIS do so.

Article 2 focuses on the effect of MIS on firm-beneficial user behavior. Following the service-dominant logic, the article incorporates a value co-creation perspective between firms and users under consideration of the unique characteristics of MIS. In the same vein as Article 1, MIS are investigated in terms of MIS-facilitated user experiences while theoretical tenets of self-determination theory are applied. However, the study not only considers the influence of the individual experiences on user behavior but also their interactions. By focusing on firm-beneficial behavior that reflects customer value (i.e., commitment, willingness to pay, referrals) the article broadens the understanding of MIS's implications for user behavior. Also, the findings complement the scarce literature on unintended and negative effects of MIS by isolating distinct experiences which lead to those undesirable effects. In sum, this article addresses the question of *whether* MIS support the achievement of firm goals and *how* MIS drive user behavior in terms of which MIS-facilitated experiences trigger the different manifestations of firm-beneficial behavior.

Article 3 centers on the influence of MIS on users and user-beneficial behavior. More precisely, it draws on the findings of Article 1 and 2, which show that specific MIS-facilitated user experiences have both negative and positive effects on user behavior. Therefore, this article relates to social interdependence theory to compare two specific MIS structures that facilitate these experiences. Furthermore, based on the achievement goal theory, two studies reveal that both structures trigger two opposing psychological paths which are specific to social interdependence contexts and influence user behavior and outcomes differently. The article is one of the first to

reveal the influence of MIS on user well-being and additionally contributes to transformative service research by showing that subjective and psychological well-being is affected differently by MIS design. Thus, this article addresses the questions of *whether* MIS support the achievement of user goals as well as *how* MIS drive user behavior.

Overall, the three articles provide a broad understanding of the impact of MIS on users and user behavior and thus their capability of supporting user and firm goals. While Article 1 focuses on user engagement as a goal of both users and firms, Article 2 concentrates on firm-beneficial behavior and Article 3 on user goals in terms of engagement, performance, and well-being. Furthermore, each article draws on different theories to elaborate on the unique aspects of each perspective on MIS and their effects on downstream consequences. Table 4 summarizes the research goals, theories, key findings, and contributions of the respective articles.

Table 4. Overview of the articles

Article	Research goal	Theories	Key findings	Key contributions
Article 1: The Effects of Motivational Information Systems on Continued User Engagement: A Self-determination Theory Perspective	Examining whether and how MIS and MIS-facilitated experiences drive continued user engagement.	Self-determination theory, organismic integration theory	• MIS increase continued engagement in terms of engagement frequency. • Autonomous and controlled regulations simultaneously mediate the relationship between MIS and engagement. • Experiencing social comparison reduces engagement intensity.	• Examining the effects of MIS on actual engagement. • Providing a conceptual model of the psychological processes of MIS. • Providing insights which MIS features facilitate desirable user experiences and behavior.
Article 2: Experiences that Matter? The Motivational Experiences and Business Outcomes of Gamified Services	Revealing whether and how MIS-facilitated user experiences affect firm-beneficial user behavior.	Service-dominant logic, self-determination theory	• MIS-facilitated user experiences of self-development, social connectedness, expressive freedom, and social comparison boost desired business outcomes. • Although each user experience fosters firm-beneficial behavior, their interactions can negatively affect desired business outcomes.	• Considering user experiences allows service providers to evaluate the immediate consequences of MIS on firm-beneficial user behavior. • Emphasizing the need to consider the interplay of MIS-facilitated user experiences to avoid firm performance-damaging MIS design.
Article 3: Competition versus Cooperation: How Technology-facilitated Social Interdependence Initiates the Self-improvement Chain	Investigating whether competitive or cooperative goal structures are more effective in helping users to achieve their personal goals (i.e., engagement, performance, and well-being).	Social interdependence theory, achievement goal theory, self-concordance theory	• MIS with competitive goal structures are superior in driving performance and personal growth, while MIS with cooperative goal structures boost engagement and life satisfaction. • Strive for success and fear of failure explain these differential effects on personal goals.	• Comparing the effects of MIS with competitive and cooperative goal structures on user behavior and well-being. • Emphasizing the need to consider both subjective and psychological well-being to evaluate the impact of MIS on users. • Developing an integrative framework that links social interdependence structures with personal goal attainment through different goal orientations.

Table 5 gives an overview of the data, sample, and analysis approach of the articles. Common to all articles is that they rely on primary data. Thus, for gathering data to test the conceptual models of the three articles, experiments and surveys have been conducted. First, Article 1 combines a field experiment and a field study. The field experiment offers high internal validity by randomization of treatments, prevention of self-selection, and endogeneity as well as high external validity by accounting for a real-life environment. The field study establishes an even higher external validity by including a variety of MIS users across various contexts. Both studies have been conducted over a four-week period which also increase the reliability and validity of the data. Second, Article 2 includes a survey which collected data from experienced users of ten MIS across four contexts, leading to high external validity. Last, Article 3 includes an experiment and a field study. The experiment provides high internal validity by randomization, prevention of self-selection, and avoidance of confounding factors. The field study complements the findings by including user data of several MIS across different contexts, leading to high external validity.

Although each study poses different analytical challenges, seemingly unrelated regressions (SUR) could be conducted to test all research models due to the advantages and high flexibility of this approach. SUR accounts for correlated error terms across different equations (Wallace & Silver, 1988; Zellner, 1962) which is needed in all studies as they include multiple dependent variables which are potentially correlated (e.g., different user and firm goals). Further, it allows estimating direct and indirect effects simultaneously in order to assess mediation effects (i.e., psychological processes; Preacher & Hayes, 2008). Moreover, SUR can account for various distributions in data (e.g., continuous and skewed data) by providing the opportunity to specify different density functions across equations (Cameron & Trivedi, 2013). Therefore, SUR is an appropriate approach to test the research models of the studies with the obtained primary data. Additionally, various analytical methods were used, such as bootstrapped mediated analysis,

confirmatory factor analysis, and methods to address self-selection. Detailed descriptions of the analysis approaches are provided in the methods and results sections of the studies.

Table 5. Data, sample, and analysis approach of the articles

Article	Research approach	Data source	Sample size	Contexts	Validity	Further analytical considerations
Article 1: The Effects of Motivational Information Systems on Continued User Engagement: A Self-determination Theory Perspective	Study 1: Field experiment Study 2: Field study	Study 1: Students of the University of Goettingen Study 2: Social media channels	N_{S1} = 106 N_{S2} = 312	Study 1: Nutrition Study 2: Community, education, fitness, nutrition, organization	Study 1: Internal, external Study 2: External	• Tau-equivalent reliability test • Confirmatory factor analysis • Heckman correction factor • Fornell and Larcker test
Article 2: Experiences that Matter? The Motivational Experiences and Business Outcomes of Gamified Services	Survey	Social media channels	N = 511	Education, fitness, nutrition, organization	External	• Tau-equivalent reliability test • Confirmatory factor analysis • Fornell and Larcker test • Harman's one-factor test
Article 3: Competition versus Cooperation: How Technology-facilitated Social Interdependence Initiates the Self-improvement Chain	Study 1: Experiment Study 2: Field study	Study 1: Social media channels Study 2: Social media channels	N_{S1} = 242 N_{S2} = 728	Study 1: Community Study 2: Education, fitness, nutrition	Study 1: Internal Study 2: External	• Tau-equivalent reliability test • Confirmatory factor analysis • Fornell and Larcker test

1.6. Abstracts

1.6.1. Article 1

Digital service providers are increasingly embedding features of hedonic services such as games or social networks to utilitarian services (e.g., nutrition apps, fitness trackers, brand communities, or self-improvement websites) to provide users with motivational support and maintain an active user base. Given this trend, it is critical to understand whether and how those motivational information systems (MIS) influence continued user engagement. In two studies—a field experiment and a field study—the authors demonstrate that MIS can trigger feelings of autonomous and controlled regulation. The activated path determines whether user engagement is persistent in terms of engagement frequency and intensity. More precisely, if MIS trigger feelings of controlled regulation (e.g., perceiving pressure) it leads to increased frequency but jeopardizes engagement intensity. Our findings advise service providers how to design MIS in order to boost continued engagement, and hence positive outcomes for users and service providers.

1.6.2. Article 2

Digital service providers are increasingly "gamifying" their services (i.e., enriching non-game services with game elements) to foster additional user value in terms of specific user experiences. Understanding how such experiences of gamified services influence business outcomes is critical. Drawing on service-dominant logic and self-determination theory, this research examines the impact of motivational user experiences (self-development, social connectedness, expressive freedom, and social comparison) on firm-beneficial behavior. Findings from a cross-contextual study reveal that motivational experiences increase these outcomes to different extents. Among the experiences examined, self-development has the strongest effect on business outcomes.

Importantly, some experiences interact in a way that negatively affects those outcomes. For instance, the interplay between social comparison and social connectedness or expressive freedom is dysfunctional and impairs firm-beneficial user behavior. The study's results help service providers to prioritize those experiences that matter most for their business goals.

1.6.3. Article 3

Consumers are increasingly using technologies such as wearables or mobile apps to achieve their self-improvement goals. Such technologies often contain features that enable social interdependence (competition or cooperation) among users to support them in improving their engagement, performance, and well-being (life satisfaction and personal growth). However, the critical question remains: does competition or cooperation best serve users in attaining these self-improvement goals? Evidence from an online experiment and a field study reveals that competition is more effective in driving performance and personal growth, while cooperation is superior in terms of behavioral engagement and life satisfaction. Furthermore, the results indicate that the effects are mediated by strive for success and fear of failure, two counteracting psychological processes. While competition is the stronger trigger for both pathways, downstream effects vary depending on the self-improvement goal considered. This research thus provides insights into whether and how users can best realize their self-improvement goals using technologies that include social features.

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2. Article 1: The Effects of Motivational Information Systems on Continued User Engagement: A Self-determination Theory Perspective

(with Welf H. Weiger and Maik Hammerschmidt)

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Keywords: Motivational information systems; Self-determination theory; Regulation styles; Engagement; User experiences; Mobile apps

2.1. Introduction

In digital markets, service firms, such as mobile or web application providers, predominantly count on business models that generate revenues by advertising, in-app purchases, or paid premium upgrades instead of paid apps (Appel et al., 2020). Therefore, digital service providers' profitability depends on establishing continued user engagement (Eisingerich et al., 2019; Rutz et al., 2019). However, 63% of users do not reuse a new mobile app more than ten times, and digital service providers struggle to maintain an active user base (Localytics, 2017). To promote continued user engagement, service providers add principles of hedonic services such as games or social networks to utilitarian information systems to facilitate additional hedonic value— resulting in so-called MIS (Hassan et al., 2019; Koivisto & Hamari, 2019). The fundamental idea of MIS is to guide users towards appropriate behaviors to achieve system-related goals by providing motivational support (Koivisto & Hamari, 2019). Thus, continued user engagement takes on a dual role in the context of MIS by fostering firms' financial success and supporting users to perform more goal-oriented activities (Kumar & Pansari, 2016; Pansari & Kumar, 2017). MIS are widely established across various domains such as customer relationship management tools (e.g., Salesforce), brand communities (e.g., Huawei), digital fitness programs (e.g., Weight Watchers), mobile learning apps (e.g., Duolingo) or self- improvement websites (e.g., Habitica).

Recent research already reveals that MIS can increase users' intention to engage with co-creation communities (Leclercq et al., 2018) as well as health and dating apps (Eisingerich et al., 2019). However, in such areas dominated by self-set goals, users often fail to walk their talk or procrastinate instead of becoming active (Devezer et al., 2013; Diefenbach & Müssig, 2019; Koivisto & Hamari, 2019). Thus, when examining engagement with MIS, it is crucial to consider actual and continued behavior instead of relying on self-reported intentions. Additionally, prior findings (Mekler et al., 2017; Zimmerling et al., 2019) indicate that MIS might affect the quantity

and quality of behavior differently, which suggests that user engagement should be considered in a more nuanced way (i.e., engagement frequency and intensity). Furthermore, previous research is limited in terms of understanding the psychological processes that lead to continued behavior. While most studies argue that MIS are making activities more enjoyable (Hofacker et al., 2016; Koivisto & Hamari, 2019; Liu et al., 2017), recent findings indicate that the entire motivational spectrum must encompass more than mere enjoyment. For example, a study by Eisingerich et al. (2019) suggests that MIS can lead to compulsion, and Etkin (2016) demonstrated that MIS may even undermine enjoyment in certain contexts. In sum, this raises the questions of whether and how MIS drive continued user engagement.

To fill these research gaps, we draw upon self-determination theory (SDT; Ryan & Deci 2002). SDT posits that although humans have innate tendencies towards personal growth and self-regulated behavior, they may also act on external motivational forces such as MIS (Ryan & Deci, 2002). We further rely on organismic integration theory (OIT)—a mini-theory of SDT—to argue that the extrinsic motivational processes triggered from MIS can either be internalized and facilitate feelings of autonomous regulation or inflict perceived pressure and thereby lead to feelings of controlled regulation (Ryan & Deci, 2000b, 2002). We exploit the strengths of a multi-method approach which focuses on actual and continued engagement of MIS users. In Study 1, we conducted a field experiment that compares a motivational information system with a non-motivational information system (i.e., an information system with no game or social network features). The results provide evidence that MIS drive engagement frequency through both autonomous and controlled regulations. In Study 2, we adopt a more fine-grained approach and examine how different MIS-facilitated user experiences affect engagement to understand how MIS foster both regulation styles. This field study, which includes 14 MIS across five domains, reveals that certain experiences either lead to autonomous or controlled regulation. The findings further

indicate that while both regulation styles increase engagement frequency, feelings of controlled regulation impair engagement intensity.

Our research contributes to the emerging literature on utilitarian services enriched with design principles of games and social networks (e.g., Berger et al., 2018; Huang, 2018). First, we broaden prior findings (e.g., Eisingerich et al., 2019; Leclercq et al., 2018) by revealing how MIS can sustain customer engagement. Our results show that the adoption of MIS can, but not necessarily will, create a win-win situation for users and firms. Users can receive motivational support in pursuing their goals while service providers can simultaneously gain a competitive advantage through increased user engagement frequency. Second, we establish a conceptual and empirical understanding of how MIS may impact continued user engagement through two opposing psychological processes. By considering autonomous and controlled regulation, we move beyond prior research (e.g., Mekler et al., 2017; Sailer et al., 2017; Xi & Hamari, 2019) and additionally include perceived pressure as a potential consequence of MIS which has been overlooked so far. This enables us to shed light on the potentially dark sides of MIS and demonstrate that they can harm intensive engagement when users feel pushed into action. Third, by adopting an experience-centric perspective, we can clarify how MIS activate different regulation styles and different manifestations of continued engagement. Based on these findings, MIS developers can better understand their users' responses to such systems and target their system design initiatives accordingly to avoid detrimental effects and safeguard those outcomes which are equally beneficial for users and firms.

2.2. Conceptual framework

2.2.1. Continued user engagement and motivational information systems

Engagement. The objective of MIS is to guide users towards appropriate behaviors to achieve their system-related goals in domains such as education, fitness, or nutrition, where continued performance of goal-related activities is key to success. To establish such behaviors, users need to frequently engage with the systems (Servick, 2015). Engagement—understood as the user's motivationally driven, volitional investment of resources into interactions with a system (Brodie et al., 2011; Hollebeek et al., 2019)—encompasses cognitive, emotional, social, and conative dimensions. Because these different dimensions will ultimately manifest in actual engagement behavior (Brodie et al., 2011; Hennig-Thurau et al., 2010), we focus on the latter to conceptualize continued user engagement which refers to the time and effort invested by the user in the service system (Flaherty et al., 2019).

In the context of information systems, prior research has focused on frequency of use to examine continued user engagement (e.g., Rutz et al., 2019). We argue that the intensity of use represents an additional constituting facet of continued user engagement in the context of MIS since it indicates the effort made in performing goal-related activities as well as the investment in the relationship with the service (provider) and hence the qualitative component of engagement. Thus, in the present research, we distinguish between *engagement frequency* as the number of system use episodes in a given time period (i.e., "quantity" of encounters), and *engagement intensity* as the length of a system use episode indicating a user's stickiness (i.e., "quality" of encounters; Dagger et al., 2009; Deci & Ryan, 2000; Gupta et al., 2004).

Motivational information systems. User engagement depends on the expected value drawn from experiences arising during system use (Brodie et al., 2011; Vivek et al., 2012). To engage users continuously, systems are designed to facilitate a wide array of experiences that provide value

to the user (Stocchi et al., 2018). In the context of media engagement, Calder et al. (2009) and Stocchi et al. (2018) argue that the experiences should provide utilitarian as well as hedonic value. MIS are specifically designed to offer both (Koivisto & Hamari, 2019). By supporting users in achieving their goals, MIS provide utilitarian value (i.e., reaching a goal that is separate from the system use itself; Davis, 1989). At the same time, the users should enjoy interacting with the systems, offering hedonic value (i.e., having fun when using the system; van der Heijden & Heijden, 2004). More precisely, the objectives of MIS' use are related to effectiveness and thus utilitarian, however, the means by which the systems promote effectiveness are hedonic in nature (Koivisto & Hamari, 2019). To provide hedonic value to users and to enhance continued engagement, MIS draw on design principles of hedonic services. The most established MIS designs are based on games and social networks (Hassan et al., 2019; Koivisto & Hamari, 2019). Games are played for their own sake, as people enjoy them (Ryan et al., 2006). By implementing features of games such as points, badges, or leaderboards in information systems, providers aim to arrange goals in a SMART (i.e., specific, measurable, achievable, relevant, and time-bound) way and supply users with informational and affective feedback (Hamari et al., 2018; Huotari & Hamari, 2017; Wolf et al., 2018). Social networks leverage the nature of human beings by providing a sense of belonging and help to define oneself through social feedback (Festinger, 1954; Liu et al., 2013; Ryan & Deci, 2002). Service providers aim to afford social support by embedding features of social networks such as friending, sharing, or social feedback (e.g., thumbs up). While some features cannot exclusively be allocated to one of the design principles (e.g., groups or leaderboards), most MIS often combine features of different principles. Nowadays, MIS are well established in various domains such as fitness (Freeletics, Nike+), education (Duolingo, Babbel), and habit formation (Habitica, stickK).

Previous literature on MIS and engagement. Several qualitative studies in the domains of brand communities, healthcare, and co-creation indicate that MIS could lead to enhanced behavioral engagement (Hammedi et al., 2017; Harwood & Garry, 2015; Leclercq et al., 2017; Robson et al., 2016). These results are in line with quantitative studies showing that MIS positively affect behavioral engagement intention (Eisingerich et al., 2019; Leclercq et al., 2018, 2020). In the domains of health and dating, Eisingerich et al. (2019) found that design principles of MIS enhance system use intention. In several experiments, Leclercq et al. (2018, 2020) demonstrated that depending on the design, MIS can enhance the intention of participation in co-creation communities. Further, previous studies have shown that MIS can enhance the willingness to pay for a service and increase the intention of referrals (Stocchi et al., 2018; Wolf, Weiger, et al., 2020), which are both considered as outcomes of behavioral engagement (Kumar & Pansari, 2016). Additionally, Zimmerling et al. (2019) have experimentally found that MIS design can enhance the quantitative output in an idea contest, but not the quality.

In summary, these findings indicate that MIS can increase actual engagement behavior even if this has not yet been confirmed empirically. However, these studies do not address whether MIS can actually promote continued user engagement, or whether it fades after the initial attraction, as studies only capture the intention to engage which users often fail to enact (Etkin, 2016; Liu et al., 2017; Wemyss et al., 2019). In addition, while previous research focused on the effects of MIS on the intention to engage frequently, the influence on engagement intensity as an indicator of the quality of the behavior has so far been neglected. This is surprising because engagement intensity is crucial to the success of many business models of digital service providers as well as to the achievement of users' goals (Appel et al., 2020; Devezer et al., 2013).

Previous literature on how MIS drive engagement. As stated previously, to achieve continued user engagement, MIS are designed to let the user draw hedonic value from using the system itself,

beyond the utilitarian benefit of supporting the users' goal achievement. In order to do so, such systems focus on making the usage more enjoyable and perceived as self-regulated (Koivisto & Hamari, 2019; Liu et al., 2017). Even though the psychological processes of MIS have been examined by prior studies, it is still unclear which mechanisms MIS actually trigger to drive behavior (Koivisto & Hamari, 2019). In fact, prior research indicates that MIS may drive behavior in different ways (Landers et al., 2019; Mekler et al., 2017; Sailer et al., 2017; Xi & Hamari, 2019). While some studies show that MIS foster need satisfaction (e.g., Sailer et al., 2017; Xi & Hamari, 2019), others find no effect (e.g., Landers et al., 2019; Mekler et al., 2017) and suggest that MIS only foster extrinsic motivation. However, the consideration of different but simultaneously triggered psychological paths to explain these inconclusive findings has been neglected so far. To close this gap, we will next draw on SDT to explain the different psychological processes that may occur during MIS use.

2.2.2. Self-determination theory

Fundamentals of SDT and OIT. SDT is a meta-theory of human motivation which emphasizes that people act based on intrinsic and extrinsic reasons (Ryan & Deci, 2002). SDT differentiates between intrinsic motivation, carrying out a self-initiated activity for its own sake because it is interesting and enjoyable, and extrinsic motivation, where people do something for instrumental reasons (i.e., outcomes external to the behavior itself) which is the case when using supportive services such as MIS. OIT, a mini-theory of SDT, argues that extrinsic motivation can lead to feelings of autonomous or controlled regulations (Deci & Ryan, 2000; Ryan & Deci, 2000b). In essence, such perceived regulation styles describe the degree of internalization of extrinsically motivated behavior. The stronger the internalization of behavior (i.e., degree of perceived self-regulation of behavior), the more the extrinsic motivation is perceived as autonomous and less controlling. Vice versa, if a certain behavior is not internalized, it is perceived as less autonomous

and more controlling. However, both regulation styles may exist in parallel and operate simultaneously, but independently of one another, as external stimuli may inflict various reasons for certain behavior (Ryan & Deci, 2002).

Regulation styles. Autonomous regulation (i.e., "I want to do this") is experienced when people act freely and volitional, while controlled regulation (i.e., "I have to do this") is experienced when people feel forced to do something due to external factors (Howard et al., 2017). More precisely, feelings of controlled regulation are present when people act to obtain tangible rewards (e.g., monetary incentives) or avoid punishment from external sources and to avoid feelings of guilt or shame, to enhance self-esteem or their social status. On the contrary, feelings of autonomous regulation occur when behavior is perceived as personally valuable, meaningful, and an expression of oneself (Deci & Ryan, 2000; Howard et al., 2017). Whether a behavior is perceived as rather autonomously or controllingly regulated depends on the satisfaction of the three basic psychological needs.

Needs satisfaction and regulation styles. SDT posits that people are inherently active and have a natural tendency to internalize the regulation of uninteresting though important activities. However, contextual factors (e.g., used systems) play an important role for the internalization of extrinsic motivation (Deci et al., 1994; Ryan, 1995). Depending on the extent to which contextual factors promote the satisfaction of the three basic psychological needs of autonomy, competence, and relatedness, the internalization process is facilitated or forestalled (Deci & Ryan, 2000; Ryan & Deci, 2002). Autonomy relates to perceiving oneself as the origin of one's behavior, competence refers to feeling effective in one's environment, and relatedness refers to feeling connected to others (Deci & Ryan, 1985; Ryan & Deci, 2002). OIT suggests that situations which foster the satisfaction of those three needs lead to perceptions of stronger autonomous regulation, whereas hampering the satisfaction will end in feelings of controlled regulation (Deci & Ryan, 2000; Ryan & Deci, 2002).

Importantly, both regulation styles may release the necessary psychological resources to develop the willpower to repeatedly engage in an activity (Ryan & Deci, 2000c), although the underlying reasons for the behavior vastly differ.

Applying SDT to the MIS context. We suggest that SDT is particularly helpful in explaining the reasons behind MIS engagement because it allows the consideration of different regulation styles for user behavior. More precisely, we emphasize the importance of focusing on the internalization of extrinsic motivation when investigating MIS engagement behavior. In general, engaging with MIS is extrinsically motivated because people start using MIS for instrumental reasons (e.g., learning a new language or losing weight). In other words, an MIS represents an external stimulus which provides the initial impulse to take actions while it is designed to be meaningful and supportive for pursuing user goals at the same time (Blohm & Leimeister, 2013; Liu et al., 2017; Nicholson, 2012). Further, by utilizing design principles of games and social networks, MIS aim to facilitate the three basic psychological needs (Sailer et al., 2017; Xi & Hamari, 2019). Thus, MIS are well suited to facilitate the internalization of external motivation and lead to feelings of autonomous regulation. Nevertheless, it cannot be ruled out that MIS are perceived as partially controlling. Objectives set by MIS, for example completing a task within a certain time frame (e.g., run 5 miles under 40 minutes) or encouraging social comparison between MIS users (e.g., ranking of users based on the total number of miles run), may lead to perceived pressure (Peters et al., 2018). Thus, MIS may also result in behavior merely performed to avoid feelings of shame or to enhance social status.[5] Accordingly, MIS can trigger both autonomous (i.e.,

[5] In the context of MIS use, we rule out feelings of controlled regulation based on obtaining (tangible) rewards or avoiding punishment. Although MIS offer (non-tangible) rewards such as badges, their main function is to facilitate cognitive, emotional, and social experiences and provide feedback on activities performed with the MIS (Blohm & Leimeister, 2013). This prevents that the resulting behavior is perceived as purely externally regulated as the main function of the reward (e.g., badge) is to provide additional value propositions and support users' goal achievement.

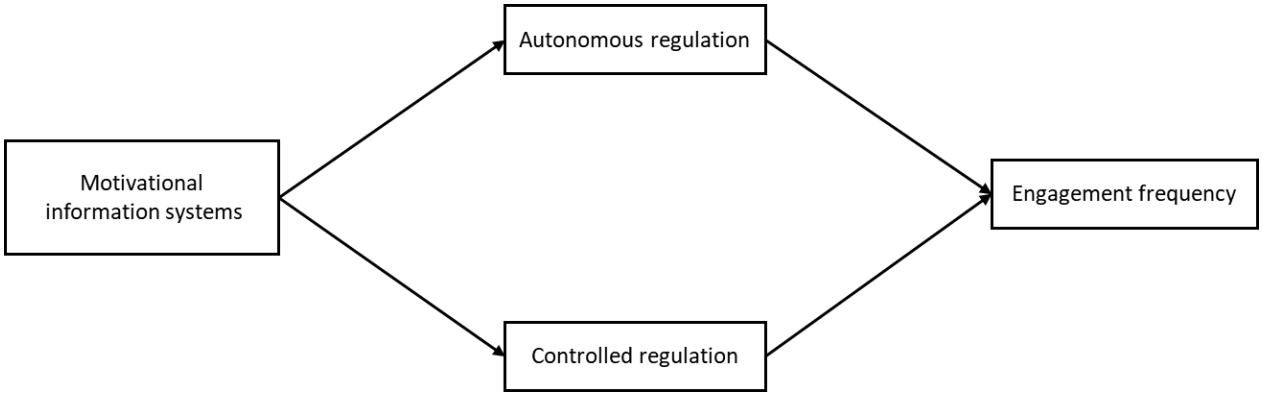
"I use it because I believe it's worthwhile and helps to achieve my goals.") and controlled (i.e., "I should use it because if I don't, I will feel bad about myself.") regulations. We will discuss in more detail the different psychological processes triggered by MIS in the hypothesis development section in the next chapter.

2.3. Study 1

2.3.1. Study goal

The purpose of Study 1 was to investigate the relationship between MIS and continued user engagement. In line with prior literature, we focus on engagement frequency to address the inconclusive effects of MIS found in the literature regarding this engagement facet (Etkin, 2016; Liu et al., 2017; Wemyss et al., 2019). In addition, to examine whether MIS can maintain actual user engagement, we were interested in clarifying through which regulatory style (i.e., autonomous and controlled regulations) MIS drive engagement (see Figure 2).

Figure 2. Article 1: Research model Study 1: The influence of MIS on continued engagement



2.3.2. Hypothesis development

As described, MIS aim at engaging users by applying game and social network principles. In order to implement these principles, features from the said fields are embedded in the MIS (Koivisto & Hamari, 2019). These features facilitate certain user experiences that may stimulate continued user engagement by addressing users' needs (Wolf, Weiger, et al., 2020). For example, MIS set targets related to the users' goals (e.g., assigning a quest to run 10 miles in a week) and provide users with informational feedback on their goal attainment (e.g., displaying the development on a progress graph or awarding a badge for quest completion). Through those features, users can experience competence (Ryan et al., 2006; Sailer et al., 2017; Xi & Hamari, 2019). Further, users have the freedom to customize the MIS (e.g., digital representation of users) and the choice to decide how to interact with the systems in terms of selecting among different functions and tasks. Thereby, users experience autonomy when employing MIS (Ryan et al., 2006; Sailer et al., 2017; Xi & Hamari, 2019). Also, MIS provide the opportunity to connect and communicate with each other (e.g., chats and friending) and enable users to perform activities with others (e.g., participating in team challenges). Those features facilitate experiences of relatedness (Ryan et al., 2006; Sailer et al., 2017; Xi & Hamari, 2019). Therefore, MIS are able to convey the three basic psychological needs which will lead to feelings of autonomous regulation (Deci & Ryan, 2000; Ryan & Deci, 2002). Subsequently, the perceived autonomous regulation should increase users' engagement frequency as users recognize the interaction with the MIS as valuable and helpful to achieve their goals (Deci & Ryan, 2000). Hence:

> *H_1: MIS have a positive effect on engagement frequency which is mediated by autonomous regulation.*

However, MIS not only facilitate experiences which address autonomy, competence, and relatedness. Especially social features can inflict pressure on users as their activities with the MIS are no longer just private (Wolf, Weiger, et al., 2020). Features which rank people based on their performance (e.g., leaderboards) or status symbols reflecting users' achievements (e.g., public badges), belong to the most frequently used features of MIS (Koivisto & Hamari, 2019). Such features can lead to concerns about what others think about ones' performance, which might promote MIS engagement to gain approval. Likewise, they might trigger feelings of guilt or shame if individuals stop using the system (e.g., displayed through declining in leaderboards), which make them feel that they are failing to reach their goals or cause them to be judged negatively by other users for becoming inactive. To avoid these negative experiences, users might engage although the behavior is based on feelings of controlled regulation. Likewise to autonomous regulation, controlled regulation should increase users' engagement frequency, but only to avoid negative consequences and to reduce the perceived pressure (Deci & Ryan, 2000). Thus:

H_2: MIS have a positive effect on engagement frequency which is mediated by controlled regulation.

2.3.3. Method

Design, sample, and procedure. Study 1 employs a field experiment, with a one-factorial (MIS versus non-MIS) between-subject design to test hypotheses 1 and 2. Therefore, we observed subjects' behavior over four weeks after the initial use of the systems. More precisely, we recruited 205 university students who consented to take part in the experiment which included two sessions. For the analysis, we excluded 99 participates because they failed to take part in a follow-up session four weeks later. This resulted in an effective total of 106 participants (67% female, M_{age} = 23

years), of which 52 used the non-MIS and 54 the MIS. As compensation for participating in the experiment, the students received an incentive of $20 independent of actual system use.

For the manipulation we used two existing state-of-the-art nutrition apps (i.e., “Drink Water” and “My Water Balance”) that enable users to track their daily water intake. Both apps aim to help users to stay hydrated by drinking water and offer identical basic functionalities, that is, determining the daily water requirement, logging water intake, and a reminder. The apps are non-branded, and each has identical user ratings in the app stores. Further, both apps are equally structured in that they provide tabs for water input, usage history, and settings, and have a strongly comparable visual design. Both apps offer precise tracking of daily app use through the history function.[6] “Drink Water” only provides utilitarian features in terms of the basic functions to track daily water intake and serves as the control group system (i.e., non-MIS). “My Water Balance” serves as the treatment group system (i.e., MIS), which only differs from the control group app by including five game and social network features in addition to the basic functions: quests (i.e., tasks to achieve daily water drinking goals), badges (i.e., trophies for quest accomplishments), friending (i.e., adding other users to one's in-app network), leaderboards (i.e., rankings of users and their friends based on daily drinking performance), and user profiles (i.e., customizable avatar).

We recruited participants at the university for three days by inviting students, who indicated a minimum level of interest in monitoring their hydration, to establish a representative real-life setting because individuals only download apps if they care about the topic. After the acquisition, participants came to the lab for the first session and were randomly assigned to either the treatment (MIS group) or control condition (non-MIS group). Participants were told that the study is about individual water intake and that the experimenter was interested in “how much water people drink

[6] It was only possible to enter water intake on a daily basis in both apps. Thus, users could not manipulate their data input afterwards.

on average per day." We excluded participants that already used or knew of the selected apps. After introducing the participants to the assigned app by presenting screenshots and explanations of the basic system functions, they installed the focal app on their smartphones and were encouraged to log their water intake on that day. In doing so, the apps first guided them to adjust the reminder and calculate the required daily water intake. Then, they completed a survey about their demographics and first perceptions of the app. After four weeks, participants who opted in to take part in the follow-up session came to the lab again and answered questions about their perceived regulation styles, further app use details, and submitted their actual app use data based on the app's log.

Manipulation checks. At the end of the second survey, we asked participants to answer questions about their app perception. The results reveal that the participants perceived the visual design of the apps equally appealing ($M_{non\text{-}MIS} = 5.27$, $M_{MIS} = 5.61$; $t(104) = 1.32$, $p > .05$; "The app is aesthetically appealing."). Further, both apps have a freemium business model, but contain in-app advertising. The latter is perceived as equally disturbing for both apps ($M_{non\text{-}MIS} = 3.88$, $M_{MIS} = 3.44$; $t(104) = 1.02$, $p > .05$; "The in-app advertising was really disturbing."). Also, there were no app updates that changed the functionality or structure, and no technical issues or marketing campaigns of the providers during the course of the study.

Measures. We relied on established seven-point Likert scales (1 = "strongly disagree" and 7 = "strongly agree") to capture user regulation styles and controls if not stated otherwise. We included MIS as a dummy variable based on the assigned app (non-MIS = 0; MIS = 1). To capture engagement frequency, we aggregated the days of app use across the observation period. We measured autonomous (controlled) regulation using six (three) items ($\alpha \geq .87$) adapted from Ryan and Connell (1989). To allow for independent user regulations, we used regression-based factor scores to capture autonomous and controlled regulation (see Appendix D for factor loadings).

Further, to account for other factors that may explain user engagement, eliminate confounds, and reduce within-group error variance, we also included controls using single items.[7] As system-specific controls we captured user's network size [NWS], reminder usage [REU] and perception [REP], perceived ease of use ([EOU]; Nysveen et al., 2005), aesthetics ([AES]; Mathwick et al., 2001), operating system [OPS], and app compatibility ([COA]; Taylor & Todd, 1995). We also added the user-specific controls variety seeking ([VAS]; Van Trijp et al., 1996), age [AGE], and gender [GEN]. Further, we controlled for the start day when the participants took part in the first session of the experiment. Appendix D provides all scale items used in this study and Table 6 shows the descriptive statistics and correlations.

Model. We adopt seemingly unrelated regressions (SUR) to test the expected relationships because it accounts for correlated error terms across different equations (Wallace & Silver, 1988; Zellner, 1962) and allows us to estimate the direct and indirect effects in our model simultaneously to assess mediation effects (Preacher & Hayes, 2008). Moreover, the dependent variables in the regulation regressions (continuous data) and the engagement frequency regression (skewed count data) follow different distributions, which we can account for in SUR by specifying different density functions across equations (Cameron & Trivedi, 2013).

[7] Single items are sufficient to measure both constructs as they are unidimensional, have a clear meaning for participants, and can be easily and uniformly imagined (Rossiter, 2002).

Table 6. Article 1: Descriptive statistics and correlations for Study 1

Measure	M	(SD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 MIS[a]	.51	.50	1.00													
2 Engagement frequency	10.11	8.87	.08	1.00												
3 Autonomous regulation	3.78	1.63	.34	.47	1.00											
4 Controlled regulation	2.59	1.55	.15	.26	.52	1.00										
5 Network size	1.25	1.53	.07	.25	.31	.10	1.00									
6 Reminder usage	3.04	2.24	-.29	.39	.27	.21	.12	1.00								
7 Reminder perception	3.43	2.10	-.24	-.02	.03	.18	.05	.44	1.00							
8 Ease of use	6.06	1.21	-.03	.19	.09	.07	.10	.10	.06	1.00						
9 Aesthetics	5.44	1.34	.13	.02	.10	-.01	.11	-.15	-.01	.49	1.00					
10 Operating system[a]	.57	.50	.02	-.01	-.03	.12	.06	.07	.05	-.09	-.18	1.00				
11 Compatibility	4.42	1.45	-.15	.13	.25	.14	.13	.22	.27	.31	.23	.05	1.00			
12 Variety seeking	2.88	1.69	-.08	-.12	.10	.22	-.05	.15	.17	.01	-.03	.02	.02	1.00		
13 Age	23.36	2.20	-.04	-.04	-.08	-.10	.03	-.04	.05	.02	-.05	.02	-.05	.18	1.00	
14 Gender[a]	.33	.47	.01	-.15	-.12	-.10	-.06	.14	.14	-.17	-.25	.05	-.01	.20	.20	1.00

[a] Dummy variable.

Notes: $n = 106$; $p < .05$ for $|r| > .19$; based on two-tailed t-tests.

We estimate the three equations simultaneously, with the first two representing the mediator models (autonomous regulation, [AUR], and controlled regulation, [COR], as dependent variables), and the third representing the behavior model (engagement frequency, [EGF], as the dependent variable). We specify a negative binomial regression model for the behavior model due to the count nature of app use data, while specifying regression models with normal density functions for the mediator models.

(1) $AUR_i = \beta_0 + \beta_1 MIS_i + \beta_2 NWS_i + \beta_3 REU_i + \beta_4 REP_i + \beta_5 EOU_i + \beta_6 AES_i + \beta_7 OPS_i + \beta_8 COA_i + \beta_9 VAS_i + \beta_{10} AGE_i + \beta_{11} GEN_i + \beta_{12} SSD_i + \beta_{13} TSD_i + \varepsilon_{1i}$

(2) $COR_i = \gamma_0 + \gamma_1 MIS_i + \gamma_2 NWS_i + \gamma_3 REU_i + \gamma_4 REP_i + \gamma_5 EOU_i + \gamma_6 AES_i + \gamma_7 OPS_i + \gamma_8 COA_i + \gamma_9 VAS_i + \gamma_{10} AGE_i + \gamma_{11} GEN_i + \gamma_{12} SSD_i + \gamma_{13} TSD_i + \varepsilon_{2i}$

(3) $EGF_i = exp[\delta_0 + \delta_1 AUR_i + \delta_2 COR_i + \delta_3 NWS_i + \delta_4 REU_i + \delta_5 REP_i + \delta_6 EOU_i + \delta_7 AES_i + \delta_8 OPS_i + \delta_9 COA_i + \delta_{10} VAS_i + \delta_{11} AGE_i + \delta_{12} GEN_i + \delta_{13} SSD_i + \delta_{14} TSD_i + \varepsilon_{3i}]$

Appendix D defines the variable notations for the scale constructs. We also include control variables: SSD and TSD as second and third start day (reference: first day). ε_{1i}, ε_{2i}, ε_{3i} refer to the error terms of subject *i*.

The estimated regression parameters might be biased by user self-selection since the sample comprises only those who participated in the follow-up session. We corrected for this potential bias by applying Heckman's (1976) two-step correction procedure. In the first step, we estimated a probit model for participation in the follow-up survey based on a sample containing both those who took part in the follow-up survey and those who did not. In this model, we considered demographic factors (i.e., age, gender), and initial interest in using the app (i.e., expected enjoyment; Dabholkar, 1994) as predictors of users' participation in the follow-up study ($p < .05$). Next, based on the probit estimates, we calculated the Heckman correction factor (i.e., inverse Mills ratio) and included it as an additional control in the SUR equation system.

2.3.4. Results

Table 7 provides the results of the SUR models, which show positive and significant effects of MIS on autonomous (β_1 = .72, p < .001) and controlled regulation (γ_1 = .36, p < .05). Autonomous (δ_1 = .38, p < .001) and controlled regulation (δ_2 = .19, p < .05) have positive and significant effects on engagement frequency.

To test the indirect effects of MIS on engagement frequency, we estimated direct and indirect effects simultaneously. We employed bootstrapped SUR (5,000 draws) by building on an empirical sampling distribution of the indirect effects (Zhao et al., 2010). We estimated the indirect effects using the products of coefficient approach. This approach results in bias-corrected bootstrapped confidence intervals for each indirect effect (Hayes, 2009). Supporting H1 and H2, the results show that MIS have a significant positive effect on engagement frequency mediated by both autonomous ($\beta_1\delta_1$ = .27; 90% confidence interval [CI]: lower-level confidence interval [LLCI] = .11, upper-level confidence interval [ULCI] = .49) and controlled regulation ($\gamma_1\delta_2$ = .07; 90% CI: LLCI = .01, ULCI = .19).

2.3.5. Discussion

Study 1 leads to two key take-aways. First, the findings provide initial evidence that MIS increase continued engagement in terms of enhanced engagement frequency compared with non-MIS. Second, autonomous and controlled regulation simultaneously mediate this relationship. Thus, the findings provide evidence that understanding actual user behavior in the context of MIS requires a consideration of the internalization of extrinsic motivation. MIS not only lead to perceptions of autonomous regulation, but also concurrently inflict pressure which leads to feelings of controlled regulation. Notably, both regulation styles increase engagement frequency.

Table 7. Article 1: Results of direct effects for Study 1

	Autonomous regulation		Controlled regulation		Engagement frequency	
Independent variable	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
Constant	1.69	1.40	-.64	1.43	2.89*	1.35
MIS (0 = non-MIS; 1 = MIS)	.72***	.17	.36*	.18		
Psychological processes						
Autonomous regulation					.38***	.10
Controlled regulation					.19*	.08
Controls						
Network size[a]	.06*	.02	-.01	.02	.02	.02
Reminder usage	.14***	.04	.04	.04	.14***	.04
Reminder perception	-.07	.04	.09	.05	-.19*	.05
Ease of use	-.02	.07	.05	.09	.19**	.07
Aesthetics[b]	.15	.22	-.43*	.22	-.27	.18
Operating system (0 = iOS; 1 = Android)	-.17	.15	.24	.17	-.06	.15
Compatibility[b]	.17	.17	.19	.19	-.08	.15
Variety seeking	.06	.05	.11	.06	-.12*	.05
Age	-.05	.04	-.03	.05	-.04	.05
Gender (0 = female; 1 = male)	.10	.26	-.38	.29	.25	.25
Second start day	.00	.16	-.11	.19	-.06	.07
Third start day	-.29	.27	-.04	.24	-.26	.03
Heckman correction factor	-1.17	.63	-.04	.57	-.97	.59
Ln alpha[c]					-.78*	.18
Adj. R^2	.26		.06		.08[d]	

* $p \leq .05$; ** $p \leq .01$, *** $p \leq .001$; [a] logarithm; [b] median split; [c] Dispersion parameter α. Significance indicates that a negative binomial model is preferred to a Poisson model; [d] Pseudo R^2.

Notes: n = 106. To account for heteroscedasticity, we estimated all models using robust standard error.

While this field experiment shows that MIS can actually increase continued MIS engagement, it does not clarify how MIS trigger the different user regulation styles which lead to continued engagement. Thus, in Study 2, we take a more fine-grained approach by focusing on the different experiences facilitated by MIS to understand how MIS foster autonomous and controlled regulation simultaneously. Additionally, we want to explore if both regulation styles are also able to enhance the intensity of engagement with MIS beyond engagement frequency.

2.4. Study 2

2.4.1. User experiences in the MIS context

While a lot of research highlights the importance of user experiences in the context of MIS (Deterding et al., 2011; Huotari & Hamari, 2017; Wolf, Weiger, et al., 2020), most empirical studies have neglected MIS-facilitated user experience so far. However, focusing on the user experiences seems to be especially important in the context of MIS as the goal of MIS is to capitalize on experiences which are similarly powerful as those instilled through gameplay or social network use in order to effectively motivate user behavior (Hassan et al., 2019; Koivisto & Hamari, 2019).[8]

Relying on previous literature and actual MIS design, Wolf et al. (2018) identified four dimensions of user experiences during MIS use. In the first step, the authors collected all mentioned user experiences (e.g., challenge, choice perception, competition, and social interaction) of MIS

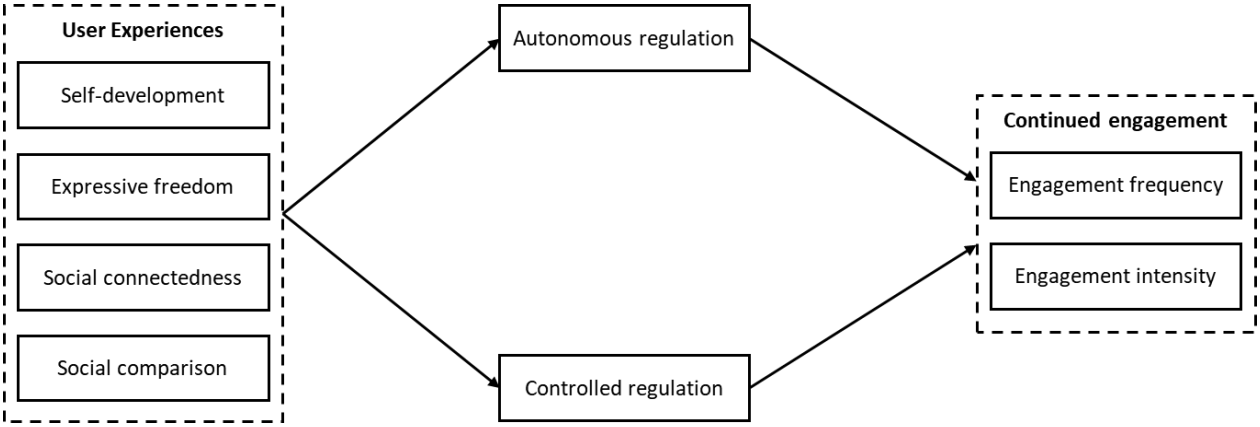
[8] We decided to investigate the influence of MIS through user experiences rather than individual game or social network features for two reasons. First, only users' experiences determine their behavior, while implemented features can only facilitate them (Holbrook, 2006; Verhoef, 2003; Wolf, Weiger, et al., 2020). For example, a system implements a leaderboard, but if users are not aware of it or do not use it, it will not create a competitive or challenging experience. Second, based on its design, the same feature can have different downstream effects. For example, if badges are private, they will just provide users with goals and feedback about their progress. However, if badges are public too, they can create a competitive environment between users – both being completely different experiences despite considering the same feature. Therefore, user experiences are more appropriate to assess the effects of MIS, as they will directly influence psychological and behavioral outcomes (Wolf, Weiger, et al., 2020).

literature or related streams. Then, they reconciled the experiences with a focus group of experienced MIS users, that led to nine specific experiences, which are common during MIS use across different domains. Next, the authors collected data through a survey in which the participants related MIS features to the identified experiences. Based on the data, the user experiences were condensed to four distinct dimensions by using explorative factor analysis. The four experience dimensions are self-development, expressive freedom, social connectedness, and social comparison. We rely on these dimensions as they reflect an extensive spectrum of user experiences evoked by game and social network features in the context of MIS. While other approaches to capture the experiences of MIS revealed similar dimensions of experiences (Eppmann et al., 2018; Högberg et al., 2019), Wolf et al.'s (2018) experience dimensions have the advantage of including both experiences related to games and social network features and thus cover a broader spectrum of experiences than other studies which focused on one of the design principles in particular (i.e., game principles; Eppmann et al., 2018).

2.4.2. Study goal

The purpose of Study 2 was to replicate the results from Study 1 and to understand how MIS foster autonomous and controlled regulation. To achieve these objectives, we focused on the four experience dimensions: self-development, expressive freedom, social connectedness, and social comparison (Wolf et al., 2018; Wolf, Weiger, et al., 2020). In addition to this fine-grained consideration of MIS, we wanted to investigate in Study 2 whether MIS not only have a positive effect on engagement frequency but also intensity (see Figure 3).

Figure 3. Article 1: Research model Study 2: The influence of MIS experiences on continued engagement



2.4.3. Hypothesis development

People experience *self-development* when they are capable of mastering their everyday life through continuous improvement of valued skills and abilities (Bauer & McAdams, 2004; Ryff & Keyes, 1995). This experience dimension includes feelings of being challenged, making progress, and achieving success (Wolf et al., 2018; Wolf, Weiger, et al., 2020). MIS facilitate these feelings by assigning dynamic quests, which are appropriate to a user's current skill level. Thereby, users feel optimally challenged and do not have the impression of stagnation (Csikszentmihalyi, 1975; Peters et al., 2018). MIS also provide users with positive feedback about their progress (e.g., points, performance graphs), instilling a sense of achievement (Hamari et al., 2018). Experiencing self-development should therefore convey competence as users feel effective in their actions (Ryan & Deci, 2002; White, 1959). As a result, users perceive their interactions with the MIS as helpful as well as meaningful and feel autonomous regulation. To preserve and reinforce this feeling of self-regulation, users will continuously engage with the MIS in terms of frequency. Additionally, when autonomously regulated, people perform activities based on perceived value and interest (Deci &

Ryan, 2000; Ryan & Deci, 2002). Thus, users will intensify engagement with MIS resulting in an increase of system use length per episode. Hence:

H_3: Self-development has positive effects on (a) engagement frequency and (b) engagement intensity which are mediated by autonomous regulation.

Expressive freedom prevails if individuals have the possibility to act in their own interest without external restrictions (de Almeida et al., 2014). In MIS environments, this experience dimension contains perceptions of choice and self-expression (Wolf et al., 2018; Wolf, Weiger, et al., 2020). First, MIS use should be perceived as voluntarily per se, as voluntariness is not defined as doing things independently or being in control but rather behave with high willingness and in accordance with personal goals (Peters et al., 2018). Thus, when users choose MIS to serve the fulfillment of personal goals, MIS system structures or quests are unlikely to suppress users' perceptions of choice. Second, by providing options on how to use a system, MIS do not demand specific actions from their users and allow for a sense of volition in acting (Peters et al., 2018; Przybylski et al., 2010). Further, by enabling the personalization of MIS, for example in terms of user profiles or avatars, they can convey a sense of ownership. Thus, expressive freedom should address feelings of autonomy. This will make the MIS use more supportive and enjoyable and therefore highly internalized. Thus, this should lead to autonomous regulation and result in more MIS engagement frequency and intensity by helping individuals to express themselves (Peters et al., 2018; Ryan & Deci, 2002). Thus:

H_4: Expressive freedom has positive effects on (a) engagement frequency and (b) engagement intensity which are mediated by autonomous regulation.

The experience dimension of *social connectedness* refers to the formation of interpersonal attachments (Baumeister & Leary, 1995). It includes interacting and cooperating with one another to achieve common goals (Wolf et al., 2018; Wolf, Weiger, et al., 2020). To facilitate social connectedness, MIS contain features like chats or other forms of interaction (e.g., likes) as well as group tasks where users have to solve quests as a team (Peters et al., 2018; Wolf, Weiger, et al., 2020). Experiences of social connectedness create relatedness by increasing feelings of bonding (Deci & Ryan, 2000; Ryan & Deci, 2000a). Feeling related to others when performing an activity will make it more enjoyable and interesting and therefore nurtures autonomous regulation. By connecting users and enabling the support of each other, MIS should increase continued engagement in terms of frequency and intensity (Ryan & Deci, 2002). Therefore:

H_5: Social connectedness has positive effects on (a) engagement frequency and (b) engagement intensity which are mediated by autonomous regulation.

Social comparison refers to the human desire to benchmark one's own skills and accomplishments against those of others (Festinger, 1954). People are inherently motivated to outperform others to gain recognition (Zuckerman & Gal-Oz, 2014). Accordingly, the dimension of social comparison includes experiences such as competition and status concerns (Wolf et al., 2018; Wolf, Weiger, et al., 2020). Popular features of MIS such as leaderboards, which rank users based on their performance, or public badges, which symbolize certain achievements within the system, can inflict social comparison (Koivisto & Hamari, 2019; Wolf, Weiger, et al., 2020). In situations with social comparison, people often act because they want to either avoid feelings of shame for underperforming or to be worshiped for their performance. Hence, this behavior stems from pressure whose locus of causality is perceived as external which then leads to feelings of controlled regulation (Deci & Ryan, 2000; Howard et al., 2017). Controlled regulation, like

autonomous regulation, should lead to enhanced MIS engagement frequency but only to avoid negative feelings or to generate social approval and promoting feelings of worth (Deci & Ryan, 2000). However, we emphasize that just engaging in MIS to dissolve perceived pressure—without interest in the activity itself or recognizing importance or value of the activity—encourages users to minimize the time and effort with each interaction. Consequently, we assume that controlled regulation should decrease MIS engagement intensity. Hence:

H_6: Social comparison has (a) a positive effect on engagement frequency and (b) a negative effect on engagement intensity which are mediated by controlled regulation.

2.4.4. Method

Data collection and sample. To test hypotheses 3 to 6, we conducted an online field study in which we collected data from MIS users across five different service domains: community, education, fitness, nutrition, and organization. To find a representative MIS sample, our goal was first to identify 50 apps in the Google Play Store and Apple App Store.[9] To include the apps in our initial selection they needed to have at least 500,000 downloads, which indicates a minimum level of relevance, visibility, and success. Then, we conducted a pre-study (n = 443) to identify the most popular apps out of the initial selection. For every domain, we included only the apps mentioned by at least 10% of the participants, which yielded 14 apps (see Appendix F for the selected apps).

We collected data using two online surveys, including a diary approach with a four-week interval. To find users of selected apps, we distributed the initial survey across social media channels and online forums directly related to one of the apps or the respective service domain

[9] The MIS selected for Study 2 had varying numbers of game and social network features (minimum = 2, maximum = 9; see Appendix E for an overview of common features), which supports representativeness and ensures high variance of MIS-facilitated user experiences.

(Wolf, Weiger, et al., 2020). We raffled four vouchers worth a total of $100 among all respondents to increase participation rates. We collected data from 821 respondents. Users who had no experience using any of these apps have been excluded from the survey. In the initial survey, the participants first chose one of the 14 apps based on their previous personal experience and usage history. Then, the respondents answered questions on how strong each of the four experiences has been facilitated by the focal app, regulation styles, and several control variables (e.g., demographics and personality traits). After finishing the survey, participants who opted in to take part in a follow-up survey received a digital diary and were instructed to document how often and how long they used the app on a daily basis over 4 weeks (Bolger et al., 2003; Lovett & Peres, 2018).

Second, four weeks after the initial survey, the participants received a personalized link to the follow-up survey. By completing the second survey, respondents had the chance to win one of four vouchers worth a total of $200. Participants reported their actual app use in the last four weeks based on their diary entries. We matched the responses of the initial survey and the recorded engagement behaviors after 4 weeks. We used the resulting sample (n = 312; 69% female, M_{age} = 28; community = 84, education = 31, fitness = 91, nutrition = 80, and organization = 26) for all further analyses.

Measures. We again used seven-point Likert scales (1 = "strongly disagree" and 7 = "strongly agree") to capture all items if not stated otherwise. We captured continued engagement (engagement frequency and intensity) based on the behavior recorded in the digital diary during the four weeks after the initial survey. More specifically, we measured engagement frequency by the number of app uses across the observation period and engagement intensity by the average time spent per use. To capture autonomous and controlled regulation, we adapted the items in Study 1 to the specific service domains ($\alpha \geq .88$). We again rely on factor scores to capture these regulations (see Appendix D). Further, we adopted the nine items from Wolf et al. (2018, 2020) to measure

MIS user experiences. The Cronbach's alphas confirm high construct reliability for all four dimensions of MIS experiences ($\alpha \geq .74$), except expressive freedom ($\alpha = .50$). Due to the insufficient Cronbach's alpha value for expressive freedom, we ran a confirmatory factor analysis to ensure reliability and validity of all experience dimensions. The results suggest that convergent validity (AVE ≥ .52) and composite reliability (CR ≥ .73) are satisfactory (AVE > .50 and CR > .70; Fornell & Larcker, 1981). Further, the Fornell and Larcker's (1981) test suggests sufficient discriminant validity, as all square roots of the AVEs are greater than the correlations between the corresponding constructs and all other constructs (see Table 8). As a result, we relied on the resulting factor scores for further analysis of the user experiences.

Table 8. Article 1: Validity and reliability of experience dimensions in Study 2

Measure	AVE	CR	1	2	3	4
1 Self-development [DEV]	.58	.80	**.76**			
2 Expressive freedom [EXF]	.52	.73	.52	**.72**		
3 Social connectedness [CON]	.61	.76	.19	.41	**.78**	
4 Social comparison [COP]	.99	.99	.19	.14	.29	**.99**

Notes: Bold numbers on the diagonal = square root of the AVE of the focal construct; AVE is average variance extracted; CR is composite reliability.

As controls, we captured network size [NWS], app compatibility [COA], perceived ease of use [EOU], aesthetics [AES], operating system [OPS], variety seeking [VAS], age [AGE], and gender [GEN], corresponding to Study 1. Additionally, we added as system-specific controls brand attitude ([BRA]; Bellman et al., 2011) and perceived update type ([PUT]; Fleischmann et al., 2016), app usage length ([AUL]; "For about how many months have you been using [App]?"), and app version ([APV]; "Do you use the premium version of [App]?"). See Appendix D for scale items and Table 9 for descriptive statistics and correlations.

Model. For the same reasons as in Study 1, we chose SUR to test our expected relationships. Equations 4 and 5 represent the mediator models (autonomous regulation, [AUR], and controlled regulation, [COR], as dependent variables), while equations 6 and 7 represent the behavior model (engagement frequency, [EGF], and engagement intensity, [EGI], as dependent variables). As in Study 1, we specify the mediator models with standard linear regression models and the behavioral outcome models with negative binomial regression models. We estimate the four equations simultaneously:

(4) $AUR_i = \zeta_0 + \zeta_1 DEV_i + \zeta_2 EXF_i + \zeta_3 CON_i + \zeta_4 COP_i + \zeta_5 NWS_i + \zeta_6 BRA_i + \zeta_7 PUT_i + \zeta_8 AUL_i + \zeta_9 EOU_i + \zeta_{10} AES_i + \zeta_{11} APV_i + \zeta_{12} OPS_i + \zeta_{13} COA_i + \zeta_{14} VAS_i + \zeta_{15} AGE_i + \zeta_{16} GEN_i + \zeta_{17} EDU_i + \zeta_{18} FIT_i + \zeta_{19} NUT_i + \zeta_{20} ORG_i + \epsilon_{1i}$

(5) $COR_i = \eta_0 + \eta_1 DEV_i + \eta_2 EXF_i + \eta_3 CON_i + \eta_4 COP_i + \eta_5 NWS_i + \eta_6 BRA_i + \eta_7 PUT_i + \eta_8 AUL_i + \eta_9 EOU_i + \eta_{10} AES_i + \eta_{11} APV_i + \eta_{12} OPS_i + \eta_{13} COA_i + \eta_{14} VAS_i + \eta_{15} AGE_i + \eta_{16} GEN_i + \eta_{17} EDU_i + \eta_{18} FIT_i + \eta_{19} NUT_i + \eta_{20} ORG_i + \epsilon_{2i}$

(6) $EGF_i = exp[\theta_0 + \theta_1 AUR_i + \theta_2 COR_i + \theta_3 NWS_i + \theta_4 BRA_i + \theta_5 PUT_i + \theta_6 AUL_i + \theta_7 EOU_i + \theta_8 AES_i + \theta_9 APV_i + \theta_{10} OPS_i + \theta_{11} COA_i + \theta_{12} VAS_i + \theta_{13} AGE_i + \theta_{14} GEN_i + \theta_{15} EDU_i + \theta_{16} FIT_i + \theta_{17} NUT_i + \theta_{18} ORG_i + \epsilon_{3i}]$

(7) $EGI_i = exp[\iota_0 + \iota_1 AUR_i + \iota_2 COR_i + \iota_3 NWS_i + \iota_4 BRA_i + \iota_5 PUT_i + \iota_6 AUL_i + \iota_7 EOU_i + \iota_8 AES_i + \iota_9 APV_i + \iota_{10} OPS_i + \iota_{11} COA_i + \iota_{12} VAS_i + \iota_{13} AGE_i + \iota_{14} GEN_i + \iota_{15} EDU_i + \iota_{16} FIT_i + \iota_{17} NUT_i + \iota_{18} ORG_i + \epsilon_{4i}]$

Appendix D summarizes the variable notations for scale constructs. We also include dummy variables for the service domains of education [EDU], fitness [FIT], nutrition [NUT], and organization [ORG] (reference: community). Finally, $\epsilon_{1i,}$ $\epsilon_{2i,}$ $\epsilon_{3i,}$ ϵ_{4i} refer to the error terms of subject *i*.

By opting in to participate in the follow-up survey, the participants self-selected into our sample. To correct sample self-selection, we again rely on the two-step correction procedure employed in Study 1 (Heckman, 1976). In the selection function, we include demographic factors (i.e., gender, education) and previous involvement with the app (i.e., premium app version), which predict participation in the follow-up study significantly ($p < .05$). We included the Heckman correction factor as an additional control in the SUR.

Table 9. Article 1: Descriptive statistics and correlations for Study 2

Measure	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Self-development	4.81	1.42	1.00																			
2 Expressive freedom	3.36	1.36	.39	1.00																		
3 Social connectedness	2.83	1.80	.15	.43	1.00																	
4 Social comparison	2.31	1.56	.18	.27	.35	1.00																
5 Engagement frequency	42.63	51.82	.32	.10	.11	-.01	1.00															
6 Engagement intensity	17.48	18.72	.14	.08	-.09	.26	-.12	1.00														
7 Autonomous regulation	4.60	1.56	.67	.32	.03	.21	.27	.28	1.00													
8 Controlled regulation	2.28	1.58	.31	.12	.02	.11	.31	-.02	.47	1.00												
9 Network size	2.50	7.64	.02	.07	.07	.21	.05	.12	.09	.11	1.00											
10 Brand attitude	5.53	1.18	.38	.32	.26	.12	.16	-.03	.33	.13	.02	1.00										
11 Perceived update type	2.46	1.17	.13	.18	.22	.11	.09	.04	.24	.17	-.01	.06	1.00									
12 App usage length	18.80	15.88	-.10	.07	.12	.10	-.27	.07	-.13	-.22	.17	-.01	.03	1.00								
13 Ease of use	6.17	.90	.27	.19	.20	.07	.14	-.01	.19	-.01	-.03	.6	-.05	.06	1.00							
14 Aesthetics	5.47	1.17	.38	.17	.14	.08	.25	.02	.48	.26	.04	.47	.11	-.07	.49	1.00						
15 App version[a]	.23	.42	.28	.06	.00	.10	.30	.11	.31	.27	.08	.16	.06	-.11	.05	.20	1.00					
16 Operating system[a]	.55	.50	.02	-.12	-.05	-.09	.10	-.07	.01	-.06	-.03	-.07	-.03	-.12	-.01	.00	.00	1.00				
17 Compatibility	4.96	1.31	.34	.29	.23	.07	.26	.00	.35	.26	.11	.45	.18	.00	.36	.42	.10	.00	1.00			
18 Variety seeking	3.04	1.63	.01	-.09	-.04	.12	-.01	.05	.06	.00	.02	-.16	.09	.02	-.13	-.12	.03	-.04	-.06	1.00		
19 Age	28.26	8.69	.13	-.02	.05	.07	.29	.06	.16	.02	.14	.07	.05	-.04	.12	.07	.36	.07	.04	-.08	1.00	
20 Gender[a]	.31	.46	-.06	-.13	.01	.07	-.15	-.03	-.04	-.09	.04	-.15	.03	.10	-.14	-.05	.05	.04	-.14	.10	.09	1.00

[a] Dummy variable.

Notes: $n = 312$; $p < .05$ for $|r| > .11$; based on two-tailed t-tests.

2.4.5. Results

The results in Table 10 show positive and significant effects of self-development (ζ_1 = .36, p < .001), expressive freedom (ζ_2 = .19, p < .001), and social connectedness (ζ_3 = .09, p < .05) on autonomous regulation. Social comparison has no significant influence on autonomous regulation (ζ_4 = .01, p > .10). In contrast, only social comparison shows a positive effect on controlled regulation (η_4 = .12, p < .05; all others $|\eta_{1,2,3}|$ < .07, p > .10). Autonomous (θ_1 = .16, p < .05) and controlled regulation (θ_2 = .13, p < .05) have positive and significant effects on engagement frequency. However, while autonomous regulation (ι_1 = .17, p < .05) increases engagement intensity, controlled regulation (ι_2 = -.12, p < .05) reduces engagement intensity. Interestingly, the controls for the service domains indicate that the regulation styles significantly differ by domains.

We test for mediation effects using the same bootstrap approach as in Study 1 (Preacher & Hayes, 2008). The results presented in Table 11 confirm that self-development ($\zeta_1\theta_1$ = .06; 90% CI: LLCI = .01, ULCI = .11; $\zeta_1\iota_1$ = .06; 90% CI: LLCI = .02, ULCI = .11), expressive freedom ($\zeta_2\theta_1$ = .03; 90% CI: LLCI = .01, ULCI = .07; $\zeta_2\iota_1$ = .03; 90% CI: LLCI = .01, ULCI = .06), and social connectedness ($\zeta_3\theta_1$ = .01; 90% CI: LLCI = .00, ULCI = .04; $\zeta_3\iota_1$ = .01; 90% CI: LLCI = .00, ULCI = .04) have indirect positive effects on engagement frequency and intensity through autonomous regulation, supporting H3-H5. Confirming H6a, social comparison only increases engagement frequency through controlled regulation ($\zeta_4\theta_2$ = .02; 90% CI: LLCI = .00, ULCI = .05). In contrast, social comparison shows a negative indirect effect on engagement intensity through controlled regulation ($\zeta_4\iota_2$ = -.02; 90% CI: LLCI = -.04, ULCI = -.01) verifying H6b.

Table 10. Article 1: Results of direct effects for Study 2

	Autonomous regulation		Controlled regulation		Engagement frequency		Engagement intensity	
Independent variable	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
Constant	-2.26***	.62	-.37	.86	-.37	1.01	1.38	.85
User Experiences								
Self-development	.36***	.04	.02	.06				
Expressive freedom	.19***	.04	-.01	.06				
Social connectedness	.09*	.04	.06	.05				
Social comparison	.01	.04	.12*	.06				
Psychological processes					.16*	.08	.17*	.07
Autonomous regulation					.13*	.07	-.12*	.06
Controlled regulation								
Controls								
Network size[a]	.02*	.01	-.03*	.01	.04**	.01	.01	.01
Brand attitude	.13***	.04	.06	.05	-.07	.07	-.06	.05
Perceived update type	.07*	.03	.04	.05	-.01	.05	.11	.05
App usage length	.00	.00	-.01	.00	.00	.00	.00	.00
Ease of use	.07	.05	-.18**	.06	.03	.08	-.03	.06
Aesthetics[b]	-.07	.15	-.06	.21	-.02	.24	-.08	.20
App version (0 = Free Version; 1 = Premium Version)	-.20	.17	.53*	.23	1.31*	.27	.41	.23
Operating system (0 = iOS or Windows; 1 = Android)	.16*	.07	-.11	.10	.12	.11	.05	.10
Compatibility[b]	.08	.09	.25*	.12	.23	.14	-.02	.11
Variety seeking	.06	.04	.01	.06	.06	.06	.05	.05
Age	.00	.00	-.01*	.01	.02**	.01	.00	.00
Gender (0 = female; 1 = male)	.00	.12	-.27	.15	-.72***	.19	-.60***	.15
Education domain	.94***	.14	.00	.19	.15	.26	-.26	.17
Fitness domain	1.26***	.12	.55***	.16	-.64***	.19	.82***	.18
Nutrition domain	.76***	.13	.98***	.18	.76***	.19	-.88***	.19
Organization domain	-.03	.17	.63**	.21	.42	.24	-.92*	.36
Heckman correction factor	-.04	.59	.90	.76	3.18***	.85	1.72*	.83
Ln alpha[c]					-.13*	.08	-.47*	.09
Adj. R^2	.60		.23		.06[d]		.07[d]	

* $p \leq .05$; ** $p \leq .01$, *** $p \leq .001$; [a] logarithm; [b] median split; [c] Dispersion parameter α. Significance indicates that a negative binomial model is preferred to a Poisson model; [d] Pseudo R^2.

Notes: n = 312. To account for heteroscedasticity, we estimated all models using robust standard errors.

Table 11. Article 1: Results for bootstrapped indirect effect estimates for Study 2

Mediation path	Effect	SE	LLCI	ULCI
Self-development → Autonomous regulation → Engagement frequency	.06	.03	.01	.11
Expressive freedom → Autonomous regulation → Engagement frequency	.03	.02	.01	.07
Social connectedness → Autonomous regulation → Engagement frequency	.01	.01	.00	.04
Social comparison → Controlled regulation → Engagement frequency	.02	.01	.00	.05
Self-development → Autonomous regulation → Engagement intensity	.06	.03	.02	.11
Expressive freedom → Autonomous regulation → Engagement intensity	.03	.02	.01	.06
Social connectedness → Autonomous regulation → Engagement intensity	.01	.01	.00	.04
Social comparison → Controlled regulation → Engagement intensity	-.02	.01	-.04	-.01

Notes: n = 312; number of bootstrap resamples = 5,000; LLCI = 90% bias-corrected lower-level confidence interval; ULCI = 90% bias-corrected upper-level confidence interval.

2.4.6. Discussion

The main objectives of Study 2 were to replicate the results of the field-experiment in Study 1 in a non-experimental setting and to reveal how MIS trigger autonomous and controlled regulation simultaneously. Additionally, we wanted to investigate if MIS can also increase engagement intensity regardless of which regulation style is triggered. To understand these relationships, we conducted an online field study collecting data from users of 14 apps across five service domains over a four-week period.

Our findings support the results of Study 1 by showing that MIS increase continued engagement in terms of engagement frequency mediated by autonomous and controlled regulation. Further, the findings reveal that MIS foster autonomous regulation through experiences of self-development, expressive freedom, and social connectedness while they also trigger controlled regulation through social comparison. Furthermore, the results also show that the latter experience dimension can backfire MIS ambitions to enhance continued engagement. While autonomous regulation also enhances engagement intensity, controlled regulation leads to reduced engagement intensity. Once again, these findings underpin the importance of considering the internalization process of extrinsic motivation when designing and examining MIS. The two perceived regulation styles entail different effects on engagement behaviors not only in terms of strength but also direction and explain that MIS can also have detrimental effects on engagement.

2.5. Conclusion

Today, MIS proliferation is growing exponentially (e.g., Statista, 2020b). People use MIS to receive support for achieving system-related goals and firms want to build profitable customer relationships via enhanced system use. But can MIS really increase continued engagement and thus create a win-win situation for both users and service providers? To address this issue, this research

used a multi-method approach to examine whether and how MIS drives continued user engagement. First, the results provide strong evidence that MIS can, but not necessarily will, increase engagement. Second, we show that MIS-facilitated experiences differ in their impact on engagement by triggering two opposite regulation styles of which one has the potential of unfolding undesirable downstream effects that undermine the objectives of MIS and have to be carefully scrutinized.

2.5.1. Research implications

MIS can increase continued user engagement. Although previous research showed that MIS increase the intention to engage (e.g., Eisingerich et al., 2019; Leclercq et al., 2018), some researchers question if MIS can actually promote continued engagement, or whether the effect is only short-term (Etkin, 2016; Liu et al., 2017; Wemyss et al., 2019). To test this assumption, we employed a field experiment, including a control group (i.e., information system with no game or social network features) and a treatment group (i.e., identical core system with additional game or social network features), matched with actual app use tracking across an extended time. The findings demonstrate a positive effect of MIS on engagement frequency, which could be confirmed by a further field study including 14 apps across five service domains. Thus, our findings reveal the importance to consider the hedonic aspects of information systems to assess their downstream behavior effects. This justifies marketing research's increased investigation of systems which initially were purely utilitarian and got enriched with hedonic design principles of games and social networks (e.g., Berger et al., 2018; Eisingerich et al., 2019; Leclercq et al., 2018; Müller-Stewens et al., 2017; Wolf, Jahn, et al., 2020; Wolf, Weiger, et al., 2020).

Adopting a more fine-grained perspective is key to understanding the repercussions of MIS. While the existing MIS literature mostly focuses on the impact of game and social network features (Koivisto & Hamari, 2019), we follow recent developments in the MIS stream and focus on user

experiences which emerge during MIS use (Huotari & Hamari, 2017; Wolf et al., 2018; Wolf, Weiger, et al., 2020). Adopting this experience-centric perspective comes with several advantages. First, adopting a framework of holistic user experience dimensions enables to identify the strength and weaknesses of MIS. While some experiences (e.g., self-development) are strong drivers of the positive effect of MIS on engagement, others have only a weak effect (e.g., social connectedness). Second, the differentiation between the experience dimensions allows to identify undesirable MIS experiences. We reveal that facilitating social comparison might increase engagement frequency but reduce engagement intensity. Thus, MIS are no silver bullets for benefiting users and firms, as our results indicate that they can also harm continued user engagement. Third, by considering the different experience dimensions we can explain how the two opposing psychological processes (i.e., autonomous and controlled regulation) emerge during MIS use. Therefore, it is important to adopt a more fine-grained approach and consider the unique dimensions of MIS-facilitated user experiences when investigating the underlying mechanisms of downstream consequences of MIS.

When examining continued user engagement, differentiating between frequency and intensity is imperative. Even though previous marketing literature suggests that in the context of digital services, behavioral engagement should be assessed in terms of frequency of use (e.g., Rutz et al., 2019), our results indicate that this measure is not sufficient to grasp the full effect of MIS on continued user engagement. While all considered MIS-related experiences affect engagement frequency positively, one impairs engagement intensity. This can be explained by the two triggered regulation styles which affect both engagement forms differently. Therefore, we contribute to the engagement research in revealing that behavioral engagement has different facets which are not aroused by the same forces (e.g., Brodie et al., 2011; Hollebeek et al., 2019; Weiger et al., 2017). Hence, we suggest that future research on digital services and behavioral engagement should

consider both "how frequently" and "how intensively" a system is used. Only then a comprehensive picture of the influence of information systems on continued user engagement can be obtained.

MIS affect a broad motivational spectrum. Previous research has often viewed the adoption of digital services in a more traditional manner in terms of perceived usefulness and ease of use (Chatterjee et al., 2002; Davis et al., 1989; Gilal et al., 2019). However, this does not allow to examine the increasingly important hedonistic aspect of information systems (Hassan et al., 2019). It is necessary to draw on theories that take into account both utilitarian and hedonistic aspects and can explain their influence on user behavior in more detail (Gilal et al., 2019). Hence, we adopted the SDT to the context of MIS, which enabled us to explain how different MIS-facilitated user experiences influence continued user engagement.

Moreover, by applying SDT to MIS research in terms of considering the internalization of extrinsic motivation, we are able to shed more light on the inconclusive findings on the motivational effects of MIS (Landers et al., 2019; Mekler et al., 2017; Sailer et al., 2017; Xi & Hamari, 2019). Evidence from a field experiment and a field study show that MIS affect user engagement through two different regulation styles (e.g., autonomous and controlled regulation). Thus, we encourage researchers to avoid motivational myopia by focusing on enjoyment (i.e., intrinsic motivation) when examining MIS, and instead to also consider less self-regulated psychological processes. More specifically, in contrast to utilitarian information systems, MIS may foster perceptions of autonomous regulation by providing users with feedback on goal accomplishment but on the downside, MIS can also trigger controlled regulation by fueling status concerns among users.

Further, our findings contribute to SDT research in general. MIS as external stimuli have a positive effect on continued user engagement. This can be explained by strong internalization of MIS' extrinsic motivation which leads to feelings of autonomous regulation. However, this is not

always the case, as engagement intensity can also be harmed by MIS. Our results are in line with previous MIS research, which showed that quantity (e.g., frequency of use) can be increased by MIS, but quality (e.g., intensity of a usage episode) might be negatively affected (e.g., Mekler et al., 2017; Zimmerling et al., 2019). Our findings suggest that this is caused by MIS triggering feelings of controlled regulation in addition to autonomous regulation. Hence, on one side, our findings confirm previous literature stating that extrinsic motivation or controlled regulation are not as lasting as intrinsic motivation or autonomous regulation (Deci & Ryan, 2000; Ryan & Deci, 2000b, 2002). But on the other side, our findings show that this is only true for engagement intensity but not engagement frequency, as feelings of controlled regulation also increase continued user engagement in terms of engagement frequency in the MIS context. Therefore, we suggest that when contrasting extrinsic and intrinsic motivation in terms of their behavioral outcomes, future research should differentiate between the "quantity" and "quality" of the behavior to determine differences in motivational strength, especially in the context of digital services.

2.5.2. Practical implications

MIS can improve customer lifetime value. Broadly speaking, our findings justify service providers' increasing investments in MIS (e.g., Mordor Intelligence, 2018). MIS can enhance customer lifetime value by safeguarding continued user engagement as a key driver of purchases and recommendations (Kumar & Pansari, 2016). Thus, enriching initially utilitarian goal-supporting systems with hedonic service principles might improve the productivity of those systems more than maximizing the utilitarian value propositions. However, our results also demonstrate that MIS can have undesired consequences if they evoke "false" experiences.

Objective game and social network features can be linked to MIS-facilitated user experiences. While our results reveal that various user experiences have a different impact on continued user engagement, managers need to know which technical game and social network features facilitate

those experiences in order to optimize MIS. Therefore, we executed an additional survey to link common MIS features[10] (see Appendix E) with the investigated user experience dimensions. 148 respondents (57% female; M_{age} = 27, SD_{age} = 7.52) rated up to five features in terms of how strong each selected feature is associated with each of the experience dimensions. We ended up with 397 ratings of game and social network features in regard to the perceived MIS-facilitated user experiences. Figure 4 displays which features are associated with the four experience dimensions above and below average. Self-development has the strongest association with features such as quests, teams, user levels, badges, and points, while expressive freedom is most strongly linked to user profiles and avatars. Chats, teams, friending, and social feedback are most related to social connectedness, and social comparison is predominantly linked to leaderboards, points, user levels, and badges. However, the findings indicate that managers need to be careful when using game and social network features, since one feature can be associated with different user experiences. For example, user levels, badges, and points strongly relate to self-development and social comparison concurrently. Thus, our findings equip service design executives with practical knowledge of how to foster or avoid certain user experiences, which helps to reduce costly A/B testing.

Understanding MIS-facilitated experiences improves the prediction of customer behavior. Considering that some experiences strongly foster continued user engagement (e.g., self-development), while others initiate a psychological path that may hinder engagement (e.g., social comparison), service managers can better target their system design initiatives. By examining a wider motivational spectrum, our results prevent managers from misreading potentially beneficial features as ineffective and vice versa. Our results especially indicate that managers counting on

[10] The game and social network features have been defined and designed according to the description in Appendix E. These designs are the default of the corresponding features (Lopez & Tucker, 2017; Sailer et al., 2017). As mentioned before, other designs of the features will lead to different user experiences and therefore different user behavior.

business models where profitability depends on engagement intensity need to be careful when fostering experiences of social comparison.

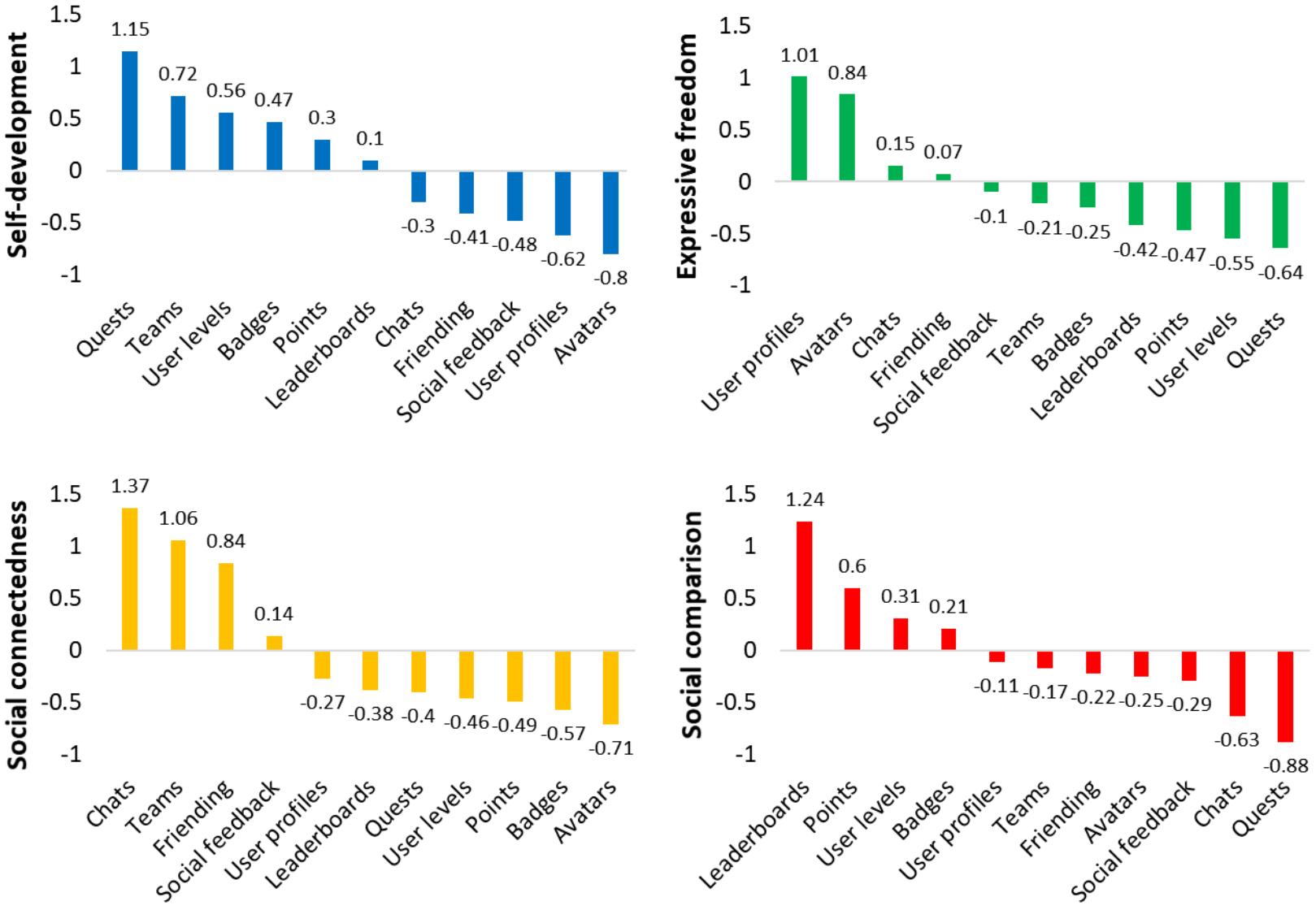
2.5.3. Limitations and future research

Our research has some limitations that merit fruitful avenues for further research. For instance, we considered communities, education, fitness, nutrition, and organization as focal service domains. Future research could tap into other domains, such as financial services, where the dimensions of user experiences may lead to other behavioral outcomes. The effects elicited by the domain-specific variables in Study 2 underscore the need to explore additional domains because our results indicate different motivational effects across service domains.

There could be cultural differences in how strongly different regulation styles (i.e., autonomous and controlled regulation) influence continued user engagement. The participants in our studies originate from a more individualistic country, where satisfaction of one's own desires is paramount. In more collectivist countries, controlled regulation may play a bigger role for service engagement because peer considerations and actions are more dominant.

Similarly, future research endeavors could also focus on identifying moderating factors that may leverage or mitigate the impact of MIS-facilitated experiences on continued engagement, such as service-related (e.g., degree of co-creation) and user-related characteristics (e.g., network size).

Figure 4. Article 1: Relationship between game and social network features and MIS experiences



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3. Article 2: Experiences that Matter? The Motivational Experiences and Business Outcomes of Gamified Services

(with Welf H. Weiger and Maik Hammerschmidt)

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Keywords: Gamification; Gamified services; Service marketing; Self-determination theory; Motivational experiences; Firm-beneficial behavior

3.1. Introduction

The explosive proliferation of digital services has increased service providers' difficulty in standing out from the crowd and has intensified switching behavior (Arora et al., 2017). Switching is particularly evident in the rapidly growing mobile market, where 89% of users churn within just one week after initial app installation (Appboy, 2016). These numbers are alarming, as the profitability of mobile app providers depends on business models where revenues predominantly result from advertising, in-app purchases, or paid-premium upgrades (Liu et al., 2014). Thus, to retain profitable customers and to grow revenue streams, digital service providers need to offer additional value propositions.

One emerging approach to enhance value is gamification, which aims at nurturing user experiences (e.g., competition) through game elements (e.g., badges) that motivate users to achieve personal goals (Deterding et al., 2011; Huotari & Hamari, 2017). Already employed by many companies to engage users (e.g., Nike+ Run Club; Microsoft Ribbon Hero), gamification is expected to grow to $11.10 billion in investments by 2020 (Markets and Markets, 2016).

Gamification has been researched in various contexts such as health (e.g., Hamari & Koivisto, 2015b; Hammedi et al., 2017), education (e.g., Landers & Armstrong, 2017; Landers & Landers, 2014), work environments (e.g., Korn & Schmidt, 2015; Vesa et al., 2017), e-commerce (e.g., Hamari, 2013, 2017), and marketing (e.g., Berger et al., 2018; Müller-Stewens et al., 2017). While some studies have empirically examined the impact of gamification on usage intention (Hamari, 2017; Hamari & Koivisto, 2015a, 2015b; Rodrigues et al., 2017; Suh et al., 2017; Wolf et al., 2018), quantitative research examining the impact of gamified services on firm-beneficial outcomes remains scarce (with the notable exceptions of Hamari & Koivisto, 2015b and Jang et al., 2018). As marketers already have high expectations of gamified services, the need to examine their effectiveness in driving business outcomes beyond service use is critical (Hofacker et al., 2016).

To understand how user experiences stemming from gamified services affect firm-beneficial user behavior, we draw upon a theoretical tandem of service-dominant logic (S-D logic) and self-determination theory (SDT). Prior research suggests that these user experiences can satisfy basic psychological needs or elicit perceived pressure (Ryan et al., 2006; Wolf et al., 2018) and thereby provide motivational value. Thus, to gauge whether gamified services translate into firm-beneficial behavior, we examine how motivational user experiences influence three firm-beneficial outcomes: (1) customer commitment, (2) willingness to pay, and (3) customer referrals. Because gamified services typically facilitate multiple motivational experiences simultaneously, we also consider their interplay in affecting business outcomes.

We conduct a field survey across four service contexts. The dataset comprises 511 users' perceptions of motivational experiences of ten gamified apps that vary regarding the embedded game elements. The results of seemingly unrelated regressions provide evidence that motivational user experiences affect firm-beneficial outcomes differently and not only positively.

The findings contribute to service marketing literature as well as the emerging research stream on gamification in marketing in several ways. First, when examining the impact of gamification on user behavior we concentrate on user experiences instead of game elements (Hammedi et al., 2017; Huotari & Hamari, 2017). Specifically, we draw on S-D logic to argue that gamified services add value-in-use in form of user experiences that occur through users' interaction with game elements embedded in a service (Sandström et al., 2008; Vargo & Lusch, 2008). We show that individuals' experiences related to gamified services have immediate consequences for firm-beneficial outcomes (Payne et al., 2008; Zomerdijk & Voss, 2010). Thereby, we focus on a user-centered perspective to highlight that promoting specific experiences in gamified services can be a powerful approach through which providers are able to co-create value (Hammedi et al., 2017). This

perspective complements seminal research that adopted a design-oriented understanding of gamification (e.g., Mekler et al., 2017).

Second, we draw on SDT to point out that experiences while using gamified services unfold motivational value by either promoting the satisfaction of three basic psychological needs (competence, relatedness, and autonomy) or eliciting perceptions of pressure (Deci & Ryan, 2000; Wolf et al., 2018). Thus, gamified services can nurture inherently pleasurable and satisfying experiences as well as outcome-oriented experiences such as status gains (Hamari et al., 2018; Reeve & Deci, 1996; Ryan et al., 2006). Specifically, we argue that user experiences occurring during the use of gamified services – self-development, social connectedness, expressive freedom, and social comparison (Wolf et al., 2018) – are genuinely motivational and drive firm-beneficial user behavior beyond motivating personal goal achievement.

Third, we provide insights into how the simultaneous occurrence of such experiences plays out for firms. In real life, use of gamified service is often associated with more than one experience at the same time (Wolf et al., 2018). For instance, gamified services that issue public badges could lead to experiencing competition, status, achievement, and challenge. As SDT supports the view that different motivational experiences can emerge simultaneously (Ryan & Deci, 2002), examining the experiences' interactions helps explain behavioral consequences of gamified services that have so far been neglected. This consideration allows for a more realistic picture of the implications of gamified services, and we argue that researchers and managers risk missing performance-relevant aspects if they consider experiences only in isolation.

3.2. Conceptual framework and hypotheses

3.2.1. Firm-beneficial user behavior

To remain profitable, digital service providers depend heavily on customers who commit to continued service use, who are willing to pay for further or more intensive use, and who recommend services to other potential customers. Thus, our framework centers on outcome variables that reflect such firm-beneficial user behavior: customer commitment, willingness to pay, and customer referrals (e.g., Kumar & Reinartz, 2016).

Customer commitment refers to a user's enduring desire to continue a relationship with a service provider and to make efforts to maintain that relationship (DeWulf et al., 2001). Commitment is critical for customer profitability because it translates directly into repeated service use (Cho, 2006). We use *willingness to pay* to refer to the inclination to accept price increases for using a service (Pihlström & Brush, 2008; Zeithaml et al., 1996), which contributes to customer profitability as it is linked to higher customer spending. Finally, we define *customer referrals* as all interpersonal communication containing recommendations of a service (Anderson, 1998). Because consumers perceive customer referrals as more authentic than traditional advertising, referrals are especially potent in persuading others to adopt a service. Recommendations increase profitability as they likely influence an existing customer's own activity with the firm and lead to the acquisition of new customers (Garnefeld et al., 2013).

3.2.2. Gamification as a co-creation process

To foster firm-beneficial user behavior, firms started enhancing their services through gamification to offer additional value (Hofacker et al., 2016). *Gamification* is a process of enhancing a service with game elements. The goal of this process is to facilitate user experiences in form of a game-like feeling and result in user value by providing motivational support (Huotari & Hamari, 2017).

Consequently, the present research considers experiences as genuine drivers of user behavior, and our conceptual framework reflects this user-centric understanding of gamification.

We draw on S-D logic to understand how gamification creates value in terms of user experiences (Zomerdijk & Voss, 2010). S-D logic holds that firms do not provide value through their services but only a value proposition (Vargo & Lusch, 2004). Thus, user value unfolds through a co-creation process between service providers and users. Further, the actual value is determined solely by users' subjective experiences, which arise through the interaction with the provided service, generally referred to as value-in-use (Payne et al., 2008; Vargo & Lusch, 2008). Consequently, experiences can only be facilitated and not provided by service firms (Hume et al., 2006).

Applying S-D logic in the context of gamified services, we first argue that the game elements embedded in gamified services offer a value proposition (Zomerdijk & Voss, 2010). Second, the co-created value stems from user experiences as users interact with the gamified service (Sandström et al., 2008; Vargo & Lusch, 2008). Importantly, this understanding integrates the provider and user perspectives, as input from both sides is required to allow for value co-creation.

3.2.3. Motivational user experiences of gamified services

The main idea behind gamification is to leverage the motivational power of games to help users achieve personal goals (Nicholson, 2012). Thus, we focus on motivational experiences arising through gamified service use (constituting the co-created value) to understand gamification's implications for firm-beneficial user behavior. According to SDT, motivational experiences are the reasons for recurrent gamified service use and can be categorized along a continuum of self-determination. High self-determination relates to engaging in an activity for the pleasure and satisfaction derived from the activity itself, whereas low self-determination refers to behavior carried out to achieve outcomes unrelated to the activity (Ryan & Deci, 2000a). Perceptions of high

self-determination arise through satisfaction of the three psychological needs of competence, relatedness, and autonomy. Competence is the need to feel effective in one's ongoing actions and is enhanced by experiencing challenges and coping with these challenges. Relatedness is the need to feel connected to others and stems from experiences of being part of a community. Autonomy is the need to perceive oneself as the origin of one's behavior and emerges from experiencing freedom of choice and acting on the basis of personal interest and values (Ryan & Deci, 2000a). Perceptions of low self-determination relate to experiencing pressure while engaging in an activity, such as when seeking approval, feeling shame, or avoiding guilt (Deci & Ryan, 2000; Gagné & Deci, 2005).

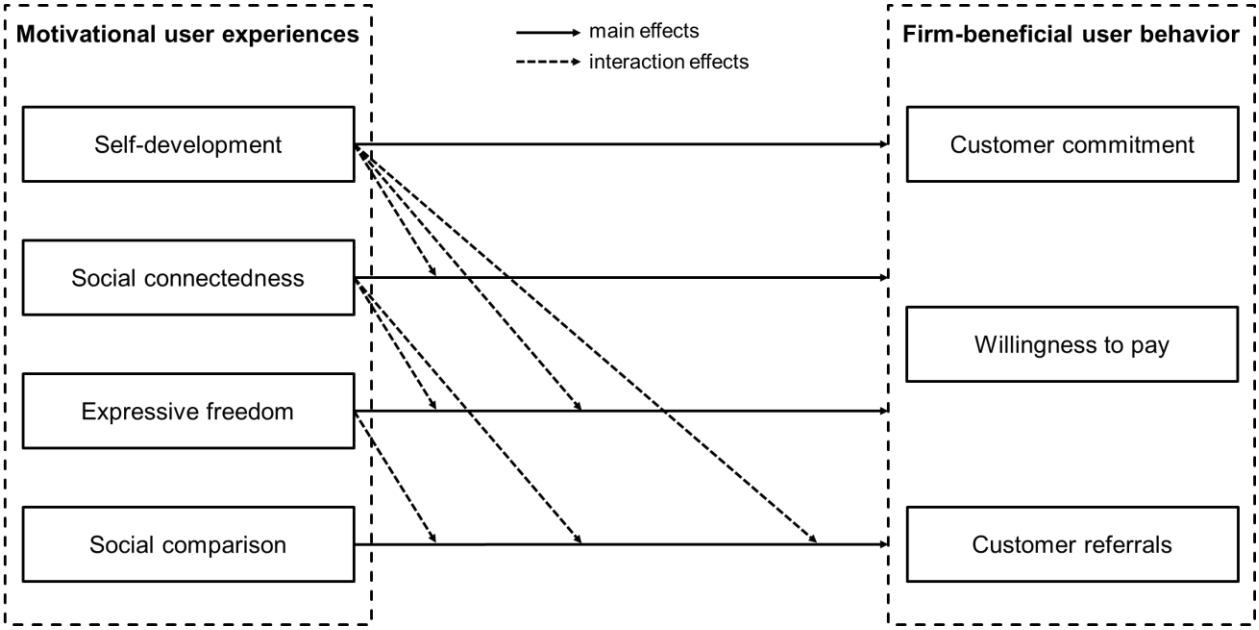
SDT is particularly appropriate for investigating the behavioral impact of various motivational user experiences in the context of gamified services. Psychological need-satisfying experiences occur with full-fledged games (e.g., Peng et al., 2012; Ryan et al., 2006) as well as gamification (e.g., Sailer et al., 2017).[11] In a nutshell, people play games because of the inherent properties of need-satisfying experiences, which create "fun" independent of external contingencies (Przybylski et al., 2010; Ryan et al., 2006). However, although gamified services aim to facilitate experiences that motivate by satisfying the three basic psychological needs, they nevertheless represent external stimuli and thus can inflict a sense of pressure (e.g., through competition). Accordingly, the experiences arising in the context of gamified services may provide different motivational forces for use behavior and thus may influence business outcomes differently (Deci & Ryan, 2000; Peters et al., 2018).

[11] The concept of flow could be another appropriate theory (Csikszentmihalyi, 1975) for investigating the effects of gamification. However, we draw on SDT, as it considers a broader spectrum of motivational experiences, as is the case in this study.

Gamification literature repeatedly lists a plethora of user experiences (e.g., achievement, competition, self-expression, social interaction), which essentially represent motivational experiences but are not necessarily labeled as such (Koivisto & Hamari, 2019). Wolf et al. (2018) identified nine user experiences that are common in the context of gamified service use, which were captured in literature overviews (e.g., Matallaoui et al., 2017), conceptual articles (e.g., Bui et al., 2015), quantitative research (e.g., Suh et al., 2015), and qualitative research (e.g., Lucassen & Jansen, 2014) and then matched with insights from a focus group. In the study, users of gamified services rated to what extent common game elements are associated with the experiences, resulting in four distinct dimensions of user experiences: self-development, social connectedness, expressive freedom and social comparison (Wolf et al., 2018).

We draw on these findings and relate the identified experiences to the pillars of SDT to elaborate whether they reflect relevant motivational user experiences that affect firm-beneficial user behavior. Given that individuals primarily use services to gather satisfying experiences (Holbrook, 2006) and that games and gamified services are designed to evoke pleasurable, need-satisfying, or supportive experiences to achieve personal goals (Huotari & Hamari, 2017; Ryan et al., 2006), we argue that the four user experiences stemming from gamified services will influence firm-beneficial user behavior by creating additional user value (Lemon & Verhoef, 2016). Furthermore, we assume that some of those motivational experiences interact positively in that they are even more satisfactory to users if they emerge concurrently, but other experiences may evoke interactions that are unpleasant and hamper firm-beneficial behavior (see Fig. 5).

Figure 5. Article 2: Conceptual model of motivational user experiences in the context of gamified services and firm-beneficial user behavior



Self-development. Broadly speaking, self-development refers to mastering one's everyday life by continued improvement of abilities and valued skills (Bauer & McAdams, 2004; Ryff & Keyes, 1995). This dimension relates to perceiving achievement, being challenged, and making progress (Wolf et al., 2018). Thus, since self-development is fostered by seeking challenges and advancing effectiveness, we assume that it satisfies the need for competence (Ryan & Deci, 2002; White, 1959). Therefore, in gamified service contexts, perceived self-development is enhanced when tasks deliver ongoing challenges and the service provides positive feedback (Ryan et al., 2006). For example, game elements like points or badges represent feedback mechanisms for achieving progress and reaching goals (Hamari et al., 2018). Other typical features, such as digital coaches who assign missions or quests adapted to users' skill levels, also make people feel challenged and result in continued experiences of self-development (Peng et al., 2012; Przybylski et al., 2010). Thereby, gamified service users are less likely to be either bored or overwhelmed and are able to sustain the desired activity (Csikszentmihalyi, 1975). Hence, we propose that experiencing self-

development through a gamified service can also provide increased enjoyment like playing video games (Peng et al., 2012; Przybylski, Ryan, & Rigby, 2009), which makes this experience valuable for users (Lemke et al., 2011). Thus, we suggest that self-development will foster firm-beneficial behavior like committing to a service provider and recurrently using the service to experience competence need satisfaction and joy (Lemon & Verhoef, 2016), paying for the opportunity to re-experience the satisfaction (Lemke et al., 2011), or recommending the service to share memorable experiences with peers (Pullman & Gross, 2004).

H1: Self-development has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

Social connectedness. Social connectedness refers to the formation of interpersonal attachments (Baumeister & Leary, 1995) and relates to perceptions of social interaction and cooperation (Ryan & Deci, 2002; Wolf et al., 2018). According to SDT, experiencing social connectedness is linked directly to relatedness need satisfaction and is enhanced by activities that foster a sense of belonging (Deci & Ryan, 2000; Ryan & Deci, 2000a). By providing features like commenting or other forms of interaction as well as working together to solve quests, gamified services are likely to facilitate social connectedness experiences (Ryan & Deci, 2000a; Wolf et al., 2018). Experiencing social connectedness is need satisfying and thus increases perceived user value (Deci & Ryan, 2000; Hamari & Koivisto, 2015b). Like self-development, social connectedness will enhance firm-beneficial user behavior in terms of customer commitment, willingness to pay, and customer referrals by providing memorable and meaningful user value (Pullman & Gross, 2004).

H2: Social connectedness has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

Expressive freedom. Expressive freedom is the ability to act in one's own interest without restrictions (de Almeida et al., 2014) and is represented by choice perception and self-expression (Wolf et al., 2018). Experiencing expressive freedom corresponds to the satisfaction of the need for autonomy, as both convey the feeling that behavior originates from oneself (Ryan & Deci, 2002). Minimizing external restrictions in gamified service use and offering a variety of personalization options establish expressive freedom (Deci et al., 1999; Peters et al., 2018). For example, the possibility of presenting oneself fosters self-expression experiences, and providing a wide range of exercises to achieve fitness goals in fitness apps, promotes a sense of choice and freedom (Przybylski et al., 2010; Ryan et al., 2006). Thus, as expressive freedom is valuable and autonomy-satisfying, it will drive firm-beneficial user behavior as users try to prolong obtaining these benefits (Verhoef, 2003), are willing to pay for valuable experiences (Sweeney & Soutar, 2001), and are moved to talk about them (Lemke et al., 2011).

H3: Expressive freedom has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

Social comparison. Social comparison refers to the inherent human desire to benchmark one's own abilities and accomplishments with those of other people (Festinger, 1954). The underlying assumption is that individuals are motivated to outperform others to gain recognition (Zuckerman & Gal-Oz, 2014). Hence, this dimension relates to status concerns and experiences of competition (Wolf et al., 2018). We emphasize that, in line with SDT, social comparison can lead to behavior that seeks to avoid feelings of shame for underperforming or to be admired for one's performance, which both induce perceived pressure to perform (Deci & Ryan, 2000). Thus, social comparison is prevalent in gamified service contexts where users are compared with others or ranked on the basis of performance (Reeve & Deci, 1996). Game elements like leaderboards or ranking lists help users

to gain status or cause rivalry among users (Blohm & Leimeister, 2013). These experiences are inherently satisfying, as humans define themselves through social feedback (Liu et al., 2013), and thus motivate individuals to sustain activities merely for the outcome (Deci & Ryan, 2000; Leary & Kowalski, 1990). In sum, social comparison provides motivational support (Deci & Ryan, 2000) and will increase firm-beneficial user behavior by providing user value during service use (Lemon & Verhoef, 2016).

H4: Social comparison has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

The interaction between self-development and social connectedness. Typically, because gamified services often include multiple game elements, they facilitate different motivational user experiences at the same time. Thus, to understand experiences' impact on firm-beneficial outcomes, we elaborate on whether and how the interplay of motivational experiences can enhance or mitigate users' perceived value.

The need satisfaction of gamified service use should be strengthened by concurrent experiences of self-development and social connectedness (Ryan & Deci, 2000a). We expect that users will perceive increased value when they share their own development with closely connected peers, because recognition from a highly valued reference group is critical for psychological well-being (Barnett et al., 2000; Cialdini & Goldstein, 2004; Hamari et al., 2018). For example, when letting users share or receive praise for their achievements a gamified service facilitates perceptions of progress and belonging simultaneously. Thus, satisfaction of the needs for competence and relatedness should be reinforced (Hamari & Koivisto, 2015a). As argued earlier, need-satisfying experiences should lead to greater user value, which will translate into behavior that enables users to repeatedly gather such experiences or encourages sharing such experiences. Hence:

H5: The interaction between self-development and social connectedness has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

The interaction between self-development and expressive freedom. Further, if self-development and the freedom to express oneself co-exist, mutually reinforcing effects on users' need satisfaction are likely to occur (Fisher, 1978; Ryan, 1982). Goal attainment and achievements are more satisfying when they result from activities carried out voluntarily (i.e., "doing as I want") instead of resulting from external contingencies (i.e., "doing as I should"; Ryan, 1982). For example, when an individual successfully finishes a quest the experience of self-development will be more competence-satisfying and provide more value if at the same time the individual feels autonomous in terms of identifying with the quest's goal (Przybylski et al., 2010). Similarly, if users have the freedom to do whatever they want in a service, the satisfaction of the need for autonomy should increase with a strengthened ability to actually master all challenges (e.g., start and solve the hardest quest). Thus:

H6: The interaction between self-development and expressive freedom has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

The interaction between self-development and social comparison. We expect that experiences of self-development and social comparison, if nurtured together, will reinforce each other to enhance perceived value. For instance, challenging oneself is an important factor for perceiving gains in competence, which can be enhanced when competing with others. Hence, mere competition, regardless of the result, is perceived as challenging, in particular when benchmarking oneself with others who have a comparable skill level (Deci & Ryan, 2000; Reeve & Deci, 1996). When gamified services induce a sense of comparison by ranking users on the basis of their

ongoing progress and simultaneously foster perceptions of being challenged, the resulting value and the satisfaction of the need for competence should be exponentially increased (Liu et al., 2013).[12] Correspondingly, the motivational effect of social comparison will be boosted (e.g., through increased status) when skills are compared in which users are advanced. Hence:

H7: The interaction of self-development and social comparison has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

The interaction between social connectedness and expressive freedom. We suppose that social connectedness and expressive freedom also function as a set of mutually reinforcing experiences in terms of increased need satisfaction. Experiencing social connectedness stems from the feeling of being part of a group (Ryan & Deci, 2002), which has social norms that determine the interaction of group members and can lead to normative behavior to meet the expectations of peers (Goldstein et al., 2008; Hsu & Lu, 2004). However, if a service community's norms match a member's own values, the member's behavior in the community should be perceived as volitional and not "enforced" by group norms. Thus, experiencing social connectedness paired with expressive freedom should increase satisfaction with both relatedness and autonomy needs, resulting in increased user value (Ryan & Deci, 2002). Therefore:

H8: The interaction of social connectedness and expressive freedom has a positive effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

[12] Competition can also be perceived as controlling and thereby impairing self-development experiences (Reeve & Deci, 1996). However, feedback provided by gamified services concentrates on being informational and usually avoids negative framing (Blohm & Leimeister, 2013). Thus, the potential negative effect of social comparison on the satisfying effect of self-development is less likely to occur in this context.

The interaction between social connectedness and social comparison. We expect social connectedness and social comparison to be less satisfying for users when evoked concurrently. When social connectedness is strong, people are concerned about the well-being of their peers and preservation of relationships is paramount (Fiske, 1992). Thus, group members try to avoid situations that can negatively affect group cohesion. However, social comparison can lead to exactly those situations. For example, leaderboards constantly upgrade and downgrade peers by ranking them, fostering issues between members (Hamari et al., 2018; Krasnova et al., 2015) and potentially hampering relatedness need satisfaction in a strongly connected group (Peters et al., 2018). Concurrently, the motivational power of social comparison also shrinks, as in a strongly connected group a member's status is not based solely on performance comparison (Wirtz et al., 2013). Accordingly, we suggest that simultaneously experiencing social connectedness and social comparison will be less desirable and less valuable for users. Hence:

H9: The interaction between social connectedness and social comparison has a negative effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

The interaction between expressive freedom and social comparison. We also propose that the simultaneous occurrence of expressive freedom and social comparison will be less satisfying for users. Because experiencing expressive freedom stems from perceptions of acting out of one's own interests, it is strongly associated with the feeling of self-determination (Ryan & Deci, 2002). However, as social comparison puts external contingencies on the outcomes of expressive freedom, it might be crowded out (de Almeida et al., 2014; Reeve & Deci, 1996). In the case of gamified services, this crowding out effect might occur when users have vast possibilities to reach a goal while using a service, but the activity performance (i.e., outcome) is benchmarked against other users. In other words, social comparison undermines autonomy need satisfaction gained through

expressive freedom. In essence, the ability to individually express oneself conflicts with social comparison, and thus facilitating both experiences concurrently is less satisfying and less valuable for users. Hence:

H10: The interaction between expressive freedom and social comparison has a negative effect on (a) customer commitment, (b) willingness to pay, and (c) customer referrals.

3.3. Method

We conducted an online field survey to collect data on users' motivational experiences with gamified services and their intentions to engage in firm-beneficial behavior. To ensure external validity, the sample contains actual users of gamified apps in different service contexts. We focus on users of ten apps that we selected from 50 apps in four service contexts (education, fitness, nutrition, and organization) on the basis of app popularity.[13] Importantly, to achieve a representative sample and high variance of motivational experiences, we ensured that the selected apps had varying numbers of game elements (minimum = 2, maximum = 9) because these elements constitute the baseline of an app's capacity to nurture motivational experiences and thus also need satisfaction.[14] Table 12 presents an overview of the selected apps contained in the sample, the sample size per service context, and embedded game elements.

[13] We conducted a pre-study (n = 443) to identify the most popular apps among 50 randomly selected gamified apps with more than 500,000 downloads. To pre-select the 50 gamified apps, we trained two research assistants, who were blind to our research goal, to single out gamified apps by conducting a search in the Google Play Store and Apple App Store according to the definition of gamified services used in this research. For every service context, we included only those apps in the main study that were mentioned by at least 10% of the pre-study participants, which yielded ten apps in the selected four service contexts.

[14] Wolf et al. (2018) examined the relationship between game elements and those experiences. The results indicate that every game element is associated with at least one of the motivational experiences.

Table 12. Article 2: Selected gamified apps, sample size per service context and implemented game elements

Service context	Mobile app	Implemented game elements	Number of game elements
Education (n = 94)	Babbel	Badges, friending, points, quests, social feedback, user levels, user profiles	7
	Duolingo	Badges, friending, points, quests, social feedback, teams, user levels, user profiles	8
Fitness (n = 196)	Nike+	Badges, chats, friending, leaderboard, points, quests, social feedback, user levels, user profiles	9
	Runtastic	Badges, chats, friending, leaderboard, quests, social feedback, teams, user levels, user profiles	9
Nutrition (n = 149)	FatSecret	Quests, user profiles	2
	MyFitnessPal	Chats, friending, quests, social feedback, teams, user levels, user profiles	7
	Yazio	Quests, user profiles	2
Organization (n = 72)	Evernote	Quests, user profiles, social feedback	3
	Flatastic	Chats, friending, points, quests, social feedback, user levels, user profiles	7
	Wunderlist	Chats, friending, social feedback, user levels, user profiles	5

Note: For reasons of face validity, we did not assign survey participants to service contexts and, hence, the sample size per service context is unevenly distributed. We account for these differences by controlling for service context in our analysis

3.3.1. Data collection

To target actual users of gamified apps we conducted an online questionnaire, which we distributed across social media groups directly related to one of the focal apps or the respective service context. Four vouchers worth 25€ each were raffled among all participants. We collected data from 571 respondents, who used one of the focal apps at least once. Responses from participants who did not answer the survey completely or answered click-through questions incorrectly were removed from the initial sample, resulting in an effective total of 511 respondents (61% female; M_{age} = 28.23, SD_{age} = 8.53) for further analyses. The course of the survey was as follows. First, on the basis of their previous use experience, participants chose one of the ten gamified apps. Second, the respondents answered questions about their intentions to engage in firm-beneficial behavior toward the app, their motivational experiences with the focal app, and several control variables (e.g., demographics and technology experiences).

3.3.2. Measures

Unless stated otherwise, we used seven-point Likert scales (1 = "strongly disagree" and 7 = "strongly agree") to capture all items. We adapted single items[15] to capture willingness to pay (Pihlström & Brush, 2008) and customer referrals (Maxham & Netemeyer, 2002). To capture customer commitment we adapted two items (DeWulf et al., 2001), and to capture motivational user experiences in the context of gamified services, we adopted nine items from Wolf et al. (2018). The Cronbach's alphas confirm acceptable construct reliability for the experience dimensions ($\alpha \geq .71$), except for expressive freedom ($\alpha = .50$; Nunnally, 1978). Owing to the insufficient Cronbach's alpha value for expressive freedom, we ran a confirmatory factor analysis to ensure reliability and

[15] Single items are sufficient to measure both constructs as they are unidimensional, have a clear meaning for participants, and can be easily and uniformly imagined (Rossiter, 2002).

validity of the motivational experiences. Average variance extracted (AVE ≥ .65) and composite reliability (CR ≥ .79) suggest that the convergent validity and reliability requirements are met for the experience measures (AVE > .50 and CR > .70; Fornell & Larcker, 1981). We evaluated the experiences' discriminant validity using Fornell and Larcker's (1981) test, which revealed that all square roots of the AVEs are greater than the correlations between the corresponding experience and all other experiences (see Table 13).[16] The results confirm the four dimensions of user experiences identified by Wolf et al. (2018). Thus, we use the resulting factor scores to measure motivational user experiences in the following analyses.

Table 13. Article 2: Validity and reliability of motivational user experiences

Measure	AVE	CR	1	2	3	4
1 Self-development	.75	.90	**.86**			
2 Social connectedness	.77	.87	.19	**.88**		
3 Expressive freedom	.65	.79	.49	.41	**.81**	
4 Social comparison	.85	.92	.23	.35	.27	**.92**

Notes: Bold numbers on the diagonal = square root of the AVE of the given construct; AVE is average variance extracted, CR is composite reliability.

To eliminate confounds, we included service-specific and user-specific controls. First, we integrated dummies for the app contexts as service-specific controls, since baseline firm-beneficial user behavior may vary across different app contexts (Hofacker et al., 2016). More specifically, baseline customer commitment may depend on the specific purpose of a service (Palmatier et al., 2006), baseline willingness to pay may differ because of context-specific price structures (Liu et al., 2017), and baseline customer referrals may depend on whether the service context is a top of mind activity (Berger & Schwartz, 2011). Further, we used single items to control for user-specific

[16] Each experience loads higher on its corresponding factor than on the others, supporting the discriminant validity of the four dimensions of motivational user experiences (see Appendix G for loadings).

factors: app usage duration, premium users (vs. free users), technology experiences, age, and gender. App usage duration and premium use may explain individual's behavioral outcomes because they reflect a user's retention likelihood (i.e., habitual effect and integration into everyday life) and previous involvement (e.g., personal importance of the service and previous economic investment) regarding the focal app (Datta et al., 2015). Further, prior research suggests that differences in user behavior may be due to technology experience, as experience with apps and technology in general might increase perceived usefulness and self-efficacy (Olsson et al., 2016), to age, as older users might extract less value (Bittner & Shipper, 2014), or to gender, as females are more likely to perceive social benefits from gamified service use (Koivisto & Hamari, 2014). See Appendix G for items and Table 14 for descriptive statistics and correlations.

We tested for common method bias as all measures are self-reported and the majority of items were measured using Likert scales. The results of Harman's one-factor test reveal the presence of six distinct factors behind the nine motivational experience items and the four firm-beneficial behavior items, where the first factor accounted for 32% of the total variance. Thus, the results demonstrate that common method bias did not contaminate the results of this study (Podsakoff & Organ, 1986).

Table 14. Article 2: Descriptive statistics and correlations

Measure	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1 Self-development	4.92	1.41	1.00											
2 Social connectedness	2.56	1.64	.19	1.00										
3 Expressive freedom	3.22	1.38	.49	.42	1.00									
4 Social comparison	2.33	1.62	.23	.36	.29	1.00								
5 Customer commitment	4.40	1.42	.34	.20	.22	.32	1.00							
6 Willingness to pay	2.30	1.70	.34	.25	.23	.33	.42	1.00						
7 Customer referrals	5.90	1.22	.36	.12	.03	.18	.43	.19	1.00					
8 App usage duration	17.24	16.01	-.07	-.10	.17	.03	.09	.01	-.04	1.00				
9 Premium app[a]	.19	.39	.18	.13	.13	.16	.10	.42	.03	-.05	1.00			
10 Technology experience	5.07	1.54	.22	.16	.18	.17	.23	.14	.20	.13	.09	1.00		
11 Age	28.23	8.53	.11	.10	.14	.09	.12	.20	.08	.00	.37	-.02	1.00	
12 Male[a]	.39	.49	-.10	.06	.10	-.08	-.13	-.03	-.17	.12	-.05	.08	-.06	1.00

[a] Dummy variable.

Notes: $n = 511$; $p < .05$ for $|r| > .10$; based on two-tailed t-tests.

3.3.3. Model

Our model contains three multiple regression equations for customer commitment (CUC), willingness to pay (WTP), and customer referrals (CUR) as the outcome variables. The relatively strong correlations between customer commitment and the other two outcome variables ($r \geq .42$) indicate that a separate estimation with ordinary least square regression models would be inadequate and lead to biased, inconsistent results, because the errors would correlate across equations (Johnston & DiNardo, 1997). A Breusch-Pagan test for independence ($\chi 2 = 112.82$, $p = .00$) confirms the significant contemporaneous correlation among the error terms across the three equations and shows that the endogenous variables are not stochastically independent from the error terms. This finding seems reasonable as our three dependent variables all represent firm-beneficial user behavior (Kumar & Reinartz, 2016). To avoid the potential violation of the assumption of independent observations and standard error inflation and to conduct joint hypotheses testing among coefficients across different equations, we use seemingly unrelated regressions (SUR; Kashyap, Antia, & Frazier, 2012). SUR modeling estimates a system of multiple equations while accounting for cross-equation parameter restrictions and correlated error terms (Parker & Dolich, 1986; Zellner, 1962). We estimate the following equation system:

(1) $$CUC_i = \beta_0 + \beta_1 DEV_i + \beta_2 CON_i + \beta_3 FRE_i + \beta_4 COM_i + \beta_5 DEV_i \times CON_i + \beta_6 DEV_i \times FRE_i + \beta_7 DEV_i \times COM_i + \beta_8 CON_i \times FRE_i + \beta_9 CON_i \times COM_i + \beta_{10} FRE_i \times COM_i + \beta_{11} FIT_i + \beta_{12} NUT_i + \beta_{13} ORG_i + \beta_{14} AUD_i + \beta_{15} PRU_i + \beta_{16} TXP_i + \beta_{17} AGE_i + \beta_{18} MAL_i + \varepsilon_{1i}$$

(2) $$WTP_i = \gamma_0 + \gamma_1 DEV_i + \gamma_2 CON_i + \gamma_3 FRE_i + \gamma_4 COM_i + \gamma_5 DEV_i \times CON_i + \gamma_6 DEV_i \times FRE_i + \gamma_7 DEV_i \times COM_i + \gamma_8 CON_i \times FRE_i + \gamma_9 CON_i \times COM_i + \gamma_{10} FRE_i \times COM_i + \gamma_{11} FIT_i + \gamma_{12} NUT_i + \gamma_{13} ORG_i + \gamma_{14} AUD_i + \gamma_{15} PRU_i + \gamma_{16} TXP_i + \gamma_{17} AGE_i + \gamma_{18} MAL_i + \varepsilon_{2i}$$

(3) $CUR_i = \delta_0 + \delta_1 DEV_i + \delta_2 CON_i + \delta_3 FRE_i + \delta_4 COM_i + \delta_5 DEV_i \times CON_i + \delta_6 DEV_i \times FRE_i + \delta_7 DEV_i \times COM_i + \delta_8 CON_i \times FRE_i + \delta_9 CON_i \times COM_i + \delta_{10} FRE_i \times COM_i + \delta_{11} FIT_i + \delta_{12} NUT_i + \delta_{13} ORG_i + \delta_{14} AUD_i + \delta_{15} PRU_i + \delta_{16} TXP_i + \delta_{17} AGE_i + \delta_{18} MAL_i + \varepsilon_{3i}$

where DEV_i, CON_i, FRE_i, and COM_i are motivational experiences: self-development, social connectedness, expressive freedom, and social comparison. Included control variables are FIT_i, NUT_i, ORG_i as dummy variables for the service contexts of fitness, nutrition, and organization (reference: education context), AUD_i as app usage duration, PRU_i as premium user, TXP_i as technology experience, AGE_i as age, and MAL_i as male. Finally, ε_{1i}, ε_{2i}, ε_{3i} refer to the error terms of subject *i*.

3.4. Results

Table 15 contains the results for the SUR model. In support of H1a/b–H4a/b, the results show that all motivational experiences with gamified services have significant positive main effects on customer commitment and willingness to pay ($\beta_{1,2,3,4} \geq .17$, $p \leq .01$; $\gamma_{1,2,3,4} \geq .19$, $p \leq .05$). Interestingly, for customer referrals only self-development shows a positive and significant effect (H1c: $\delta_1 = .43$, $p \leq .001$), while the effects of other experiences remain insignificant (H2c–H4c: $\delta_{2,3,4} \leq .06$, $p > .10$). Our results yield at least partial support for the hypotheses on the interaction effects of motivational experiences on firm-beneficial outcomes. Specifically, the results indicate that all experience interactions exhibit at least one significant effect on firm-beneficial outcomes, except for the interaction of social connectedness and expressive freedom ($\beta_8, \gamma_8, \delta_8 \leq .04$, $p > .10$). Consequently, H5–H10 are partially supported while H8 is rejected.

In detail, the results support H5c, as the interaction of self-development and social connectedness has a positive significant effect on customer referrals ($\delta_5 = .09$, $p \leq .05$), while H5a/b are not supported because of insignificant effects on customer commitment and willingness to pay

Table 15. Article 2: Main and interaction effects of motivational user experiences on firm-beneficial behavior

Independent variable	Customer commitment				Willingness to pay				Customer referrals			
	Coefficient	SE			Coefficient	SE			Coefficient	SE		
Constant	3.40***	.35			1.79***	.32			5.25***	.27		
Motivational user experiences												
Self-development	.43***	.07	H1a	✓	.44***	.07	H1b	✓	.43***	.06	H1c	✓
Social connectedness	.19**	.06	H2a	✓	.23***	.07	H2b	✓	.01	.05	H2c	×
Expressive freedom	.23***	.06	H3a	✓	.29**	.07	H3b	✓	.05	.04	H3c	×
Social comparison	.17**	.06	H4a	✓	.19*	.08	H4b	✓	.06	.06	H4c	×
Interactions												
Self-development × social connectedness	.01	.06	H5a	×	.05	.06	H5b	×	.09*	.04	H5c	✓
Self-development × expressive freedom	-.03	.07	H6a	×	.12*	.06	H6b	✓	.08†	.05	H6c	✓
Self-development × social comparison	.13*	.06	H7a	✓	.17*	.07	H7b	✓	.10	.06	H7c	×
Social connectedness × expressive freedom	.04	.05	H8a	×	.02	.05	H8b	×	-.02	.04	H8c	×
Social connectedness × social comparison	-.02	.05	H9a	×	-.15*	.07	H9b	✓	-.04	.04	H9c	×
Expressive freedom × social comparison	-.16***	.05	H10a	✓	.02	.07	H10b	×	.03	.04	H10c	×
Controls												
Fitness context	.07	.17			-.03	.19			-.38*	.16		
Nutrition context	.10	.17			.15	.22			.17	.15		
Organization context	.24	.24			-.14	.23			.24†	.20		
App usage duration	.01†	.00			.00	.00			.00	.00		
Premium user	-.02	.15			1.44***	.19			-.18	.13		
Technology experience	.12**	.05			.01	.04			.10**	.04		
Age	.01	.01			.00	.00			.01†	.01		
Male	-.39***	.12			.04	.13			-.34***	.10		
Adj. R^2	.20				.29				.21			
Max. VIF[a]	2.28				2.28				2.28			

† $p \leq .10$, * $p \leq .05$; ** $p \leq .01$, *** $p \leq .001$; [a] Variance inflation factor.

Notes: $n = 511$. To account for heteroscedasticity, we estimated all models using robust standard errors.

($\beta_5, \gamma_5 \leq .05$, $p > .10$). In support of H6b/c, the interaction of self-development and expressive freedom has a significant effect on willingness to pay and a weakly significant effect on customer referrals ($\gamma_6 = .12$, $p \leq .05$; $\delta_6 = .08$, $p \leq .10$). However, this interaction has no effect on customer commitment ($\beta_6 = -.03$, $p > .10$) and thus we find no support for H6a. Further, the results show positive significant interactions of self-development and social connectedness on customer commitment and willingness to pay ($\beta_7 = .13$, $p \leq .05$; $\gamma_7 = .17$, $p \leq .05$), thereby supporting H7a/b, while there is no significant effect on customer referrals ($\delta_7 = .10$, $p > .10$), thus rejecting H7c. H9b is endorsed as the interaction of social connectedness and social comparison shows a significant negative effect on willingness to pay ($\gamma_9 = -.15$, $p \leq .05$), but results show no significant interaction effect on customer commitment and customer referrals ($\beta_9, \delta_9 \geq -.04$, $p > .10$), rejecting H9a/c. Furthermore, the results show a significant interaction effect of expressive freedom and social comparison on customer commitment (H10a: $\beta_{10} = -.16$, $p \leq .001$). However, this interaction has no significant effect on either willingness to pay or customer referrals (H10b/c: $\gamma_{10}, \delta_{10} \geq .02$, $p > .10$).[17]

Furthermore, the majority of the control variables show significant and plausible effects on at least one firm-beneficial user behavior. While customer referrals are infrequent in the context of fitness, they are more numerous for organizational apps in relation to the education context. App usage duration shows a weakly significant positive effect on customer commitment. Additionally, premium users are more willing to pay an extra for an app than users of the free version. Technology experience has positive effects on both customer commitment and referrals. As age

[17] We performed an additional model, which included customer commitment as an independent variable in equations (2) and (3) to compute the effect on willingness to pay and customer referrals. Customer commitment shows a positive significant effect on both firm-beneficial behavior aspects. These results confirm previous findings about the relations between these variables (e.g., Albert et al., 2013). The effects of the motivational experiences and their interactions on firm-beneficial behavior are similar to the reported model.

increases users recommend gamified services more often, and women show more commitment and recommend more frequently than men.

3.5. Discussion, implications, and avenues for future research

Many service providers have started to gamify digital services (Hofacker et al., 2016). So far, however, how experiences during gamified service use influence service providers' business outcomes is unclear. The present research delivers insights into how facilitation of motivational user experiences can lead to three firm-beneficial outcomes for providers of gamified services: customer commitment, willingness to pay, and customer referrals. This research follows an experience-centric approach in which user behavior is assumed to result from value co-creation processes between gamified services and users. As the core idea behind gamification is to motivate users to engage in behavior necessary to achieve personal goals, we propose that motivational experiences occurring during service use are key for understanding the firm consequences of gamifying services.

3.5.1. Discussion

The results of the study are meaningful for service providers who aim to enhance business performance by facilitating motivational experiences. First and foremost, the results demonstrate that motivational user experiences occurring during gamified service use indeed foster firm-beneficial user behavior. Thus, our findings supplement prior research on the impact of gamified services on desired business outcomes (Hamari & Koivisto, 2015b; Jang et al., 2018) by providing insights as to their impact on customer commitment, willingness to pay, and customer referrals. However, not all motivational experiences are equally promising for leveraging these outcomes.

More precisely, facilitating self-development experiences seems to be a silver bullet for providers as it strongly drives all three aspects of firm performance. These results extend previous

literature reviews that emphasize that gamified services primarily aid users in achieving their personal goals (Hamari et al., 2014; Koivisto & Hamari, 2019). Thus, nurturing self-development experiences equally benefits the service user and the service provider. Interestingly, social connectedness, expressive freedom, and social comparison seem to be ineffective for enhancing referrals. We assume that users are likely to recommend apps primarily when they nurture experiences of self-development, as users want to share memorable experiences of personal advancement with their peers. In contrast, when apps establish other-related experiences of social comparison and social connectedness, users may not feel impelled to "recruit" new users because an increased user base could inhibit need-satisfying experiences by threatening the intimacy of the community. Likewise, when users strongly experience behavioral freedom to do what they desire to do, they are not moved to invite others to use the app because they may fear constraint of their expressive freedom owing to social norms.

Second, all interactions between motivational user experiences have an impact on firm-beneficial outcomes, except for the interplay between social connectedness and expressive freedom. This finding implies that no motivational boost occurs if the social norms of a group match one's own beliefs. As an ad hoc reasoning, we suggest that feelings of social connectedness lead to an internalization of social norms, so that no increased effect results when one's own values overlap with the prevailing norms (Deci & Ryan, 2000). The remaining interactions between self-development, social connectedness, and expressive freedom exhibit a positive effect on firm-beneficial user behavior. However, particularly noteworthy is that experiencing social comparison in combination with social connectedness or expressive freedom negatively influences firm-beneficial behavior, whereas the simultaneous occurrence of self-development and any of the other three motivational experiences leads to synergistic interactions that enhance desired business outcomes.

Third, our results suggest that there is no interaction between motivational experiences that drives all three business outcomes at once. This finding indicates that firm-beneficial user behavior is multifaceted and, depending on their experience, users behave differently toward desired outcomes. Importantly, interactions containing social connectedness show no significant effect on customer commitment. This result may be explained by the fact that the selected gamified apps (i.e., the self-improvement context) are not primarily made to bond individuals with other users and therefore do not additionally boost the effect on recurrent app use when the gamified service facilitates another user experience at the same time. Further, consistent with the findings of the main effects on customer referrals, only interactions with self-development additionally increase customer referrals. However, strong social comparison does not increase customer referrals when self-development is also very pronounced. This result may occur because users feel no need to invite more users in order to feel challenged when there is already strong competition with other users.

3.5.2. Research implications

The findings are relevant for service research in general and for research concerned with gamification in marketing in particular. First, drawing on S-D logic, we suggest that user experiences arise from a co-creation process between the service provider and the user (Hammedi et al., 2017; Huotari & Hamari, 2017). Our empirical findings underline the need for taking a more user-centric perspective and shifting the focus from designing game elements to facilitating experiences during gamified service use, as experiences determine user behavior.

Second, by relying on the tenets of SDT we advance the understanding of the motivational repercussions of gamified services (e.g., Ryan et al., 2006; Wolf et al., 2018). Specifically, SDT enables us to theoretically underscore that self-development, social connectedness, expressive freedom, and social comparison either satisfy basic psychological needs or induce perceived

pressure. These experiences constitute a broad motivational spectrum and promote superior user value by supporting users in achieving their goals. By including perceived pressure in the motivational spectrum we expand prior gamification literature, which is restricted to autonomous or intrinsic sources of motivation (e.g., Mekler et al., 2017; Sailer et al., 2017). Thus, we draw future researchers' attention to the fact that gamified services as extrinsic stimuli not only promote "fun" but also can result in perceived stress. Moreover, our findings verify the validity and reliability of the four dimensions of user experiences of gamified services put forward in prior literature (Wolf et al., 2018).

Third, our study contributes to recent research dealing with gameful experiences (Eppmann et al., 2018). While the dimensions of gameful experiences concentrate on experiences more characteristic of games (e.g., absorption), the user experiences examined in our study are not exclusive to games or gamification. Although our motivational user experiences play a central role in explaining the motivational power of games (Przybylski et al., 2009; Ryan et al., 2006), they extend to an explanation of user behavior in other non-game contexts like gamified services. Additionally, we pinpoint that, because service delivery most often occurs in non-game contexts, the experiences emerging during gamified service use might be of a different nature than those occurring while playing a full-fledged game. This broader motivation-centric perspective of user experiences enables us to establish the firm-beneficial consequences of providing gamified services.

Fourth, our results show that contextual as well as user-related variables should be considered when examining user behavior occurring in the context of gamified services. As gamification is applied primarily in digital settings, we agree with previous findings and indicate that the technology experience of the customers should be considered. Further, in line with prior findings our model demonstrates that both age and gender influence behavior in the context of gamified

services. Therefore, inclusion of such variables in future studies is important to mitigate omitted variable bias. In addition, the service context variables included in our model show that baseline business outcomes can vary by context, suggesting that predominant firm-beneficial behaviors depend on the service domain.

3.5.3. Managerial implications

Broadly speaking, our findings justify service providers' inclination to rely on gamified services to nurture additional user value (Hofacker et al., 2016). Facilitating motivational experiences in gamified services can foster retention of valuable customers by enhancing their commitment to a service provider, willingness to pay, and customer referrals. However, our results also demonstrate that undesired consequences for firms can occur when gamified services are directed at "wrong" combinations of user experiences.

First, in line with our suggestion that gamification should be an experience-centered approach, we encourage service providers to shift their focus away from thinking only in terms of game elements when designing gamified services and instead concentrate on facilitating compelling co-created experiences. Experiences can differ depending on the design and implementation of game elements (Morschheuser et al., 2018), underscoring the notion that focusing on user experiences will be more effective for firms.

Second, our findings suggest that by taking a more fine-grained view of motivational user experiences service managers can better understand user responses to gamified services and how each experience is linked to each component of firm-beneficial user behavior.

Third, all three firm-beneficial user behavior components are not influenced by each motivational experience. Depending on which business outcome is the firm's main priority, different experiences and different combinations must be facilitated. For example, as only one

experience is able to trigger recommendations, service managers should consider more effective tools for customer acquisition such as referral reward programs (Ryu & Feick, 2007).

Fourth, the results imply that some combinations of experiences enhance desired business outcomes whereas other combinations harm them. In detail, service providers should design their services to afford the perception of self-development, as it represents an experience that fosters business outcomes alone as well as in concurrence with any other experience. Thus, gamified services that result in self-development benefits drive profit-enhancing user behavior. However, managers should be cautious when facilitating social competition, as blended with other user experiences (i.e., social connectedness, expressive freedom) it can lead to discordant effects and backfire.

3.5.4. Avenues for future research

This research has some limitations that offer fruitful avenues for future research. First, results show that firm-beneficial behavior can be triggered by motivational user experiences. However, while taking this user perspective, our study does not consider how different game elements used in gamified services trigger these experiences. Thus, we leave it for future research to adopt a service-design perspective and consider motivational experiences as a mediator between game elements and business outcomes. Second, as construct development was beyond the scope of this paper, our approach to capture motivational user experiences could benefit from further refinement (i.e., developing additional experience items) and extensive construct validation. Third, while the motivational experiences examined with respect to SDT cover a broad spectrum of motivation, additional experiences might arise in the context of gamified services that could drive behavior. For instance, a promising avenue might be consideration of experiences that are unique to games. Fourth, situational and personality differences in user preferences may exist, such as user competitiveness or user orientation, which could have an impact on the relationship of motivational

experiences and user behavior (Robson et al., 2016). Finally, future research should identify additional drivers of firm-beneficial outcomes in the context of gamified services to provide service firms with valuable insights to maintain or gain a profitable business.

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4. Article 3: Competition versus Cooperation: How Technology-facilitated Social Interdependence Initiates the Self-improvement Chain

(with Steffen Jahn, Maik Hammerschmidt, and Welf H. Weiger)

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4.1. Introduction

The pursuit of self-improvement is booming more than ever. A fast-growing number of people engage in activities such as learning, exercising, and healthy eating to increase their performance in the respective areas and ultimately enhance their well-being (Brand Minds, 2019; Devezer et al., 2013; Etkin, 2016). To achieve such self-improvement goals, they increasingly rely on technologies such as wearables or mobile apps. For example, in 2018 over 78% of U.S. adults used at least one fitness app (Statista, 2018). These technologies often employ features that facilitate social interdependence among users through competitive (e.g., who runs the most miles in a week) or cooperative tasks (e.g., all participants must run a combined 100 miles; Huang, 2018).[18] The reason for enriching self-improvement technologies with such features seems clear: by leveraging the social nature of human beings, these technologies seek to nudge people toward continuous engagement, performance, and well-being.

Competition and cooperation are both thought to stimulate behavioral engagement (e.g., Deutsch, 1949b; Leclercq et al., 2018), performance (e.g., Stanne et al., 1999), and well-being (e.g., Tjosvold et al., 2008). However, empirical findings regarding their impact on well-being are scarce and studies have found differences regarding their effectiveness when it comes to behavioral engagement and performance across various situations, such as contributing to school-construction projects or playing computer games (Kistruck et al., 2016; Peng & Hsieh, 2012). Given that the findings remain inconclusive (i.e., some results favor cooperation, while others favor competition), it is critical to examine which type of social interdependence best facilitates the attainment of self-

[18] In this article we focused on the social aspect of MIS. For this purpose, we relied on competitive and cooperative goal structures. These reflect the main drivers of the experience dimensions social comparison and social connectedness.

improvement goals. Answering this question is key, as it is because of such goals that most users turn to self-improvement technologies in the first place (Anderson et al., 2013).

To address this important gap, we investigate whether competition or cooperation in the context of self-improvement technologies is more effective in helping users to achieve their personal goals (i.e., behavioral engagement, performance, and well-being). We do so by developing a self-improvement chain framework that integrates social interdependence theory (Deutsch, 1949a; Johnson & Johnson, 2005) and achievement goal theory (Atkinson & Litwin, 1960; Elliot & Church, 1997). Based on the nature of social interdependence inherent in competitive versus cooperative goal structures (Johnson & Johnson, 2005), we predict different outcomes for different goals. Specifically, we consider two opposing psychological paths triggered by social interdependencies: a positive path operating through strive for success and a negative path operating through fear of failure. Our results reveal that competition not only arouses strive for success more effectively than cooperation does but also elicits greater fear of failure. Furthermore, strive for success has a stronger impact on performance and personal growth, while fear of failure affects behavioral engagement and life satisfaction to a greater degree. Hence, the relative strengths of the two indirect paths jointly determine whether a competitive or cooperative goal structure will be superior for a specific self-improvement goal.

This work offers three main contributions. First, our study contributes to the literature on the user-related impact of engaging and goal-supporting technologies. Surprisingly, little empirical research has been conducted to compare competition and cooperation in terms of downstream consequences such as user behavior and well-being (for notable exceptions with regard to engagement and performance, see Kistruck et al., 2016; Peng & Hsieh, 2012). We add to existing literature by developing an integrative framework that links competitive (vs. cooperative) goal structure with self-improvement goal attainment through different goal orientations: strive for

success and fear of failure. The two studies conducted within this paper lend support for our framework and demonstrate that there is no silver bullet for users seeking to attain their self-improvement goals. While competition is more effective in enhancing performance and personal growth, cooperation is superior in terms of behavioral engagement and life satisfaction.

Second, the current study contributes to strengthening the paradigm of transformative service research, a movement that mainly focuses on well-being outcomes related to service usage (Anderson et al., 2013). Our research is the first to link competition and cooperation with both subjective and psychological well-being (Diener, 1984; Ryff, 1989), and our findings emphasize the need to consider the two perspectives jointly. We observe a dialectical tension between competition and cooperation with respect to well-being. Depending on whether users' focal goal is life satisfaction (subjective well-being) or personal growth (psychological well-being), they should opt for services that either establish a cooperative structure or leverage competition, respectively. These insights are relevant for policy makers, as they underline the importance of tracking consumer goals and governing technology design and usage accordingly.

Third, we contribute to the pressing question of how to spark shifts in behavior (White et al., 2019). We demonstrate that social interdependence structures trigger behavioral change in the form of increased engagement, which then serves to achieve further self-improvement goals such as increased performance and well-being. In doing so, we also add to the literature on the individual-level psychological processes that drive behavioral engagement (Hollebeek et al., 2019; van Doorn et al., 2010), pointing out that the achievement goal orientations that emerge when users experience social interdependence—namely strive for success and fear of failure as opposing paths—directly influence behavioral engagement. We emphasize in particular that negative emotions (i.e., fear of failure) can erode engagement—an important insight given that previous engagement literature has largely focused on positively valenced drivers (Brodie et al., 2011; Hollebeek et al., 2019).

The remainder of the paper is organized as follows. We begin by reviewing the literature on self-improvement goals and social interdependence structures, as well as empirical results from studies that have linked the two. From these literature insights, we develop hypotheses regarding how competition versus cooperation affects self-improvement goal attainment through strive for success and fear of failure. Through two studies—an online experiment and a field study across various self-improvement contexts—we test which social interdependence structure offers better support in reaching the different personal goals. The article concludes with a discussion of the theoretical and practical implications of the findings.

4.2. Theoretical background

4.2.1. Self-improvement goals

Many people engage with self-improvement technologies to pursue meaningful life goals (Chan & Briers, 2019; Huang, 2018). For example, they may use the Fitbit app to help achieve their objectives of exercising regularly in order to be fit and happy with themselves. In this paper, we conceptualize three distinct self-improvement goals: (1) behavioral engagement, (2) performance, and (3) well-being. While well-being can be seen as a terminal goal in the self-improvement chain, behavioral engagement and performance are not only ends in themselves but also instrumental to improving well-being (for a discussion on instrumental and terminal goals, see Riediger & Freund, 2004; Rokeach, 1973).

Behavioral engagement refers to the level of effort and attention one devotes to carrying out an activity (Curran et al., 2013). In marketing, engagement typically focuses on a customer's motivationally driven, volitional investment of knowledge, skills, and equipment into interactions with service systems (Hollebeek et al., 2019; Pansari & Kumar, 2017). Technological systems in particular are thought to attract engagement behaviors (Kumar et al., 2019; Weiger et al., 2019). In

the context of self-improvement technologies, behavioral engagement captures how invested a user is in initiating and executing self-improvement activities while using said technologies (Gonida et al., 2009).

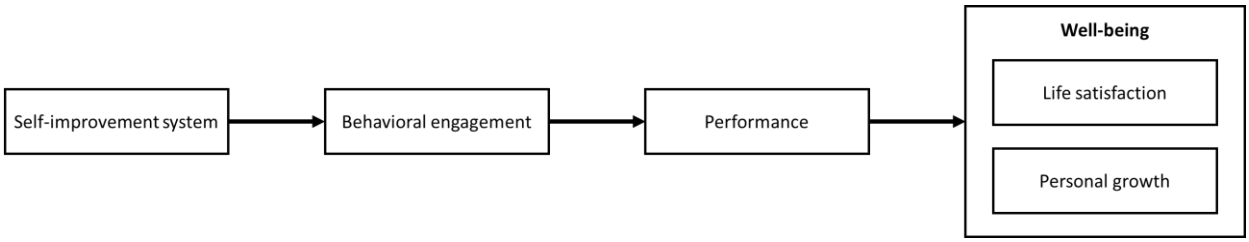
Broadly speaking, performance concerns the results of behavior, based on judgmental and evaluative processes (Campbell et al., 1993; Sonnentag & Frese, 2005). Thus, while behavioral engagement captures a user's level of investment in executing certain activities, performance represents its outcomes. In the present context, these outcomes are the results of completed self-improvement-related tasks.

The literature on well-being distinguishes two perspectives: subjective and psychological well-being (Deci & Ryan, 2008; Ryan & Deci, 2001; Ryff, 1989). Subjective well-being has been defined as "a person's cognitive and affective evaluations of his or her life as a whole" (Diener et al., 2009, p. 187). This perspective is therefore concerned with subjective evaluations of life satisfaction (Diener, 1984). Another literature stream—popularized by Ryff (1989) and Ryan and Deci (2001)—focuses on psychological well-being. Ryff (1989) argued that concentrating on subjective well-being alone is insufficient and should be complemented with a focus on optimal human functioning as a consequence of realizing one's full potential. The extent to which individuals make use of their own potentials reflects their personal growth (Ryff, 1989). As self-improvement technologies are designed to facilitate personal growth through autonomous pursuit of certain activities, this psychological aspect of well-being must be considered in parallel to subjective well-being.

In summary, we focus on two aspects of well-being as terminal self-improvement goals, namely life satisfaction and personal growth. These two goals are influenced by two instrumental self-improvement goals: behavioral engagement and performance. Taken together, these goals form the self-improvement chain facilitated by (technological) systems such as fitness trackers or

learning apps (see Figure 6). In the following section, we explore how such systems are designed to support users in their pursuit of self-improvement.

Figure 6. Article 3: The technology-facilitated self-improvement chain



4.2.2. How competition and cooperation influence the pursuit of self-improvement goals

Competition and cooperation as social interdependence structures. Self-improvement technologies often employ social interdependence structures (Koivisto & Hamari, 2019) to foster engagement through elements such as contests (e.g., "Be the first to run 100 total miles in a week!") or team challenges (e.g., "Go the distance together! Rack up 100 total miles in a week with four of your friends!"). Compared to individualistic structures (e.g., the app tracks run distance and speed), social structures create interdependence during goal pursuit whereby personal outcome is affected by other users' actions (Deutsch, 1949a; Johnson & Johnson, 1989). Social interdependence theory distinguishes two types of interdependence: competition and cooperation (Johnson & Johnson, 2005).

Competition exists when individuals' goal achievements are conflicting (Deutsch, 1949a). For example, individuals regard themselves as being in competition with other users if a task goal can only be achieved by one person (Johnson & Johnson, 2005). A competitive structure promotes oppositional interaction whereby users seek an outcome that is personally beneficial without considering the needs of others.

Cooperation exists when individuals' goal achievements are compatible (Deutsch, 1949a). In such situations users view themselves as working together to achieve a common goal, which can

only be reached by supporting one another (Johnson & Johnson, 2005). A cooperative structure promotes consensual interaction whereby users assist and encourage one another while trying to consider the needs of all members equally (Johnson & Johnson, 1989).

Literature review. We focus on competition and cooperation among individuals in goal-related situations to test which social interdependence structure is more effective in supporting self-improvement goal attainment. Some research has already been conducted to understand the relationships between competition or cooperation and behavioral engagement, performance, and well-being (e.g., Deutsch, 1949b; Lu & Argyle, 1991; Murayama & Elliot, 2012). Table 16 gives an overview of the studies that include both competition and cooperation as well as at least one of the previously mentioned self-improvement goals.

Concerning behavioral engagement, both competition and cooperation appear to exert a positive influence (Leclercq et al., 2018), albeit with conflicting findings regarding which of the two drivers boasts a bigger impact. While Peng and Hsieh (2012) noted that a cooperative goal structure led to greater effort in game play settings, Kistruck et al. (2016) found that competitive goal structures led to higher engagement levels in resource-scarce environments. Still other studies detected no significant difference between the effects of competitive and cooperative goal structures on behavioral engagement (Deutsch, 1949b; Morschheuser et al., 2019).

In terms of goal structures' influence on performance, prior research revealed that competition and cooperation can have positive impact on performance (De Dreu, 2007; Kistruck et al., 2016). Yet most studies that have compared the two effects have found no evidence for any performance-related differences (Deutsch, 1949b; Goldman et al., 1977; Peng & Hsieh, 2012; Tauer & Harackiewicz, 2004).

Very little empirical attention has been paid to the effects of competition and cooperation on well-being, let alone the comparison of the two social interdependence structures. There is some

support for the idea that both competition and cooperation are positively associated with subjective well-being (Standage et al., 2005; Tjosvold et al., 2008). Although competition is often labeled as destructive and seen as inferior to cooperation in terms of well-being (Johnson & Johnson, 2005), Standage et al. (2005) emphasized that task-involving competition where participants focus on doing their best affects well-being similar to cooperation.

From the literature review, three factors emerged that may play an important role in determining whether competition or cooperation is better for achieving self-improvement goals. First, the context in which people try to achieve their goals under social interdependence is significant. While competition could be the stronger driver of engagement and performance in skill-oriented environments (Johnson & Johnson, 1974; Kistruck et al., 2016), cooperation seems to have the upper hand in environments where executing skills is not of primary concern (Morschheuser et al., 2019; Peng & Hsieh, 2012). Second, whether competition is constructive is also of consequence. Competition is perceived as constructive and thus beneficial for goal pursuit if people perceive efficacy in completing a task; participation in the competition is worthwhile above and beyond winning; all participants have a reasonable chance to win; and there are clear and specific rules, procedures, and criteria for winning (Deutsch, 1949a; Johnson & Johnson, 2005; Stanne et al., 1999; Tjosvold et al., 2003). Third, the task assigned determines whether competition or cooperation leads to better results. The more likely it is that the task can be mastered alone, the more likely it is that competition is not inferior to cooperation in terms of performance (Johnson & Johnson, 1974; Stanne et al., 1999).

Table 16. Article 3: Literature overview of the effects of competition and cooperation on engagement, performance, and well-being

Article	Context	Independent variable(s)		Dependent variable(s)				Key findings
		Competition	Cooperation	Engagement	Performance	Subjective well-being	Psychological well-being	
Leclercq et al. (2018)	Co-creation	✓	✓	Customer engagement				• Competition and cooperation increase customer engagement
Morschheuser et al. (2019)	Crowdsourcing	✓	✓	Participation				• No significant difference between competition and cooperation on participation does
Kistruck et al. (2016)	Task in a resource-scarce environment	Competitive vs. cooperative goal structure		Group engagement	Goal performance			• Competition leads to higher levels of engagement and performance than cooperation
Peng and Hsieh (2012)	Computer game	Competitive vs. cooperative goal structure		Effort	Goal performance			• Cooperation leads to greater effort than competition does, but no difference in performance
Deutsch (1949b)	Puzzle	✓	✓	Interest, involvement	Task performance			• No significant difference between competition and cooperation on interest, involvement, or performance
Goldman et al. (1977)	Problem-solving task	✓	✓		Group performance			• Overall, no significant difference between competition and cooperation on performance • Depending on the task, competition or cooperation leads to higher performance
Tauer and Harackiewicz (2004)	Sport	✓	✓		Performance			• No significant difference between competition and cooperation on performance
Stanne et al. (1999)	Meta-analysis	✓	✓		Performance			• Cooperation increases performance more than competition does, with the exception of appropriate competition

Table 16. (continued)

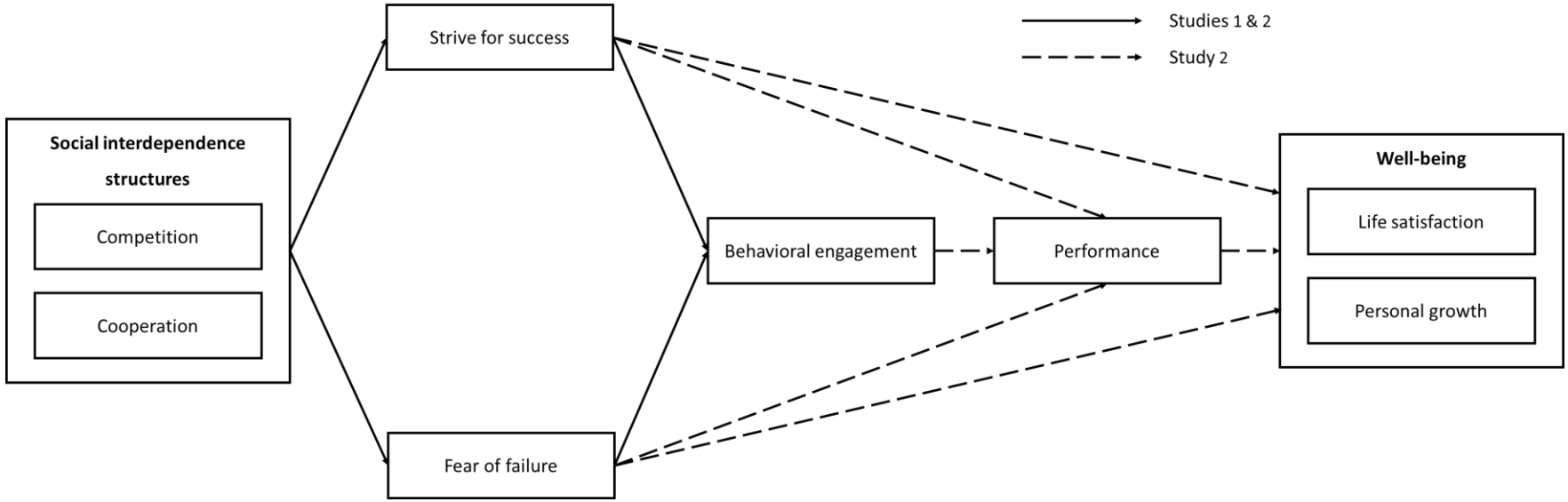
Article	Context	Independent variable(s)		Dependent variable(s)				Key findings
		Competition	Cooperation	Engagement	Performance	Subjective well-being	Psychological well-being	
Standage et al. (2005)	Physical coordination task	✓	✓			Positive and negative affect, vitality		• Task-involving competition and coopetition increases positive affect and vitality • Ego-involving competition and no competition lead to higher levels of negative affect
Tjosvold et al. (2008)	Workplace	✓	✓			Life satisfaction, positive life orientation		• Competition is positively correlated with life satisfaction and positive life orientation • Cooperation is positively correlated with positive life orientation but not life satisfaction
This paper	Self-improvement technologies	Competitive vs. cooperative goal structure		Behavioral engagement	Task performance	Life satisfaction	Personal growth	• Competition increases performance and personal growth more than cooperation does • Cooperation increases engagement and life satisfaction more than competition does

Considering these three factors in the context of self-improvement technologies, we first note that users are primarily oriented toward skill development itself rather than external perceptions. Second, self-improvement technologies provide feedback about the activities performed and—through standardization of the rules and processes—all users have an equal chance to excel, thereby paving the way for competition to be perceived as constructive. Third, the technologies assign goal-related tasks, which can be achieved or mastered alone with the support of the technology (e.g., subtasks and hints in an app). Hence, it appears that in the context of self-improvement technologies, either competition or cooperation could reasonably outperform the other when it comes to personal goal attainment. Moreover, in their meta-analysis of the relation between competition and performance, Murayama and Elliot (2012) highlighted the importance of considering opposing psychological processes to understand how this social interdependence structure affects downstream consequences. We therefore include the role of opposing achievement goal orientations in our framework to determine whether competition or cooperation is superior for self-improvement goal attainment.

4.2.3. Hypothesis development

Overview. Against the background of inconsistent findings paired with a marginal focus on directly comparing competitive and cooperative goal structures, it seems imperative to examine their relative effects. The results of previous research cannot satisfactorily answer the key question of which social interdependence structure exerts a relatively stronger influence on personal goal attainment; this holds especially true in the context of self-improvement technologies. Therefore, we develop a theoretical framework (see Figure 7) that links social interdependence structures with self-improvement goal pursuit. We argue that distinct interdependence structures (i.e., competition

Figure 7. Article 3: Research framework: The influence of social interdependence structures on behavioral engagement, performance, and well-being



or cooperation) implement different settings that shape the attainment of the instrumental goals of behavioral engagement and performance—and subsequently the terminal goals of subjective well-being (i.e., life satisfaction) and psychological well-being (i.e., personal growth)—by guiding users' achievement goal orientations. We elaborate on these processes in the subsequent sections.

The mediating role of achievement goal orientations. Murayama and Elliot (2012) demonstrated that competition (compared to no competition) simultaneously triggers desires and fears concerning success and failure, two important concepts of achievement goal theory. Achievement goal theory provides a framework for studying the opposing types of achievement goal orientations that involve approach and avoidance (Atkinson & Litwin, 1960; Elliot & Church, 1997; McClelland et al., 1953). An approach orientation focuses on performing well compared with others and is experienced as strive for success: the desire for competence, accomplishment, and superior performance (Atkinson, 1957; McClelland et al., 1953). An avoidance orientation, on the other hand, is concerned with eschewing the appearance of incompetence and performing poorly relative to others (Elliot & Church, 1997; Elliot & Harackiewicz, 1996). This orientation is captured by fear of failure: the motivation to prevent oneself from experiencing the shame or embarrassment that is triggered by lack of achievement (Atkinson & Litwin, 1960; Elliot & Reis, 2003). Goal orientations that are set by self-improvement technologies establish a mental framework of how individuals interpret, evaluate, and act in pursuit of a task (Dweck & Leggett, 1988). We therefore posit that the contextual view of achievement goal orientation can provide a powerful theoretical lens for understanding why and how such technologies influence behavioral engagement, performance, and well-being.

Beyond the impact of achievement goal orientations on the self-improvement chain, we know that the successful pursuit of one's own goals plays an important role in self-determination. In this vein, self-concordance theory—building from and extending Ryan and Deci's (2000) self-

determination theory—contends that attaining an immediate personal goal can be instrumental for well-being (Sheldon & Elliot, 1999). This implies that competitive and cooperative goal structures affect well-being to the extent that they contribute to the immediate personal goal attainment of engagement and performance. Thus, in addition to strive for success and fear of failure, behavioral engagement and performance serve as mediators on the path from competition versus cooperation toward well-being. In the following, we specify this path, including the development of propositions regarding whether competition or cooperation should have a stronger relative effect.

Linking social interdependence structures with achievement goal orientations. While both cooperation and competition can increase strive for success and fear of failure, there are several arguments for competition being the stronger driver of both orientations. In a cooperative goal structure, users work together to achieve a common goal and, depending on the specific activity, substitute for one another's actions to a certain degree. As a consequence, users enter an equalitarian mindset and feel joint responsibility for overall team achievement (Johnson & Johnson, 2010). However, reduced individual accountability might limit a user's desire to contribute to team performance (Johnson & Johnson, 2005). In contrast, in competitive settings, users compare their performance with that of other users, suggesting that relative performance is paramount (Heidemeier & Bittner, 2012). It thus follows that users in competition strive to boost their own success (Johnson & Johnson, 2010). Competition not only emphasizes outperforming others but is also paired with an inherent uncertainty of what is necessary to win (as users lack knowledge of others' future performance; Johnson & Johnson, 1989; Liu et al., 2013). Hence, we expect competition to be a stronger driver of strive for success than cooperation is.

With regard to fear of failure, it must be acknowledged that in cooperative settings, a user's performance affects the outcomes of all collaborators; in a certain way, users are responsible for their collaborators' welfare (Matsui et al., 1987). Because performing poorly and thus failing others

has negative emotional consequences (Johnson & Johnson, 2005), cooperative settings are generally thought to incite fear of failure. However, cooperation also involves mutual assistance and exchange of resources among users, which fosters a certain degree of trust (Johnson, 2003) that can act as a buffer to prevent fear of failure from escalating. In contrast, competitive settings focus explicitly on the results of an activity; poor performance and lagging behind others can cause embarrassment or shame (Heidemeier & Bittner, 2012; Johnson & Johnson, 2010). Combined with the high degree of uncertainty surrounding the performance of competitors, we expect competition to prompt greater fear of failure than cooperation does.

In sum, in competitive (vs. cooperative) goal structures, a user's own performance is always key, but there is high uncertainty about the level of performance needed to succeed. Therefore, though both competitive and cooperative goal structures should increase strive for success and fear of failure compared to individualistic conditions, competition may trigger particularly high degrees of both achievement goal orientations. From this, we next formulate hypotheses regarding the relative effects of competitive (vs. cooperative) goal structure on self-improvement goal attainment.

Competition (vs. cooperation) and behavioral engagement. Given the previous argument that competition (vs. cooperation) simultaneously triggers two distinct achievement goal orientations we expect that it influences behavioral engagement through two different paths. Strive for success makes achieving a goal seem more attractive and has therefore been posited to increase engagement (Hollenbeck & Klein, 1987). Hence, strive for success will manifest in high anticipation of task accomplishment and users will exhibit increased behavioral engagement toward goal achievement (Steers, 1975). In contrast, situations where potential failure is exposed to others can lead to avoidance and an urge to escape the situation (Elliot & Thrash, 2004). This means that experiencing fear of failure prior to or during a task is likely to cause decreased engagement, protecting oneself

from a painful situation of shame and embarrassment (Elliot & Church, 1997; Elliot & Thrash, 2004). In sum, we argue that social interdependence activates two opposing paths with counteracting effects on engagement. Specifically, we expect that the effect of social interdependence structures on behavioral engagement is mediated in parallel by strive for success as a positive path and fear of failure as a negative path.

Theoretically, if the indirect effect of competition (vs. cooperation) on engagement through strive for success is smaller than its indirect effect through fear of failure, behavioral engagement will be lower (higher) in a competition (cooperation) setting. We expect the negative path—fear of failure—to reveal a greater effect because in the context of self-improvement technologies, competition compared with cooperation facilitates fear of failure to a relatively stronger degree than it does strive for success. This is because cooperation structures reveal one's individual contribution to the common goal for oneself (Chan & Briers, 2019), making each user accountable for success much like in a competitive setting (Johnson & Johnson, 2005) and thereby reducing the difference between competition and cooperation in triggering strive for success. In contrast, the explicit display of one's achievements compared to others in competition settings makes failure more prominent than in cooperation settings. Hence, the difference between competition and cooperation in strive for success should be less distinct than the difference in fear of failure.

In addition, although strive for success increases the anticipation of goal achievement and thus promotes the user's activity engagement (Steers, 1975), fear of failure may operate even more strongly to undermine engagement efforts as a self-protection function (Elliot & Church, 1997). Fear of failure should have a stronger relation to (dis)continued engagement with an activity, as merely interacting with a self-improvement technology (e.g., using the Fitbit app) already generates quantitative feedback about the activity (i.e., users are always evaluated) and thus fosters an urge to shun the situation. Combining a stronger effect of competition (vs. cooperation) on fear of failure

than on strive for success and a stronger effect of fear of failure (than strive for success) on engagement, competition should result in less behavioral engagement than cooperation does.

H_1: The negative indirect effect of competition (vs. cooperation) on behavioral engagement is greater than its positive indirect effect.

Competition (vs. cooperation) and performance. Increased engagement is not only desirable in itself but is also expected to lead to improved performance (e.g., running regularly typically leads to being physically fitter; Silver et al., 2006). This relationship is also implied by self-concordance theory, whereby sustained effort affects task goal attainment (Sheldon & Elliot, 1999). As strive for success is characterized by doing well in comparison to others, it may affect performance directly beyond enhancing engagement (Elliot & Church, 1997). In contrast, fear of failure as an avoidance orientation has been shown to have a direct negative effect on user performance (Elliot & Church, 1997; Silver et al., 2006). Akin to a self-fulfilling prophecy, people who expect to fail will often do so (Onatsu-Arvilommi & Nurmi, 2000). In addition, the more that users fear failure, the less they will engage to boost their performance or outperform others; and thereby minimize their efforts and stop working on their skill development which then also leads to reduced performance (Elliot & Harackiewicz, 1996; Silver et al., 2006). In sum, we posit that the effect of a competitive (vs. cooperative) goal structure on performance is sequentially mediated by achievement goal orientation (i.e., strive for success and fear of failure) and behavioral engagement.

Regarding the relative strength of the positive and negative effects, we expect a greater magnitude of the positive path. While we predicted a stronger effect for the path through fear of failure than strive for success when it comes to behavioral engagement (H_1), the relationship should be reversed for performance. This is because users with an approach orientation are focused on

outperforming others and excel (Hansemark, 1998). By comparison, fear of failure should have a weak direct effect on performance because although users might diminish their efforts to increase performance, they will not actively sabotage it (Elliot & Thrash, 2004). Hence, we suggest that the positive indirect effect of competition (vs. cooperation) through strive for success on performance surpasses the negative indirect effect operating through fear of failure. Therefore, a competitive (vs. cooperative) goal structure should lead to greater performance.

H_2: The positive indirect effect of competition (vs. cooperation) on performance is greater than its negative indirect effect.

Competition (vs. cooperation) and subjective well-being. The preceding sections outline the paths from a competitive (vs. cooperative) goal structure to performance (involving strive for success, fear of failure, and behavioral engagement). Drawing from self-concordance theory (Sheldon & Elliot, 1999), we expect that performance then drives subjective well-being (i.e., life satisfaction). This would imply that the positive path of competition versus cooperation is relatively stronger than the negative path. However, achievement goal orientations are likely to directly influence life satisfaction by shifting attention to anticipated emotions. With high strive for success users concentrate on the positive consequences of accomplishment (Atkinson, 1964) but fear of failure is expected to exert a negative influence: focusing on possible negative outcomes generates negative emotions such as anxiety, which should hamper subjective well-being (Berger & Freund, 2012; Elliot & Church, 1997).

We expect the relative effect of competition (vs. cooperation) on life satisfaction to be negative. We know that losses loom larger than gains (Kahneman & Tversky, 1979); likewise, the anticipation of negative emotions from failure should be more impactful than that of positive emotions from succeeding (Gilovich & Medvec, 1995). Therefore, we propose that the negative

indirect effect of competition through fear of failure on life satisfaction is stronger than the positive effect through strive for success. Consequently, a competitive (vs. cooperative) goal structure should lead to reduced life satisfaction.

H_3: The negative indirect effect of competition (vs. cooperation) on life satisfaction is greater than its positive indirect effect.

Competition (vs. cooperation) and psychological well-being. In line with the previous argumentation based on self-concordance theory (Sheldon & Elliot, 1999), we assume that good performance, caused by behavioral engagement, leads to skill development and thus psychological well-being (i.e., personal growth; Hollebeek et al., 2019). Additionally, strive for success may directly promote a feeling of personal growth through positive attitude and the motivation to accomplish something. Furthermore, we argue that fear of failure has only a minor negative impact on personal growth. The widely accepted notion that one can personally grow from failure (Birkinshaw & Haas, 2016; Shepherd, 2003) means that merely being afraid to fail will not necessarily reduce perceived personal growth—unlike its effect on life satisfaction. Hence, a competitive (vs. cooperative) goal structure should lead to enhanced personal growth.

H_4: The positive indirect effect of competition (vs. cooperation) on personal growth is greater than its negative indirect effect.

4.3. The relationship between social interdependence structures and behavioral engagement

4.3.1. Study goal

The purpose of Study 1 was to investigate the relationship between social interdependence structures and behavioral engagement. Because competition and cooperation are two types of interdependence that trigger opposing achievement goal orientations (see Section 2.3.3), we were primarily interested in determining which type results in greater behavioral engagement and therefore compared their effects (H_1).

4.3.2. Method

Design, sample, and procedure. To test hypothesis 1, we employed an experiment with a one-factorial (competition vs. cooperation vs. no social interdependence) between-subjects design. We collected data online via university and across social media channels. As an incentive for taking part, four vouchers worth a total of $200 were raffled among all participants. We received 274 responses. To ensure more accurate and powerful tests, we used common data-cleansing procedures to remove systematic error variance and random noise (Meyvis & Van Osselaer, 2018). This resulted in the exclusion of 32 respondents from further analysis and an effective total of 242 participants (67% female, M_{age} = 24 years).

In the experiment, participants were introduced to self-developed scenarios involving a fictitious crowdsourcing app called SelectedLinks (designed after the existing Pocket app). The app allows users to share links to articles on various topics and evaluate those submitted by others in terms of fit with subject matter to determine the top three articles for each topic. Afterward, participants registered themselves with a username to try out the app and were randomly assigned to one of three scenarios: competition, cooperation, or no social interdependence structure. In the

competition scenario, participants were presented with nine links shared by other users on the topic of current sports events and were instructed to select the three articles that best fit the topic, based on their titles. They were also informed that the same task had been assigned to four other users and that all users would be ranked in a leaderboard according to how many of the articles they chose were actually in the top three. The cooperation scenario was identical to the competition one, except participants were told that they were given the task together as a team with four other users and that they would receive collective feedback on the group's combined number of correct selections. The last scenario with no social interdependence structure served as a control group. Here participants were given the same task as in the other scenarios, but they were not briefed about other users or given any feedback regarding their selections. After performing the task but before receiving feedback (to rule out responses biased by participants' task performance), participants were asked to answer questions concerning their strive for success, fear of failure, behavioral engagement, and several control variables (e.g., demographics and affective social identity).

Scenario checks. At the end of the questionnaire, we asked participants to answer manipulation checks and a question about scenario realism. To check the manipulation of the social interdependence structures, we adapted items from Gerpott et al. (2018, see Appendix H). The results indicate that the manipulation worked well. Competition was perceived as significantly higher in the competition scenario than in the other two ($M_{\text{competition}}$ = 4.40, $M_{\text{cooperation}}$ = 2.55, $M_{\text{no\_social\_interdependence}}$ = 2.74; $F(2, 239) = 42.68$, $p < .001$), while cooperation was perceived strongest in the cooperation scenario ($M_{\text{competition}}$ = 3.54, $M_{\text{cooperation}}$ = 4.48, $M_{\text{no\_social\_interdependence}}$ = 3.45; $F(2, 239) = 12.13$, $p < .001$). Furthermore, participants found the app context realistic ($t(241) = 2.57$, $p < .01$) and we found no differences between the competition, cooperation, and control scenarios in terms of realism ($F(2, 239) = 1.83$, $p > .05$; "I believe that SelectedLinks could be a

real-life app"). In addition, there was no significant difference in interest in the chosen topic of sports across groups ($F(2, 239) = .39$, $p > .05$; "I am interested in sports").

Measures. We measured all items on seven-point Likert scales (1 = "strongly disagree" and 7 = "strongly agree") and adapted three items each to capture strive for success (Lang & Fries, 2006) and fear of failure (Conroy et al., 2002). To grasp behavioral engagement, we adapted three items by Cheung et al. (2011) and Hollenbeck et al. (1989). Cronbach's alphas confirm high reliability for all constructs ($\alpha \geq .83$), and all factor loadings were significant ($p < .001$; see Appendix H for items, alphas, and loadings). Moreover, the average variance extracted (AVE $\geq .63$) and composite reliability (CR $\geq .83$) suggest that convergent validity and reliability requirements were met (Fornell & Larcker, 1981). To control for within-group variance and eliminate confounds, we included affective social identity [ASI] because it can influence the involvement in app communities (Chiu et al., 2013). We also controlled for narcissism [NAR] because it may explain differences in the statements about strive for success and fear of failure (Konrath et al., 2014). All items are stated in Appendix H.

Model. We adopted seemingly unrelated regressions (SUR) to test our hypothesis and avoid a potential violation of the assumption of independent observations and standard error inflation (Zellner, 1962). Moreover, SUR allows for the simultaneous estimation of direct and indirect effects in our model in order to assess mediation effects (Preacher & Hayes, 2008). Our model estimates three equations concurrently, with the first two representing the mediator models (strive for success [SFS] and fear of failure [FOF] as dependent variables) and the last one representing the engagement model (behavioral engagement [ENG] as the dependent variable):

(1) $SFS_i = \beta_0 + \beta_1 COMP_i + \beta_2 ASI_i + \beta_3 NAR_i + \varepsilon_{1i}$,

(2) $FOF_i = \gamma_0 + \gamma_1 COMP_i + \gamma_2 ASI_i + \gamma_3 NAR_i + \varepsilon_{2i}$, and

(3) $ENG_i = \delta_0 + \delta_1 SFS_i + \delta_2 FOF_i + \delta_3 COMP_i + \delta_4 ASI_i + \delta_5 NAR_i + \varepsilon_{3i}$,

where COMP refers to competition (cooperation as the reference category), while ε_{1i}, ε_{2i}, and ε_{3i} refer to the error terms of subject *i*.

4.3.3. Results

First, we compared the control group of no social interdependence with the competition and cooperation groups in terms of the effect on behavioral engagement. The results indicate that both social interdependence structures result in increased behavioral engagement ($M_{\text{social\_interdependence}}$ = 4.20, $M_{\text{no\_social\_interdependence}}$ = 3.83; $t(242) = 1.91$, $p < .05$). For further analyses we only used the groups with social interdependence structures, comparing competition with cooperation to examine their relative effects (see H1).

Table 17 provides the results of the SUR, which show positive and significant effects of competition (vs. cooperation) on strive for success ($\beta_1 = .59$, $p < .01$) and fear of failure ($\gamma_1 = .83$, $p < .001$). Strive for success ($\delta_1 = .29$, $p < .001$) has a positive and significant effect on behavioral engagement, while fear of failure ($\delta_2 = -.27$, $p < .001$) has a negative effect.

To test the indirect effects of competition (vs. cooperation) on behavioral engagement through strive for success and fear of failure, we employed a bootstrapped SUR (5,000 draws), building on an empirical sampling distribution of the indirect effects (Zhao et al., 2010). We estimated the indirect effects using the products-of-coefficient approach which results in bias-corrected and accelerated bootstrapped confidence intervals for each indirect effect that can then be used for hypothesis testing (Hayes, 2009). Results of this analysis are summarized in Table 18 and offer support for the proposed effects of social interdependence structures on behavioral engagement. Specifically, the results reveal that competition (vs. cooperation) has a significant positive indirect effect on engagement that is mediated by strive for success ($\beta_1\delta_1 = .17$, 95% confidence interval [CI] = .05, .39). The results also confirm that competition has a significant negative indirect effect on engagement that is mediated by fear of failure ($\gamma_1\delta_2 = -.23$, 95% CI = −.41, −.10).

Table 17. Article 3: Results of direct effects for Study 1

	Strive for success		Fear of failure		Behavioral engagement	
Independent variable	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
Intercept	1.78***	.27	1.40***	.27	3.47***	.30
Competition (0 = cooperation; 1 = competition)	.59**	.21	.83***	.21	.29	.21
Psychological processes						
Strive for success					.29***	.07
Fear of failure					−.27***	.07
Controls						
Affective social identity	.53*	.07	.10	.07	.18*	.08
Narcissism	−.08	.07	.15*	.07	−.05	.07
R^2	.24		.12		.21	

Note. n = 172.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Table 18. Article 3: Results for bootstrapped indirect estimates for Study 1

Mediation path	**Effect**	**SE**	**LLCI**	**ULCI**
Competition → Strive for success → Behavioral engagement	.17	.08	.05	.39
Competition → Fear of failure → Behavioral engagement	−.23	.08	−.41	−.10

Note. n = 172; number of bootstrap resamples = 5,000; LLCI = 95% bias-corrected and accelerated lower-level confidence interval; ULCI = 95% bias-corrected and accelerated upper-level confidence interval.

Hypothesis 1 proposes that the relative indirect effect of competition (vs. cooperation) on behavioral engagement is negative. To test this hypothesis, we extended the analytical procedures outlined by Goh et al. (2013). Using the results presented in the previous subsection, we calculate the ratio of the negative indirect effect (through fear of failure) and the positive indirect effect (through strive for success) on behavioral engagement. Formally,

(4) $\text{RIE}_{\text{ENG}} = \frac{|\gamma 1 \delta 2|}{|\beta 1 \delta 1|} * 100 - 100,$

where RIE_{ENG} is the ratio of competition's (vs. cooperation's) indirect effects on behavioral engagement.

In support of H_1, the results indicate that the negative indirect effect of competition on behavioral engagement is of greater magnitude (+31%) than the positive indirect effect.

4.3.4. Discussion

The findings of Study 1 reveal that competition and cooperation as social interdependence structures have differential effects on behavioral engagement. While both resulted in increased behavioral engagement compared to a control group with no social interdependence structure, a cooperative goal structure resulted in the greatest behavioral engagement. Second, the results indicate that this outcome is caused by the simultaneous activation of two opposing paths. While competition (vs. cooperation) increases both strive for success and fear of failure, the former has a positive effect on behavioral engagement while the latter exerts a negative effect. The ratio of positive and negative indirect effects of the comparison of competition and cooperation is negative, which indicates a superior positive effect of cooperation on engagement.

Study 1 laid the groundwork for our understanding of the self-improvement chain by revealing behavioral engagement as consequence of self-improvement systems. To examine additional

effects for performance and well-being, in Study 2 we conducted a field survey among users of real-life apps in various contexts highly relevant for self-improvement.

4.4. The relationship between social interdependence structures, engagement, performance, and well-being

4.4.1. Study goal

The objective of Study 2 was to replicate the results from Study 1 and investigate the relationship between social interdependence structures, performance, and well-being, in terms of both life satisfaction and personal growth. Because competition results in less behavioral engagement than cooperation does (see Study 1) and engagement is instrumental for enhancing performance and achieving the ultimate goals of well-being (Sheldon & Elliot, 1999), we examine whether and how competition (vs. cooperation) results in increased or decreased performance (H_2), life satisfaction (H_3), and personal growth (H_4).

4.4.2. Method

Data collection and sample. We conducted an online field survey to collect data from actual users[19] of six apps across three contexts: education, fitness, and nutrition. We chose these contexts because they not only represent areas in which people set goals to improve themselves but also are directly related to well-being. The first criterion for the selection of focal apps in each context was that they have at least one design element that promotes competition (e.g., a ranking of users based on their achievements within the app community) or cooperation (e.g., team challenges in which users complete a shared task). Most of the apps have elements that can induce both competition

[19] Actual users spent a significant amount of time using a specific app to perform an activity with high relevance for their lives. This enabled us to track consequences of app use (and their respective social interdependence structures) on performance and well-being.

and cooperation, but they differ in number and type. The second criterion was app popularity (over 10 million downloads each in Apple's App Store and the Google Play Store) as well as good ratings in the stores (at least four out of five stars). According to these criteria, we selected the following six apps: Duolingo and QuizClash! for the education context, Freeletics and Fitbit for the fitness context, and MyFitnessPal and Yazio for the nutrition context.

To target actual users of the focal apps, we developed an online questionnaire that we distributed across social media channels and online communities directly related to one of the apps or the respective context (Wolf, Weiger, et al., 2020). Four vouchers worth a total of $200 were raffled among all participants to increase response rates. We collected data from 811 respondents who had been using one of the focal apps for at least four weeks. Responses from participants who did not complete the survey or answered click-through questions incorrectly were removed from further analysis, resulting in an effective sample of 728 respondents (71% female, $M_{age} = 31$) across the three contexts: 261 in education, 244 in fitness, and 223 in nutrition.

The structure of the survey was as follows: First, respondents chose one of the six apps based on prior use experience. They then answered questions related to the app (e.g., app version), their app usage during the preceding four weeks, and their performance regarding the focal tasks. Then, participants stated the extent to which they perceived the app tasks to be competitive and cooperative. Afterward, they rated their strive for success and fear of failure when using the app. In the final section, participants completed a portion related to life satisfaction, personal growth, and further control variables (e.g., brand attitude and narcissism).

Measures. We applied the same scales as in Study 1 but measured behavioral engagement by asking respondents to state their actual app usage during the previous four weeks, based on the internal app statistics or histories. Using three items from Greguras and Diefendorff (2010), we measured performance over the course of those four weeks. To measure life satisfaction and

personal growth, we adapted three items each (Diener et al., 1985; Ryff, 1989). We adapted four items each to capture perceived competition and cooperation (Gerpott et al., 2018). Again, Cronbach's alphas confirm acceptable reliability for all constructs ($\alpha \geq .83$) and all factor loadings are significant ($p < .001$; see Appendix H for items, alphas, and loadings). Furthermore, the required convergent validity and reliability are satisfied (AVE $\geq .55$, CR $\geq .83$; Fornell & Larcker, 1981). In addition, we evaluated discriminant validity using Fornell and Larcker's (1981) test, which revealed that all square roots of the AVEs are greater than the correlations between the corresponding constructs and all other constructs.

For all subsequent analyses, we centered constructs directly related to the app or the app context (competition, cooperation, strive for success, fear of failure, app usage, and performance) on their respective app's mean to rule out the possibility of systematic differences in effect sizes across apps. Furthermore, we created the independent variable competition emphasis [COM] by subtracting perceived cooperation from perceived competition, based on the concept of competitive psychological climate (Brown et al., 1998).

We used the same control variables as in Study 1—affective social identity [ASI] and narcissism [NAR]—while also incorporating user- and app-specific control variables. First, we included network size [NWS] (i.e., the number of people users are connected with in the app) as well as perceived social support [PSS], which can influence both involvement in app communities and well-being (Chiu et al., 2013). Furthermore, we controlled for brand attitude [BAT], length of app use [LAU], self-improvement category ([EDU] for education and [NUT] for nutrition with fitness as reference category), and the use of the premium version of the app [PRE], as all these variables can affect users' engagement, performance, and well-being (Wolf et al., 2020; see Appendix H for the specific items).

Model. Consistent with Study 1, we chose SUR to test our hypotheses. Equations 5 and 6 represent the mediator models (strive for success [SFS] and fear of failure [FOF] as dependent variables), while Equations 7–10 represent the behavioral engagement, performance, and well-being models (behavioral engagement [ENG], performance [PER], life satisfaction [LSF], and personal growth [PEG] as dependent variables). The model simultaneously estimates the six equations:

(5) $SFS_i = \eta_0 + \eta_1 COM_i + \eta_2 EDU_i + \eta_3 NUT_i + \eta_4 PRE_i + \eta_5 LAU_i + \eta_6 NWS_i + \eta_7 ASI_i + \eta_8 PSS_i + \eta_9 BAT_i + \eta_{10} NAR_i + \epsilon_{1i}$,

(6) $FOF_i = \theta_0 + \theta_1 COM_i + \theta_2 EDU_i + \theta_3 NUT_i + \theta_4 PRE_i + \theta_5 LAU_i + \theta_6 NWS_i + \theta_7 ASI_i + \theta_8 PSS_i + \theta_9 BAT_i + \theta_{10} NAR_i + \epsilon_{2i}$,

(7) $ENG_i = \iota_0 + \iota_1 SFS_i + \iota_2 FOF_i + \iota_3 COM_{i+} + \iota_4 EDU_i + \iota_5 NUT_i + \iota_6 PRE_i + \iota_7 LAU_i + \iota_8 NWS_i + \iota_9 ASI_i + \iota_{10} PSS_i + \iota_{11} BAT_i + \iota_{12} NAR_i + \epsilon_{3i}$,

(8) $PER_i = \kappa_0 + \kappa_1 ENG_i + \kappa_2 SFS_i + \kappa_3 FOF + \kappa_4 COM_{i+} \kappa_5 EDU_i + \kappa_6 NUT_i + \kappa_7 PRE_i + \kappa_8 LAU_i + \kappa_9 NWS_i + \kappa_{10} ASI_i + \kappa_{11} PSS_i + \kappa_{12} BAT_i + \kappa_{13} NAR_i + \epsilon_{4i}$,

(9) $LSF_i = \lambda_0 + \lambda_1 PER_i + \lambda_2 SFS_i + \lambda_3 FOF + \lambda_4 COM_i + \lambda_5 EDU_i + \lambda_6 NUT_i + \lambda_7 PRE_i + \lambda_8 LAU_i + \lambda_9 NWS_i + \lambda_{10} ASI_i + \lambda_{11} PSS_i + \lambda_{12} BAT_i + \lambda_{13} NAR_i + \epsilon_{5i}$, and

(10) $PEG_i = \nu_0 + \nu_1 PER_i + \nu_2 SFS_i + \nu_3 FOF + \nu_4 COM_i + \nu_5 EDU_i + \nu_6 NUT_i + \nu_7 PRE_i + \nu_8 LAU_i + \nu_9 NWS_i + \nu_{10} ASI_i + \nu_{11} PSS_i + \nu_{12} BAT_i + \nu_{13} NAR_i + \epsilon_{6i}$,

where COM refers to competition emphasis (perceived competition – perceived cooperation), while ϵ_{1i}, ϵ_{2i}, ϵ_{3i}, ϵ_{4i}, ϵ_{5i}, and ϵ_{6i} refer to the error terms of subject *i*.

4.4.3. Results

Table 19 presents the direct effects estimated by SUR. The results show positive and significant effects of competition emphasis on strive for success ($\eta_1 = .10$, $p < .01$) and fear of failure ($\theta_1 = .11$,

$p < .01$). Strive for success ($\iota_1 = .52$, $p < .05$) has a positive and significant effect on behavioral engagement, while fear of failure ($\iota_2 = -.66$, $p < .01$) has a negative and significant effect on behavioral engagement. Performance is positively affected by strive for success ($\kappa_2 = .20$, $p < .001$) and behavioral engagement ($\kappa_1 = .04$, $p < .001$) but also negatively affected by fear of failure ($\kappa_3 = -.08$, $p < .01$). Furthermore, the findings indicate that strive for success ($\lambda_2 = .09$, $p < .05$) and performance ($\lambda_1 = .13$, $p < .001$) have significant positive effects on life satisfaction. In contrast, life satisfaction is significantly negatively affected by fear of failure ($\lambda_3 = -.14$, $p < .001$). Last, personal growth is positively and significantly affected by strive for success ($\nu_2 = .31$, $p < .001$) and performance ($\nu_1 = .13$, $p < .001$), while fear of failure exhibits no significant effect on personal growth ($\nu_3 = -.02$, $p > .05$).

Test of hypothesis concerning behavioral engagement. We evaluated our indirect effects hypotheses using the same approach as in Study 1. The results offer support for all proposed indirect effects (see Table 20). Specifically, in replicating Study 1's findings, the results confirm that competition emphasis has a significant positive indirect effect on engagement that is mediated by strive for success ($\eta_1\iota_1 = 4.98$,[20] 95% CI = .57, 13.30). Likewise, competition emphasis has a significant negative indirect effect on engagement that is mediated by fear of failure ($\theta_1\iota_2 = -7.38$, 95% CI = –16.18, –2.01).

To test H_1, we proceeded as in Study 1. Formally,

(11) $\text{RIE}_{\text{ENG}} = \frac{|\theta 1 \iota 2|}{|\eta 1 \iota 1|} * 100 - 100,$

where RIE_{ENG} is the ratio of competition emphasis' indirect effects on behavioral engagement.

[20] All effect values, standard errors, and intervals of the bootstrapped indirect effect estimates are multiplied by 100 for easier reporting.

Table 19. Article 3: Results of direct effects for Study 2

	Strive for success		Fear of failure		Engagement		Performance		Life satisfaction		Personal growth	
Independent variable	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
Intercept	−2.45***	.30	−.38	.34	−12.95***	2.03	−1.14***	.31	4.63***	.31	3.85***	.03
Competition emphasis	.10**	.03	.11**	.04	.09	.21	.00	.03	.06	.03	.01	.03
Psychological processes												
Strive for success					.52*	.24	.20***	.04	.09*	.04	.31***	.03
Fear of failure					−.66**	.21	−.08**	.03	−.14***	.03	−.02	.03
Behavioral engagement (Frequency of use)							.04***	.01				
Performance									.09*	.04	.13***	.34
Controls												
Education category	.30**	.12	.05	.13	1.76*	.75	.13	.11	−.22	.12	−.05	.10
Nutrition category	.09	.12	.11	.14	.54	.79	.09	.12	−.08	.12	.02	.11
Premium version	−.20	.11	−.25*	.12	2.24***	.67	−.06	.10	.10	.11	.15	.09
Length of app use	−.00	.00	−.00	.00	.03*	.02	.00	.00	.01*	.00	.00	.00
Network size	.16	.04	.00	.04	.29	.23	−.00	.03	.07*	.04	.01	.03
Affective social identity	.09*	.04	.14***	.04	.28	.24	.06	.04	−.01	.04	.01	.03
Perceived social support	.09**	.03	.13***	.03	.05	.19	.04	.03	.01	.03	.03	.03
Brand attitude	.35***	.03	−.09	.05	1.26***	.28	.13**	.04	.05	.04	.19***	.04
Narcissism	−.00	.03	−.38	.34	−.44	.22	.04	.03	−.02	.03	.03	.03
R^2	.14		.14		.13		.20		.10		.27	

Note. $n = 728$.
* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Table 20. Article 3: Results for bootstrapped indirect estimates for Study 2

Mediation path	Effect	SE	LLCI	ULCI
Competition emphasis → Strive for success → Behavioral engagement	4.98	3.08	.57	13.30
Competition emphasis → Fear of failure → Behavioral engagement	−7.38	3.54	−16.18	−2.01
Competition emphasis → Strive for success → Performance	1.94	.85	.62	4.12
Competition emphasis → Fear of failure → Performance	−.93	.49	−2.22	−.20
Competition emphasis → Strive for success → Behavioral engagement → Performance	.20	.13	.03	.57
Competition emphasis → Fear of failure → Behavioral engagement → Performance	−.29	.15	−.70	−.08
Competition emphasis → Strive for success → Life satisfaction	.86	.47	.17	2.23
Competition emphasis → Fear of failure → Life satisfaction	−1.62	.66	−3.25	−.58
Competition emphasis → Strive for success → Performance → Life satisfaction	.18	.12	.03	.54
Competition emphasis → Fear of failure → Performance → Life satisfaction	−.09	.06	−.28	−.01
Competition emphasis → Strive for success → Engagement → Performance → Life satisfaction	.02	.02	.00	.07
Competition emphasis → Fear of failure → Engagement → Performance → Life satisfaction	−.03	.02	−.09	−.00
Competition emphasis → Strive for success → Personal growth	2.97	1.21	.96	5.74
Competition emphasis → Fear of failure → Personal growth	−.28	.36	−1.18	.29
Competition emphasis → Strive for success → Performance → Personal growth	.26	.14	.07	.68
Competition emphasis → Fear of failure → Performance → Personal growth	−.12	.07	−.35	−.03
Competition emphasis → Strive for success → Engagement → Performance → Personal growth	.03	.02	.00	.09
Competition emphasis → Fear of failure → Engagement → Performance → Personal growth	−.04	.02	−.11	−.01

Note. n = 728; all effect values, standard errors, and intervals are multiplied by 100 for easier reporting; number of bootstrap resamples = 5,000; LLCI = 95% bias-corrected and accelerated lower-level confidence interval; ULCI = 95% bias-corrected and accelerated upper-level confidence interval.

In support of H_1 and in line with Study 1, the results show that the negative indirect effect of competition emphasis on behavioral engagement through fear of failure is of greater magnitude (+48%) than the positive indirect effect through strive for success.

Test of hypothesis concerning performance. Competition emphasis exhibits a significant positive indirect effect on performance mediated by strive for success ($\eta_1\kappa_2$ = 1.94, 95% CI = .62, 4.12) and by the combined path of strive for success and engagement ($\eta_1\iota_1\kappa_1$ = .20, 95% CI = .03, .57). The results also show that competition emphasis has a significant negative indirect effect on performance that is mediated by fear of failure ($\theta_1\kappa_3$ = –.93, 95% CI = –2.22, –.20) and by the combined path of fear of failure and engagement ($\theta_1\iota_2\kappa_1$ = –.29, 95% CI = –.70, –.08).

Our approach for examining H_2 was to compute the ratio of the positive indirect effects of competition emphasis on performance (through strive for success and behavioral engagement) and the respective negative indirect effects (through fear of failure and behavioral engagement). Formally,

(12) $\text{RIE}_{\text{PER}} = \frac{|\eta 1\kappa 2\,|+|\eta 1\iota 1\kappa 1|}{|\theta 1\kappa 3|+|\theta 1\iota 2\kappa 1|} * 100 - 100,$

where RIE_{PER} is the ratio of competition emphasis' indirect effects on performance.

Confirming H_2, the results indicate that the positive indirect effect of competition emphasis on performance is of greater magnitude (+75%) than the negative indirect effect.

Test of hypothesis concerning life satisfaction. We found that competition emphasis has a significant positive indirect effect on life satisfaction mediated by strive for success ($\eta_1\lambda_2$ =.86, 95% CI =.17, 2.23); the combined path of strive for success and performance ($\eta_1\kappa_2\lambda_1$ =.18, 95% CI =.03,.54); and the combined path of strive for success, engagement, and performance ($\eta_1\iota_1\kappa_1\lambda_1$ = .02, 95% CI = .00, .07). Furthermore, competition exhibits a significant negative indirect effect on life satisfaction mediated by fear of failure ($\theta_1\lambda_3$ = –1.62, 95% CI = –2.25, –.58); the combined

path of fear of failure and performance ($\theta_1\kappa_3\lambda_1$ = –.09, 95% CI = –.28, –.01); and the combined path of fear of failure, engagement, and performance ($\theta_1\iota_2\kappa_1\lambda_1$ = –.03, 95% CI = –.09, –.00).

To test H_3, we computed the ratio of competition's negative indirect effects on life satisfaction (through fear of failure, engagement, and performance) and its positive indirect effects on life satisfaction (through strive for success, engagement, and performance). Formally,

(13) $\text{RIE}_{\text{LSF}} = \frac{|\theta 1\lambda 3|+|\theta 1\kappa 3\lambda 1|+|\theta 1\iota 2\kappa 1\lambda 1|}{|\eta 1\lambda 2\,|+|\eta 1\kappa 2\lambda 1|+|\eta 1\iota 1\kappa 1\lambda 1|} * 100 - 100,$

where RIE_{LSF} is the ratio of competition emphasis' indirect effects on life satisfaction.

Consistent with H_3, the negative indirect effect of competition emphasis on life satisfaction is of greater magnitude (+64%) than the positive indirect effect.

Test of hypothesis concerning personal growth. Competition emphasis shows a significant positive indirect effect on personal growth mediated by strive for success ($\eta_1\nu_2$ = 2.97, 95% CI = .96, 5.74); the combined path of strive for success and performance ($\eta_1\kappa_2\nu_1$ = .26, 95% CI = .07, .68); and the combined path of strive for success, engagement, and performance ($\eta_1\iota_1\kappa_1\nu_1$ = .03, 95% CI = .00, .09). The results reveal no significant effect of competition emphasis on personal growth mediated by fear of failure ($\theta_1\nu_3$ = –.28, 95% CI = –1.18, .29) but indicate a significant negative indirect effect of competition on personal growth mediated by the combined path of fear of failure and performance ($\theta_1\kappa_3\nu_1$ = –.12, 95% CI = –.35, –.03) and the combined path of fear of failure, engagement, and performance ($\theta_1\iota_2\kappa_1\nu_1$ = –.04, 95% CI = –.11, –.01).

To verify H_4, we computed the ratio of competition's positive indirect effects on personal growth (through fear of failure, engagement, and performance) and its negative indirect effects on personal growth (through strive for success, engagement, and performance). Formally,

(14) $\text{RIE}_{\text{PEG}} = \frac{|\eta 1\nu 2|+|\eta 1\kappa 2\nu|+|\eta 1\iota 1\kappa 1\nu 1|}{|\theta 1\kappa 3\nu 1\,|+|\theta 1\iota 2\kappa 1\nu 1|} * 100 - 100,$

where RIE_{PEG} is the ratio of competition emphasis' indirect effects on personal growth.[21] Confirming H_4, the results indicate that the positive indirect effect of competition emphasis on personal growth through exceeds the negative indirect effect through by a factor of 20.[22]

Furthermore, there are significant effects for some of the controls. First, regarding the specific self-improvement category, the estimation suggests that the apps in the education category stimulate a greater strive for success and behavioral engagement than those in the fitness category. However, there was no difference between the nutrition and fitness categories. Second, premium users experience less fear of failure and exhibit increased behavioral engagement in comparison to users of the free version. Third, the results indicate a significant positive relationship between app usage duration and both behavioral engagement and life satisfaction. Fourth, in terms of community, users express greater life satisfaction with increases in their network size. Furthermore, people who feel attached to or perceive social support from other users, experience enhanced strive for success but also increased fear of failure. Finally, the findings reveal that brand attitude is positively related to strive for success, behavioral engagement, performance, and personal growth.

4.4.4. Discussion

The main objective of Study 2 was to replicate the results of Study 1 in a non-experimental, real-life setting and extend them by investigating the effect of competition (vs. cooperation) on the entire self-improvement chain. To investigate these relationships, we conducted an online field survey collecting data from actual users of six apps from three self-improvement categories.

[21] Please note that the indirect effect of competition emphasis on personal growth through fear of failure is not included in the calculation as it is non-significant.

[22] The magnitude of the effect is +1,916%, which is a result of the non-significant direct effect of fear of failure on personal growth (see Table 4).

Study 2 offers support for the generalizability of our findings by replicating Study 1's results with existing apps across various contexts. While the results indicate that competition increases performance and personal growth more than cooperation does, cooperation exhibits a greater effect on users' behavioral engagement and life satisfaction. These findings not only complement those of Study 1 but also reveal that neither competition nor cooperation alone is the key to maximizing self-improvement goal attainment; instead, competition best supports performance and psychological well-being, while cooperation helps users stick with an activity and boosts subjective well-being.

4.5. Conclusion

Consumers are increasingly seeking the support of self-improvement technologies to reach their personal goals—a trend exemplified by the 441% increase in active Fitbit users between 2014 and 2019 (Statista, 2020b). But can such technologies really help users achieve their goals? And if so, how should they be designed to best support goal attainment? To address these questions, we examined how competition and cooperation—social interdependence structures implemented extensively across self-improvement technologies—affect the self-improvement goals of behavioral engagement, performance, and well-being (life satisfaction and personal growth). Across two studies, we found that no technology-facilitated interdependence structure enabled users to maximize their achievement of all goals simultaneously. More specifically, while competitive goal structures might push users to enhanced performance and personal growth, cooperative goal structures are preferable for increasing behavioral engagement and life satisfaction. These results can be explained by the goal structures' activation of two counteracting paths—strive for success and fear of failure—that drive users to approach some goals but avoid others even more. Our findings have important implications for theory and practice, which we discuss next.

4.5.1. Research implications

Our findings are relevant for service technology research in general and transformative service research in particular (Anderson et al., 2013). Although self-improvement technologies are designed to provide value for their users and help them achieve their goals, there is surprisingly little marketing literature on whether such technologies in fact do so and how. Though most self-improvement technologies implement social interdependence structures (Huang, 2018), they generally tend to focus on one. This implies that potential users must decide whether competitive or cooperative tasks would be more effective for attaining their personal goals.

First, by placing our study in the context of self-improvement technologies, where users utilize standardized support systems that help them focus on improving skills, we complement prior work on social interdependence (Deutsch, 1949b; Johnson & Johnson, 2005). We emphasize three factors—task environment, task structure, and task interdependence—that determine how users perceive social interdependence structures and thus form behaviors and outcomes. Variations in these factors may explain why some studies find competition to be as fruitful as or even superior to cooperation in terms of goal attainment (e.g., Goldman et al., 1977; Kistruck et al., 2016), despite the latter generally being portrayed as more beneficial (Johnson & Johnson, 2005). If the task environment is more skill-oriented, competition is constructive, and participants can complete the tasks independently, then competition and cooperation structures could be equally supportive of goal attainment. These conditions are met for the case of self-improvement technologies: users voluntarily select apps to learn or improve their skills and the technology standardizes the process of achieving user goals with the support of the technology alone. Hence, we suggest that technologies can facilitate constructive competition, thus minimizing the dark sides and increasing the bright sides of competition (Reeve & Deci, 1996). Our findings support this conclusion, as

competitive goal structures lead to better performance and personal growth than cooperative goal structures do, while cooperation is still superior when it comes to engagement and life satisfaction.

Second, our research contributes to transformative service research (Anderson et al., 2013) by considering users' subjective and psychological well-being as the terminal goal of the self-improvement chain. By revealing that competitive and cooperative goal structures affect life satisfaction (subjective well-being) and personal growth (psychological well-being) differently, our findings reinforce Ryff's (1989) claim that capturing subjective well-being is not enough to understand people's overall well-being. This difference between subjective and psychological well-being is further supported through the opposing psychological paths triggered by social interdependence. The varying strength of their effects on subjective and psychological well-being indicate that in the case of self-improvement technologies with competition or cooperation, one is not likely to optimally satisfy both forms of well-being.

Third, by drawing on achievement goal theory (Elliot & Church, 1997; McClelland et al., 1953), we empirically demonstrate that social interdependence structures simultaneously initiate two rival psychological paths in the self-improvement chain. Hence, people experience approach and avoidance tendencies concurrently when using self-improvement technologies. Reinforcing the findings of Murayama and Elliot's (2012) meta-analysis on the relation between competition and performance, we emphasize that both achievement goal orientations must be considered with every social interdependency. Therefore, future research should explicitly account for this inherent dialectic instead of focusing on a single achievement goal orientation or neglecting them altogether.

Indeed, the inconclusive findings of previous research regarding downstream consequences of social interdependence structures (e.g., Kistruck et al., 2016; Peng & Hsieh, 2012) might be the result of neglecting goal orientation as a key mechanism. Our results reveal that in the context of self-improvement technologies, the opposing psychological paths are triggered, but strive for

success (achievement approach orientation) is particularly strongly related to performance and personal growth, while fear of failure (achievement avoidance orientation) has a pronounced impact on engagement and life satisfaction. Thus, the joint consideration of both paths is necessary to identify which of the opposing paths has more sizeable downstream effects across different contexts.

Our insights also highlight the power of psychological orientation for guiding one's behavior and responses in competitively or cooperatively structured tasks. The way people orient themselves in such a situation (fearful or striving) has a considerable impact on their behavior and accordingly their well-being. People's subjective well-being suffers when they fear failure and view a situation in a negative light; priming competitiveness in such contexts would further fuel this negativity spiral of reduced life satisfaction. This is in line with Bittner and Heidemeier (2013), who established a link between the competitive and cooperative mindsets and regulatory focus. Their results revealed that a promotion focus activates a cooperation mindset, whereas a prevention focus activates a competition mindset. However, their study also highlighted the possibility for both paths to be activated and strengthened, which we found when establishing social interdependence structures.

Finally, we contribute to the emerging literature on individual-level antecedents and outcomes of technology-facilitated engagement. Research is beginning to acknowledge the capacity of technologies to enhance individual-level resource development and interpersonal cocreation (Hollebeek et al., 2019; Kumar et al., 2019). We add to this literature by demonstrating that the potential of technology to engage users may follow a fluctuating pattern. Examining the underlying psychological processes that arise when users undertake tasks in a social context (Kannan & Li, 2017), we reveal that strive for success and fear of failure motivate users to invest different levels of cognitive and emotional resources in engaging with technologies. It is worth noting that

competition and cooperation still facilitate greater engagement compared to settings devoid of social interdependence. However, when only comparing the two, strive for success reinforces behavioral engagement and fear of failure inhibits engagement. Our findings contribute to prior engagement literature by demonstrating why customers do or do not complement physical engagement with digital, technology-driven engagement (Kumar et al., 2019; van Heerde et al., 2019) and also point to specific limitations of some engagement-facilitating technologies (e.g., Maier et al., 2015; Weiger et al., 2018). Moreover, linking technology-facilitated engagement with user well-being reveals the central role that behavioral engagement plays when it comes to achieving terminal self-improvement goals. In doing so, we provide evidence for the performance-enhancing effects of technology-facilitated engagement, which represent one of the gatekeeping functions in the self-improvement chain.

4.5.2. Practical implications

Our findings provide an explanation for why self-improvement technologies such as mobile apps that enable social interdependence among users have seen an ever-increasing number of users and high rates of continued use, specifically in the fields of sport, nutrition, and education. Furthermore, they indicate how people can leverage technologies to continue working on their self-improvement goals in times of social distancing (e.g., during pandemics, remote work, and secluded living), when traditional means of interacting with others are infeasible. First, the results of Study 1 demonstrate that both social interdependence structures increase users' engagement goal achievements. This implies that users are well advised to adopt technologies that include either of the two social structures, leaving then significant flexibility in choice of products and providers. However, if users aim to maximize life satisfaction, they should avoid technologies boasting competitive goal structures; under this condition, a cooperative structure seems to be more effective. Cooperative goal structures reduce people's tendency to flaunt their own superiority and

allay their fears of embarrassing themselves in front of others. This in turn likely promotes higher levels of self-esteem and mental health (Johnson & Johnson, 2005). In contrast, if users prioritize self-improvement through personal growth, they should make use of technologies that rely heavily on competitive goal structures. Not only are such technologies superior when it comes to performance, but they also enhance the feeling of personal growth by permitting their users to focus more on their own development.

Second, we advise policy makers and support organizations (e.g., counseling service providers, health maintenance organizations, insurance companies) to make use of social interdependence structures to encourage meaningful behavioral changes. For example, given the salutary competition effects for performance, health organizations could hold healthy lifestyle contests and award visible tags or badges to the best-performing users or publish the rankings. Encouraging people to compete for healthy lifestyle status might motivate more people to adopt healthier behavior. While competition might offer not only a significant boost to a more results-oriented performance (even more so if the superior results in comparison to reference users were public to the entire group) but also personal growth, cooperation patterns are paramount when it comes to users' continued engagement and life satisfaction. If that is the goal, organizations should assign tasks that can only be fulfilled through affiliation with and acceptance by other users and are impossible to complete alone (Johnson & Johnson, 2005; Stanne et al., 1999).

With this in mind, it becomes clear that social interdependence structures are powerful tools for nudging people toward living healthier and happier lives in a deliberate and voluntary way, without using coercion, choice restrictions, penalties, or hard economic incentives. Such structures render potentially mundane activities more pleasurable and offer readily available benefits (e.g., sitting at the top of a leaderboard or achieving mutual goals with a community). In this sense, social interdependence structures leverage or "hack" people psychologically by transforming tasks into

desirable behavior change (White et al., 2019). However, as interdependence structures not only empower users to strive for success but also generate fear of failure, people using technologies with such structures will always experience some degree of negative emotions, representing the hidden costs of such settings. Therefore, policy makers and support organizations should consider the extent to which the use of social interdependence structures—especially competition—should be promoted, particularly if subjective well-being is the public goal. Remarkably, Instagram and Facebook have been experimenting with hiding likes to help users minimize their focus on competition among them. According to a Facebook spokesperson, some consumers have suggested in interviews that hiding likes would improve their mental health (Wong, 2019). Our empirical results support this position.

Finally, our findings signal that implementing social interdependence structures is a win–win situation for users and self-improvement-technology providers and thus improves collective well-being. The results confirm the engaging effect of competition and cooperation found by prior studies (Eisingerich et al., 2019; Leclercq et al., 2018). For technology providers, particularly those offering free-to-use services, increased engagement promises increased advertising revenue (Schumann et al., 2014). As behavioral engagement thus represents an admirable goal for both sides, providers should rely on social interdependence structures, offering various tasks with competition and cooperation settings to allow for the differing effects on users' well-being goals. This would grant users the chance to self-select tasks and better support their individual goal pursuit without losing consumers who dislike either competition or cooperation with other users.

4.5.3. Limitations and further research

The limitations of our research highlight avenues for further research. First, to increase external validity and consider developments over time, future research could observe the relationship between social interdependence structure and self-improvement goals over extended periods (i.e.,

exceeding the four weeks used in this study) and record its evolution over several measurement points. Second, as we focus on competition and cooperation as social interdependence structures, it would be useful to examine whether its combination—coopetition—follows different patterns in supporting the attainment of self-improvement goals. Furthermore, other social interactions such as exchange or conflict can emerge in this context and may also influence users' behavior in the context of self-improvement technologies. Similarly, it would also be interesting to develop knowledge on other dimensions of well-being, such as social well-being (Keyes, 1998). Third, although all apps examined in Study 2 include social interdependence structures, our participants generally did not perceive them as being overwhelmingly strong—most likely because the apps also contain individualistic tasks to make entry and use as convenient as possible. In this regard, a study with apps boasting only social interdependence structures could demonstrate the strength of the relationship even better. Finally, there may exist situational and personality differences in user preferences which could affect the relationship between the social interdependence structures and users' self-improvement goals.

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5. General discussion

This dissertation was motivated by the exponential proliferation of MIS (Devezer et al., 2013; Huang, 2018). Users demand systems that provide motivational support for pursuing their personal goals and firms seek opportunities to build lasting and profitable customer relationships. MIS promise to satisfy both by seeking to support utilitarian goals via hedonic means (i.e., leveraging design principles of hedonic services such as games or social networks; Koivisto & Hamari, 2019). However, previous research could not conclusively answer the fundamental questions of *whether* MIS actually support the achievement of user and firm goals or *how* they drive user-beneficial and firm-beneficial behavior (Hofacker et al., 2016; Koivisto & Hamari, 2019; Liu et al., 2017). Therefore, the studies of this dissertation examine the impact of MIS on user-beneficial (e.g., engagement) and firm-beneficial behaviors (e.g., willingness to pay more, word-of-mouth) and their outcomes (e.g., performance, well-being) under consideration of different types of system design (e.g., social interdependence structures) and MIS-facilitated user experiences (e.g., self-development, social comparison). Further, drawing on different motivation theories (e.g., self-determination theory, achievement goal theory), the findings can explain the psychological processes which lead to those behaviors and outcomes. The results of the combined studies provide valuable insights on how MIS work and how they can create a win-win situation for users as well as firms.

5.1. Research implications

The key conclusion to be drawn from the results of the dissertation's articles is that MIS can support both firms and users to achieve their goals but not all manifestations of MIS do so. Thus, if designed properly, it is useful to enrich utilitarian systems with hedonistic aspects to generate more value for both stakeholders. This thesis offers three general research implications. First, utilizing a more

fine-grained approach (e.g., MIS-facilitated user experiences, social interdependence structures) provides insights into how MIS trigger user-beneficial and firm-beneficial behavior. Second, by exploiting this approach and investigating different user and firm goals, the results disclose that MIS can promote or hinder goal-beneficial user behavior and outcomes. Third, MIS trigger various psychological processes, which can explain their different downstream consequences.

Findings from Article 1 and Article 3 suggest that MIS support user goals. More precisely, Article 1 shows in a field experiment and a field study that MIS encourage continued user engagement, leading to more goal-beneficial activities. This is particularly evident via increased engagement frequency, however, also engagement intensity can rise. The experience-centric approach utilized in Study 2 of Article 1 reveals that the majority of MIS-facilitated user experiences (i.e., self-development, expressive freedom, and social connectedness) boost both engagement facets while experiencing social comparison during MIS use can undermine engagement intensity. Future research should therefore also utilize a fine-grained approach in order to identify the different ways through which MIS affect user behavior. Article 3 builds on and extends the findings of Article 1 by investigating whether a competitive and cooperative goal structure in MIS is more supportive of different user goals. The two studies reveal that cooperation is superior in terms of engagement and life satisfaction (i.e., subjective well-being), but competition is more effective in boosting performance and personal growth (i.e., psychological well-being). In examining the two well-being perspectives jointly, this article contributes to the emerging field of transformative service research (Anderson et al., 2013). Furthermore, the findings of both articles suggest that it is not only important to consider different factors of MIS design but also to take various behaviors and consequences into account, as they might be affected differently by a certain influencing factor, especially in the MIS context.

Article 1 and Article 2 provide evidence that MIS also assist firms in reaching their financial goals. The increased continued user engagement demonstrated in Article 1 complements prior finding on engagement intention (Eisingerich et al., 2019; Leclercq et al., 2020) and discards doubts that the impact of MIS on engagement will fade away after the initial attraction (Etkin, 2016; Liu et al., 2017; Wemyss et al., 2019). However, as stated above, the results of Study 2 in Article 1 indicate that MIS might also simultaneously facilitate experiences (i.e., social comparison) that lead to unexpected behavior and can harm firm success. Article 2 supports these findings by revealing that individual MIS-facilitated user experiences (e.g., self-development, expressive freedom) increase firm-beneficial behavior (i.e., commitment, willingness to pay, referrals), but their interactions (e.g., expressive freedom x social comparison) might backfire. Therefore, the results contribute to the rare findings on unwanted and negative effects of MIS (Koivisto & Hamari, 2019). Further, the articles point out that a more user-centric perspective is needed to understand user behavior and their consequences in the context of MIS (Huotari & Hamari, 2017).

The consideration of different theories (e.g., self-determination theory, achievement goal theory) in all three articles lays the foundation for determining how MIS work. The individual studies reveal that MIS address inherent human needs and desires (e.g., feeling competent, benchmark oneself with others), which motivates users to act. The theories explain how different MIS designs (e.g., social interdependence structures) or MIS-facilitated experiences (e.g., self-development, social comparison) trigger different psychological paths and cause both goal-beneficial and goal-hindering user behavior. The studies of Article 1 suggest that MIS can lead to feelings of autonomous and controlled regulation. While the first regulation indicates that MIS convey the importance and meaningfulness of the performed activities during MIS use, the latter shows that MIS can also inflict pressure and thus drive user behavior. Article 2 draws on the tenets of self-determination theory to explain the individual impact of MIS-facilitated experiences on

firm-beneficial behavior and is therefore able to shed light on the "black box" of psychological processes underlying MIS use. Article 3 reveals that MIS are capable of triggering approach and avoidance orientations simultaneously, which explains why opposing interdependence structures are superior in supporting different user goals. Therefore, this thesis highlights the necessity to consider a broad motivational spectrum to fully understand the psychological processes behind MIS use. Further, even if MIS intend to trigger positive emotions (e.g., fun), they may also inflict negative emotions (e.g., fear of failure). Thus, researchers must rely on theoretical frameworks that allow the coexistence of different and contrasting psychological processes. Also, our results support the assumption that "negative" emotions might be a natural part of hedonic services (e.g., games) and cannot be excluded when designing or using MIS (Mullins & Sabherwal, 2020).

5.2. Practical implications

The key message of this dissertation for consumers is that the use of MIS is a good choice to gain additional motivation to pursue personal goals when lacking the own will to stick to goal-beneficial activities. For managers, the main implication is that MIS are a suitable tool to build customer relationships and increase customer lifetime value. However, both stakeholders should consider that the MIS design and the experiences facilitated by this design determine their supporting role in achieving personal and financial goals and that therefore each MIS differs in terms of their positive and unintended negative effects.

First, Article 1 and Article 2 provide guidance on how to design MIS to strengthen firm-beneficial user behavior. By revealing which MIS experiences best encourage continued engagement and which game and social network features are associated with them, Article 1 advises service providers on how to maximize profitability with the most prevalent business model of mobile services (i.e., freemium model; Appel et al., 2020). Article 2 complements these findings by showing that across various service contexts MIS-facilitated experiences boost direct (e.g.,

willingness to pay more) and indirect (e.g., word-of-mouth) indicators of financial success. Thus, including additional hedonic value propositions (e.g., implementing game or social network principles) to existing utilitarian services can enhance the profitability of those services. Also, both articles show the importance to take on a more fine-grained view in terms of MIS-facilitated experiences to better understand users and users' responses. This enables managers to better forecast the impact of MIS design interventions and to avoid expensive failures. Our results advise firms to focus on game and social network features which are facilitating experiences of self-development, as they are the strongest drivers of firm-beneficial user behavior and do not inflict any negative outcomes. However, most features (e.g., user levels or badges) that nurture those experiences are also related to feelings of social comparison which can backfire. Therefore, service provides must carefully consider how to design those features to avoid "negative" experiences (e.g., private vs. public badges).

Second, broadly speaking, findings of Article 1 and 3 recommend users to choose MIS rather than other digital services when available. The results of both articles confirm that users engage more often in goal-beneficial activities when employing MIS than digital services without hedonic design principles. However, the included studies also show that the increased engagement not only stems from perceiving more "fun" but can also be caused by internal pressure (e.g., fear of how others might perceive oneself). Especially Article 3 highlights the impact of social interdependence which occurs in MIS when users compete or cooperate with others in any way. The results reveal that a more competitive goal structure leads to stronger performance and personal growth, while a cooperative goal structure is of advantage for optimizing engagement and life satisfaction. Therefore, users should prioritize their personal goals and choose MIS with a design that best fits their main goal. Further, users should be warned to avoid excessive MIS use, as they also trigger negative emotions which can result in decreased well-being if not employed properly.

Last, the findings of Article 3 also provide some valuable insights for policy maker and support organizations. MIS offer a fruitful opportunity to encourage meaningful behavioral changes. That is, MIS can be nudging instruments to shift user behaviors through pleasant and more playful experiences instead of coercion, choice restrictions, or economic incentives. In sum, the findings presented in this thesis show that the use of MIS design can enrich all stakeholders, however:

"There is only one man playing your game, You!"

—Vineet Raj Kapoor—

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Appendix

Appendix A. Initial study – Discovering MIS experience dimensions: Common game and social network features in MIS literature

Feature	Literature Support
Avatars	Matallaoui et al. (2017)
Badges	Hamari et al. (2014)
Bonus	Thiebes et al. (2014)
Chats	Sigala (2015)
Coins	Hanus and Fox (2015)
Collectibles	Hamari and Lehdonvirta (2010)
Friending	Weiser et al. (2015)
Leaderboards	Hamari et al. (2014)
Limited resources	Lucassen and Jansen (2014)
Lotteries	Lucassen and Jansen (2014)
Points	Matallaoui et al. (2017)
Quests	Thiebes et al. (2014)
Roles	Lucassen and Jansen (2014)
Social feedback	Matallaoui et al. (2017)
Story	Matallaoui et al. (2017)
Teams	Sailer et al. (2017)
Time constraints	Lucassen and Jansen (2014)
Titles	Seaborn and Fels (2015)
User levels	Hamari et al. (2014)
User profiles	Bui et al. (2015)
Virtual gifts	Lucassen and Jansen (2014)
Virtual goods	Matallaoui et al. (2017)

Appendix B. Initial study – Discovering MIS experiences dimensions: Common user experiences in MIS literature

User experience	Literature Support
Achievement	Matallaoui et al. (2017)
Altruism	Suh et al. (2015)
Challenge	Bui et al. (2015)
Choice perception	Chou (2015)
Competition	Matallaoui et al. (2017)
Completion	Korhonen et al. (2009)
Control	Korhonen et al. (2009)
Cooperation	Bui et al. (2015)
Discovery	Korhonen et al. (2009)
Envy	Thiebes et al. (2014)
Exploration	Blohm and Leimeister (2013)
Fellowship	Korhonen et al. (2009)
Meaning	Thiebes et al. (2014)
Ownership	Thiebes et al. (2014)
Progress	Matallaoui et al. (2017)
Self-expression	Suh et al. (2015)
Social interaction	Matallaoui et al. (2017)
Status	Suh et al. (2015)

Appendix C. Initial study – Discovering MIS experiences dimensions: Pre-study to develop user experience items for Study 2

Prior studies do not provide established items for measuring MIS-facilitated user experiences. Thus, we need to determine the common understanding of these experiences to measure the relation between game and social network features and user experiences. In a pre-study (n = 69), we detected the most appropriate measurement of each experience in terms of the item with the highest item-rest correlation out of three items adopted from the existing literature (e.g., Matallaoui et al., 2017; Suh et al., 2015). The table below lists the items that we identified in the pre-study and used in the study to capture user experiences associated with the game and social network feature.

User experience	**Measures**
	[Feature] helps me to…
Achievement	… reach my objectives.
Challenge	… face a challenging task.
Choice perception	… do things my way.
Competition	… compete with others.
Cooperation	… work together with others.
Progress	… develop myself.
Self-expression	… express my identity.
Social interaction	… communicate with others.
Status	… show my rank within the community.

Appendix D. Article 1 – Constructs and measures

Constructs (variable notation)	Measures	Factor loadings	
		Study 1	Study 2
Autonomous regulation (AUR)	I drank water using the app because[a] …		
	… it felt ambitious.	.77	.67
	… it was fun.	.78	.78
	… it was interesting to see my own improvement.	.85	.80
	… it helped me feel better.	.79	.79
	… it was key to accomplish my goals.	.87	.79
	… it was important for me.	.80	.75
Controlled regulation (COR)	I drank water using the app because[a] …		
	… I would have felt bad if I did not.	.88	.86
	… I would have felt that I would fail if I did not.	.83	.86
	… I would have felt guilty if I did not.	.87	.90
Self-development (DEV)	The app helps me to…		
	… reach my objectives.		
	… face a challenging task.		
	… develop myself.		
Expressive freedom (EXF)	The app helps me to…		
	… express my identity.		
	… do things my way.		
Social connectedness (CON)	The app helps me to…		
	… work together with others.		
	… communicate with others.		
Social comparison (COP)	The app helps me to…		
	… compete with others.		
	… show my rank within the community.		
Network size (NWS)	With how many friends did you use the app?		
Reminder usage (REU)	I have used the app reminder consistently since installation.		
Reminder perception (REP)	I felt urged to use the app by the reminder.		
Compatibility (COA)	The app fits my workstyle.		
Variety seeking (VAS)	If I have the possibility to choose between many apps for the same context, I always tend to try different apps.		
Ease of use (EOU)	It is easy to use the app.		
Aesthetics (AES)	The app is aesthetically appealing.		
Expected enjoyment (ENJ)	Using the app will be fun.		
Brand attitude (BRA)	I think the brand is excellent.		
Perceived update type (PUT)	App updates greatly changed important functions of the app.		

[a] The activity was adapted to the service domains considered in Study 2.

Notes: Results of the factor analysis of user regulations with n = 106 (n = 312) are based on principal component analysis using Varimax-rotation.

Appendix E. Article 1 – Common game and social network features embedded in MIS

Feature	Description
Avatars	Images of users that visually represent them in the service community
Badges	Signs of attainment awarded to users after successful completion of a quest or task, or attaining a milestone
Chats	Enables users to message each other in real-time
Friending	Enables users to add other users to their social network (e.g., friend list)
Leaderboards	Rankings of users based on their relative performance in service-focal activities
Points	Units that measure user performance through completion of specific tasks
Quests	Predefined objectives that users should reach by performing activities
Social feedback	Enables users to react to other users' activities (e.g., thumbs up)
Teams	Groups of users formed to achieve a common goal
User levels	Representation of users' current skill levels
User profiles	Personalized virtual identities of users in the service community

Appendix F. Article 1 – Selected apps for Study 2

Service domain	Mobile app	Number of game and social network features
Community	Chefkoch	3
	Tripadvisor	7
Education	Babbel	7
	Duolingo	8
Fitness	Freeletics	9
	Nike+	9
	Runtastic	9
Nutrition	Liefesum	4
	FatSecret	2
	MyFitnessPal	7
	Yazio	2
Organization	Evernote	3
	Flatastic	7
	Wunderlist	5

Note: The number of implemented game and social network features is determined based on the list of features in Appendix E.

Appendix G. Article 2 – Constructs and measures

Constructs	Measures	Loading
Customer commitment (Adapted from DeWulf et al., 2001)	I am willing to remain loyal to this [App].	
	I am willing to make small sacrifices in order to keep using [App].	
Willingness to pay[a] (Adapted from Pihlström & Brush, 2008)	I will continue to use [App] even if I have to pay for it.	
	I will continue to use [App] even if the subscription payment increases.	
Customer referral (Adapted from Maxham & Netemeyer, 2002)	I would recommend [App] to my friends.	
Self-development (Adapted from Wolf et al., 2018)	The app helps me to …	
	… reach my objectives.	.86
	… face a challenging task.	.86
	… develop myself.	.87
Social connectedness (Adapted from Wolf et al., 2018)	The app helps me to …	
	… work together with others.	.89
	… communicate with others.	.87
Expressive freedom (Adapted from Wolf et al., 2018)	The app helps me to …	
	… express my identity.	.72
	… do things my way.	.88
Social comparison (Adapted from Wolf et al., 2018)	The app helps me to …	
	… compete with others.	.93
	… show my rank within the community.	.91
App usage duration[b] (self-developed)	How many months have you been using [App]?	
Premium user[c] (self-developed)	Are you using a premium version of [App]?	
Technology experience (Adapted from Olsson et al., 2016)	I'm a very experienced user of apps.	

[a] The first (second) item was answered by participants, who use a free (premium) version of the focal app at the time of survey completion. [b] App usage duration was measured with an open-ended question where participants stated the number of months they have been using the app. [c] Premium user was measured as a yes/no question.

Appendix H. Article 3 – Constructs and measures

Constructs	Measures	Factor loadings Study 1	Study 2
Social interdependence structures			
Competition[a] (Gerpott et al., 2018) α = .88	When using and performing tasks of [App], …		
	… I compete with others.		.875
	… I compete with other users for goal achievement.		.891
	… I can only achieve my desired results if other users are less successful.		.824
	… the achieved results cannot satisfy me and other users at the same time.		.750
Cooperation[a] (Gerpott et al., 2018) α = .83	When using and performing tasks of [App], …		
	… I cooperate with others.		.701
	… other users and I have a common goal.		.709
	… my results should be similarly satisfying for me and for other users at the same time.		.827
	… my goal achievement depends on supporting activities of other users.		.722
Psychological processes			
Strive for success (SFS) (Lang & Fries, 2006) α = .89 (.86)	The tasks of [App] …		
	… encourage me to find out how good I am.	.895	.812
	… animate me to work on a solution immediately.	.875	.804
	… cause me to challenge my capabilities.	.773	.846
Fear of failure (FOF) (Conroy et al., 2002) α = .83 (.89)	When I am failing at the tasks of [App], …		
	… it is embarrassing if others are there to see it.	.830	.823
	… I worry about what others think about me.	.751	.896
	… I worry that others may think I am not trying.	.791	.832
Behavioral engagement (ENG)			
Engagement (Cheung et al., 2011; Hollenbeck et al., 1989) α = .85	I am strongly committed to pursuing the tasks of [App].	.739	
	I am willing to do a lot to solve the tasks of [App] well.	.852	
	I am willing to put forth a great deal of effort in performing the [App] tasks.	.843	
Frequency of use	How many days in the past four weeks have you used [App]?[b]		
Performance (PER)	In the last four weeks …		
(Greguras & Diefendorff, 2010) α = .90	… I made considerable progress with the [App] tasks.		.812
	… I did very well on [App]'s tasks.		.842
	… I met the requirements for [App]'s tasks very well.		.799
	… I mastered everything I was assigned in [App]'s tasks very well.		.868

Well-being		
Life satisfaction (LSF) (Diener et al., 1985) α = .89	In most ways my life is close to my ideal.	.795
	The conditions of my life are excellent.	.932
	I am satisfied with my life.	.832
Personal growth (PEG) (Ryff, 1989) α = .88	I am interested in activities that will expand my horizons.	.736
	When I think about it, I really improved much as a person over the years.	.950
	For me, life has been a continuous process of learning, changing, and growth.	.829
Controls		
Premium version (PRE)	Do you use the premium version of [App]?[c]	
Length of app use (LAU)	For about how many months have you been using [App]?[b]	
Network size (NWS)	I am connected or friends with many users in [App].	
Affective social identity (ASI) (Bagozzi & Dholakia, 2006)	I feel very attached to other users of [App].	
Perceived social support (PSS) (Zimet et al., 1988)	I can count on other users in [App] when things go wrong.	
Brand attitude (BAT) (Bellman et al., 2011)	I think [App] is excellent.	
Narcissism (NAR) (Konrath et al., 2014)	I am a narcissist.	

Note. Items and Cronbach's alphas of Study 2 are reported in brackets if not stated otherwise.

[a] These items were used in Study 1 only as manipulation checks.

[b] The items were measured with an open-ended question.

[c] Premium version was measured as a yes/no question.

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Overview of personal contribution to research articles

Article	Co-authors	Contributions[a, b]				
		Idea	**Concept**	**Data**	**Analysis**	**Manuscript**
Article 1: The Effects of Motivational Information Systems on Continued User Engagement: A Self-determination Theory Perspective	Welf H. Weiger, Maik Hammerschmidt	■■■■	■■■■	■■■■■	■■■■■■	■■■■■
Article 2: Experiences that Matter? The Motivational Experiences and Business Outcomes of Gamified Services	Welf H. Weiger, Maik Hammerschmidt	■■■■■	■■■■■	■■■■■	■■■■■■	■■■■■
Article 3: Competition versus Cooperation: How Technology-facilitated Social Interdependence Initiates the Self-improvement Chain	Steffen Jahn, Welf H. Weiger, Maik Hammerschmidt	■■■■	■■■■	■■■■■	■■■■■■	■■■■

[a] A typical research project of mine can be described as a process with five stages that I term “idea”, “concept”, “data”, “analysis”, “manuscript”. Each of those stages may be repeated throughout each round of revisions. The estimates given reflect my contribution across each of those stages from the start of this article till finalization.

[b] Anchored by ■ = “Completely the contribution of my co-authors” and ■■■■■■■ = “Completely my contribution”.

26.10.2020

Date, Signature

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Tobias Wolf