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GOING BEYOND TRACKING: UNDERSTANDING THE FITNESS TECHNOLOGY USE PERSISTENCE

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GOING BEYOND TRACKING: UNDERSTANDING THE FITNESS TECHNOLOGY USE PERSISTENCE

Completed Research Paper

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Abstract

Drawing on self-determination theory, this study examines the user experiences of fitness technology users, categorizing their experiences based on satisfied and frustrated Basic Psychological Needs (BPNs). We observe that fitness technology users often exhibit both positive and negative orientations toward such technologies, which affect the use continuance of these technologies. The significance of addressing both BPNs satisfaction and frustration becomes obvious in understanding post-adoptive IS use behavior. Our systematic literature review findings highlight the importance of prioritizing users' informational, affective, and social needs, enabling the creation of user-centric fitness technologies. This research supports a multifaceted approach to IS use patterns, suggesting the alignment of design choices with various user preferences.

Keywords: Fitness technology use persistence, Self-determination theory, Basic psychological needs, Post-adoptive information systems use behavior, Systematic literature review.

1 Introduction

Insufficient physical activity (PA) poses a global health risk, contributing to non-communicable diseases and premature death. Conversely, regular PA offers numerous health benefits and is crucial for disease prevention. In recent years, fitness technologies such as devices, apps, and services have gained popularity for motivating individuals to increase their PA levels and reduce sedentary behavior (Kettunen et al., 2017).

Self-monitoring devices have substantial potential to promote PA engagement in multiple ways. They offer evidence-based support for boosting PA levels (Romeo et al., 2019) and reducing sedentary behaviors (Stephenson et al., 2017). These devices facilitate goal-setting (Kirwan et al., 2013), provide digital coaching (Kettunen & Kari, 2018), foster social support (Sullivan & Lachman, 2017), and enhance engagement through exergames (Kari et al., 2020) and gamification (Koivisto & Hamari, 2019). They also offer personalized feedback, raising awareness of PA behaviors and motivating sustained usage (Wang et al., 2016). However, it's crucial to note that increased awareness does not guarantee prolonged technology usage, impacting PA consistency (Attig & Franke, 2020). Dropout rates from exercise programs can reach 50% within the first six months (Linke et al., 2011), and fitness app usage declines after just five to six weeks due to a lack of motivation (Goodyear et al., 2017; Schoeppe et al., 2016).

In the realm of motivational information systems (IS) research, three primary designs are notable: 1) Hedonic design: Enhancing intrinsic motivation and enjoyment of activities and systems (Landers et al., 2018), 2) Utilitarian design: Utilizing big data advancements to provide users with personalized, precise performance data and reports (Nafus & Sherman, 2014), and 3) Social networking design: Fostering a sense of community among users through socio-psychological responses (Chen et al., 2014). Consequently, understanding the factors that drive prolonged fitness technology use is crucial. The Self-Determination Theory (SDT) offers insights into motivational processes, emphasizing basic psychological needs (BPNs) satisfaction, including autonomy, competence, and relatedness (Ryan et al.,

2008). Previous research has explored the impact of motivational drivers on fitness technology (Hamari et al., 2018; James et al., 2019a) and its relationship with wellness outcomes (James et al., 2019b; Rockmann, 2019; Whelan & Clohessy, 2020), often mentioning motivational theories without specifying their influence (Orji & Moffatt, 2018).

This paper conducts a systematic literature review with two primary objectives. *First*, analyze existing literature on adults' experiences with fitness technologies through the lens of SDT, and *second*, understand how factors, particularly BPNs satisfaction, and frustration, influence sustained device usage or abandonment. To guide our investigation, we formulate the following research question: How do BPNs (autonomy, competence, and relatedness) interact with adults' experiences using fitness technologies and contribute to sustainable/stop usage of the device?

This study aims to identify factors impacting user engagement and disengagement, explaining how fitness technologies can address users' BPNs. Drawing from the SDT framework, we develop a conceptual framework for understanding fitness technology use persistence. We aim not only to support the design of fitness technology but also to enrich IS literature by introducing a conceptual framework that applies Self-Determination Theory to user engagement with fitness technology, providing a structured approach to analyze and design for user needs and future studies.

2 Theoretical Background

The SDT asserts that intrinsic goals, which fulfill individuals' BPNs, contribute to enhanced well-being (Deci & Ryan, 2012; Ryan et al., 2008). Empirical evidence supports this idea, demonstrating that BPNs satisfaction is linked to positive outcomes (Thøgersen-Ntoumani et al., 2010). In contrast, extrinsic goals often result in reduced well-being and compromised performance as they do not directly address these fundamental needs (Deci & Ryan, 2012).

In the realm of exercise, researchers have extended SDT to explore the role of goals (Markland & Ingledew, 1997). This study applies BPNs to investigate how users perceive their fitness technologies in terms of satisfying or frustrating their autonomy, competence, and relatedness needs. Autonomy involves the perception of being the origin or source of one's actions (Ryan & Deci, 2002). Competence pertains to feeling effective in interactions with the social environment and having opportunities to express one's abilities (Ryan & Deci, 2002). Relatedness involves feeling connected to others, experiencing care, and having a sense of belonging (Ryan & Deci, 2002).

These needs have been empirically linked to positive psychological outcomes. BPNs satisfaction enhances engagement, psychological well-being, and self-esteem (Bartholomew et al., 2011; Chen et al., 2015). Conversely, BPNs frustration can have adverse effects, leading to reduced life satisfaction and increased depressive symptoms (Bartholomew et al., 2011; Chen et al., 2015). SDT posits that fulfilling the basic needs for competence, autonomy, and relatedness is crucial for ongoing well-being (Ryan & Deci, 2000). In the context of fitness technologies, the satisfaction of competence needs has been positively associated with intentions to continue use, while competence frustration showed no significant relationship (Rockmann, 2019). Within the IS literature, BPNs satisfaction has been identified as a key factor influencing technology acceptance and sustained use, as seen in e-learning (Roca & Gagné, 2008) and open-source software development (Ke & Zhang, 2010). Autonomy and relatedness needs have also been linked to enterprise system usage and exploration satisfaction (Ke et al., 2013).

Building on this theoretical foundation, we propose that users who perceive their fitness technologies as satisfying their BPNs will continue using them, while those experiencing BPNs frustration will discontinue use. Within the existing literature on fitness technologies, the nuanced dynamics between users' Basic Psychological Needs (BPNs)—autonomy, competence, and relatedness—and their prolonged engagement remain insufficiently explored (Bartholomew et al., 2011; Chen et al., 2015). This gap, especially regarding how BPNs satisfaction and frustration impact sustained technology use, forms the core focus of our investigation. Our study focuses on users' perceptions of BPNs satisfaction and frustration in the context of fitness technologies, investigating their influence on intentions to

continue use. This understanding can inform the development of personalized interventions, thereby enhancing user engagement and overall well-being.

3 Methodology

Our literature review falls into moving beyond the mere compilation and description of prior research and address a critical research gap. We aim to reconceptualize user experiences with fitness technology through the lens of the SDT. Our goal is to synthesize these insights to provide a more comprehensive understanding of how user experiences are shaped by motivational systems, ambivalent feelings, and the satisfaction of BPNs, which are pivotal in determining whether users continue using fitness technologies. This reconceptualization and synthesis offer deeper insights into the dynamics of user interactions with fitness technologies. Notably, we have intentionally excluded digital health services from our study, focusing exclusively on user-device interaction within the context of fitness technology.
Our review process commenced with comprehensive searches of major electronic databases, including Scopus, Web of Science, and PubMed. These databases were selected for their comprehensive coverage of scientific articles. We employed specific keywords, such as ("activity track*" OR "self track*" OR "self-track*" OR "fitness track*" OR "wearable fitness track*") AND ("experience*" OR "need*" OR "preference*" OR perception OR understanding OR perspective) in our search queries. We conducted a thorough examination of reference lists (backward search) to ensure the inclusion of any relevant papers that might have been inadvertently overlooked during the initial screening (Webster and Watson, 2002).
In the initial screening phase, we rigorously reviewed the titles and abstracts of 1,329 articles. Our review process started with a detailed evaluation of each study's title, abstract, and keywords, leading to the exclusion of 1,108 papers. We subsequently conducted a comprehensive review of the full text of the remaining 221 articles, reading each in its entirety. After applying strict inclusion/exclusion criteria, articles that met the primary selection criteria underwent a critical assessment based on their relevance to the research questions. Finally, we retained 40 articles, which formed the basis of our analysis. These selected articles underwent a comprehensive examination concerning in-depth reading, coding, and analysis. Further details about the defining stage of the literature review, the search selection process, findings with coded papers, and can be found in the footnote[1].
In our methodology, we implemented a multi-phase coding process to ensure the comprehensive analysis of the selected papers. The initial coding phase involved a preliminary review, focusing on titles, abstracts, and keywords to determine relevance. Following this, the papers that met our criteria underwent a second phase of in-depth coding where we carefully analyzed the full text for detailed themes related to our research question. This two-phase approach was designed to first broadly identify relevant literature, then deeply analyze the content for nuanced insights.
During the data extraction phase, we systematically documented essential information for each article. This includes aspects such as the study's characteristics (e.g., research design and participant demographics), the specific content related to user experiences with fitness technologies, and any contextual information that could contribute to a more in-depth understanding of the reported experiences. The data extracted from the selected articles underwent a rigorous coding process to identify frequent patterns, themes, and variations. Our approach encompassed both inductive and deductive methods. Initially, we applied an inductive approach to permit themes to naturally emerge from the data, ensuring that no valuable insights were overlooked. Thereafter, we employed a deductive approach to align these identified themes with pre-defined categories derived from our research questions and objectives ([1] to analyze existing literature on adults' experiences with fitness technologies through the lens of SDT, and [2] to understand how factors, particularly BPNs satisfaction and frustration, influence sustained device usage or abandonment). This combination of methods enabled a comprehensive analysis of the data.

[1] Inclusion/exclusion criteria and screening process is available here

The data extracted from the selected articles underwent a rigorous coding process to identify recurring patterns, themes, and variations.

Our initial categorization of user experiences considered whether they were positive or negative. Building on insights from our literature review and the BPNs framework, which includes autonomy, competence, and relatedness, we further classified and extracted themes related to the satisfaction of these BPNs from positive user experiences. Conversely, we sought to extract themes associated with the frustration of these BPNs from negative user experiences. Notably, these themes were directly linked to the concepts of autonomy, competence, and relatedness, aligning with the core principles of each psychological need. To enhance the reliability and validity of our analysis, two researchers independently conducted the coding of the data. Any differences in coding were thoroughly discussed and resolved through consensus, ensuring the consistency and accuracy of the coding process.

Our initial data coding process started with an inductive approach within the iterative data analysis process. We approached the extracted information from the selected articles with an open attitude, allowing themes to naturally emerge without predefined categories. For example, themes related to users' experiences with the device, including challenges confronted during device use or exercises, interactions with other users, competitive aspects, and the effectiveness of feedback or notifications, emerged from the initial coding. Following the initial coding, we engaged in a comparative analysis, examining codes across various articles to identify patterns, similarities, and differences in user experiences. For instance, we categorized all health-related improvements, such as increased exercise capability and dietary changes, under the overarching theme of "confidence in managing health." Additionally, we recognized the importance of distinguishing between feedback generated by the device and feedback originating from social sources, as our primary focus was on device-generated factors. Continuous discussions and reflections within the research team played a pivotal role. These discussions centered on major themes identified in the data. At this stage, we sought to establish connections between our pre-defined themes and the BPNs of autonomy, competence, and relatedness (both satisfied and frustrated).

Our understanding of these concepts, as derived from our literature review and subsequent discussions, proved highly beneficial in categorizing themes based on the BPNs. Figure 1 presents the final coding according to the type of user experience, BPNs as defined by SDT, and emergent themes, which are divided to into two main user experience categories: positive and negative. For each category, we found that the experiences related to the three BPNs (autonomy, competence, and connectedness) and highlight the related themes we discovered. More specifically, the *Positive User Experiences* category explores themes related to the satisfaction of the three BPNs (in sum, 52 coded instances with positive user experiences in our 40 papers). In contrast, *Negative User Experiences* are instances where these BPNs were frustrated. It is important to note that these themes do not exist in isolation from each other but interact and potentially influence each other (in sum, 40 instances were coded with negative user experiences). To clarify our coding methodology, two researchers independently applied an inductive approach to identify emergent themes from the data, ensuring no a priori assumptions influenced the initial coding. Subsequently, through iterative discussions, consensus was reached on the emerging themes, enhancing the analysis's reliability. A deductive phase followed, where these themes were systematically aligned with the BPNs (autonomy, competence, and relatedness) of SDT, scrutinizing for alignment and divergence. This dual-phase coding process guaranteed that our thematic framework was grounded in the data while being informed by our theoretical lens, ensuring a robust and transparent analysis within the constraints of our page limitations.

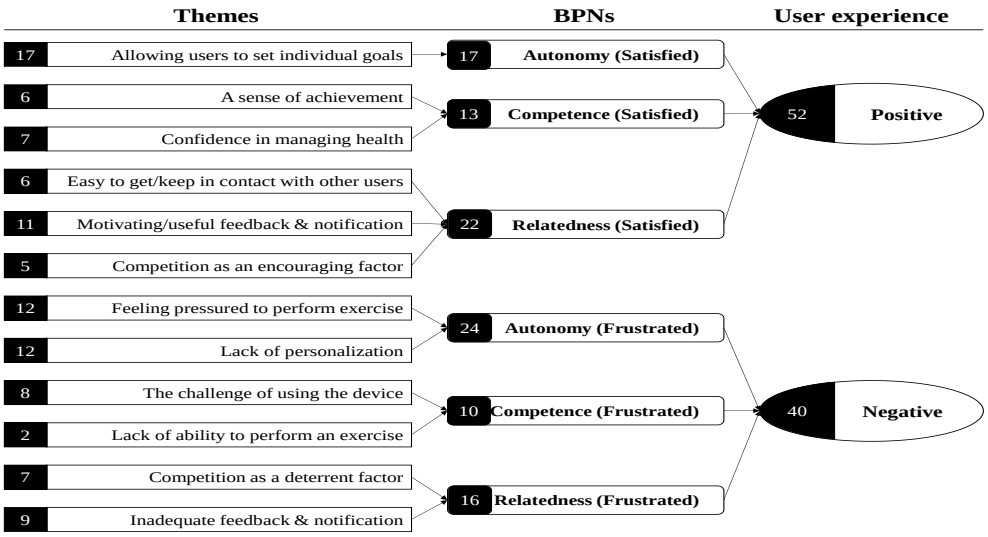

Figure 1. The Emerging Themes, BPNs, and Types of User Experience

4 Findings

In the following parts, we elaborate on the findings (based on Figure 1) and provide a more nuanced discussion of the dynamics at play.

4.1 Autonomy needs (satisfied)

4.1.1 Allowing users to set individual goals

Hedonic features, such as personal goal-setting in services, can enhance user enjoyment, which often links to intrinsically motivated behaviors (Fang et al., 2017; Huang et al., 2018; van der Heijden, 2004). Such experiences can heighten user engagement with activities, like exercise, resulting in qualitative improvements or increased frequency (Osatuyi & Qin, 2018). One illustrative example comes from a participant who remarked, “Initially daunted by the 10,000 steps baseline, I adjusted my goal to 5,000 steps. This achievable target boosted my confidence and motivation” (Shin et al., 2019). Similarly, another user emphasized, “The tracker”s goal-setting feature enhanced my motivation and prompted me to increase my steps” (Voskuil et al., 2020). In essence, these observations underscore the importance of customizable goals in fitness technology. Offering users this flexibility bolsters their autonomy and motivation, promoting consistent use of such technology.

4.2 Autonomy needs (frustrated)

4.2.1 Feeling pressured to perform self-monitoring

When fitness technology imposes constant monitoring or sets rigid expectations, it can lead to users feeling overwhelmed, resulting in diminished motivation and a sense of powerlessness.

A user captured this sentiment, saying, “After a busy day, when I finally rested, the tracker prompted 'Move!' It felt demanding given all I would do” (Nguyen et al., 2017). Such instances emphasize how pressure from self-monitoring can compromise user autonomy, negatively affecting their interactions with the device. The perceived compulsion to constantly fulfill activity targets can make users feel controlled, which in turn hampers their motivation and engagement with the technology.

4.2.2 Lack of personalized information

Users often view the absence of tailored information in fitness devices as a drawback, especially those keen on their well-being and physical activity. The lack of relevant, quality information from the service diminishes user trust and satisfaction. One user highlighted this gap, saying, “I need advice on suitable exercises for my age” (Kettunen & Kari, 2018). Another user added, “The device's generic information

reduces its reliability" (Kettunen & Kari, 2018). Thus, to effectively engage users, it's crucial to offer information that is both timely and personalized. Such personalization is fundamental to systems and services aiming to enhance motivation and user commitment (Hamari & Koivisto, 2015b; Osatuyi & Qin, 2018).

4.3 Competence needs (satisfied)

4.3.1 A sense of achievement

Experiencing a sense of accomplishment when achieving a target goal is a pleasurable aspect of motivational systems linked to positive and self-driven behavior (Fang et al., 2017; Huang et al., 2018; van der Heijden, 2004). These enjoyable experiences significantly affect users' engagement in activities supported by the motivational system, such as exercise, resulting in various advantages, including improved activity quality and increased participation frequency (Osatuyi & Qin, 2018). When users meet their target goals, it creates a feeling of fulfillment and competence, contributing to a positive user experience. One user expressed, "Achieving my target goal is genuinely satisfying. In that sense, that module adds significant value" (Degroote et al., 2020). Another user stated, "My initial goal was 10,000 steps, but I found that I could easily reach 3000, and with some effort, I could achieve 5000. Taking a walk during lunch got me to 7000. So, I discovered that increasing my activity levels allowed me to reach my goal, and I enjoyed receiving badges as recognition. That was a great fun!" (Shin et al., 2019). These examples illustrate how meeting fitness goals can satisfy users' competence needs, leading to a positive impact on their motivation, satisfaction with the fitness technology, and continued device usage.

4.3.2 Confidence in managing health

Some users have found that using fitness technologies has positively impacted their self-esteem. According to Smith (2013), self-esteem can be viewed as a resource that service providers can enhance through the features of fitness technology, helping users better manage their health and boost their confidence. For instance, one user stated, "I am a regular runner now, three days a week. I've also improved my eating habits, cutting out fast food" (Farič et al., 2021). This suggests that the device aids in establishing a consistent exercise routine, aligning with users' expectations of more regular physical activity. When users have confidence in their ability to manage their health, it boosts their self-efficacy, motivation, and the likelihood of continued fitness technology usage. This positive experience of increased confidence contributes to overall user satisfaction and reinforces their belief in their competence to make healthy choices.

4.4 Competence needs (frustrated)

4.4.1 Challenges to use the device

Systems are primarily designed to offer utilitarian benefits, and it is well-established that people's acceptance of these systems depends on how useful they perceive them to be (Davis, 1989). These connections between a system's utilitarian value and its adoption, even across different cultures, have been studied (Dwivedi et al., 2016). However, some users have faced challenges with their fitness devices, such as phone shutdowns or app malfunctions that lead to issues like the device getting stuck. For example, when a user put in a lot of effort, like walking or running extensively to meet a goal (e.g., burning 300 Kcal), but the device failed to register the kilometers walked, these users felt that their time and effort were wasted. Such device-related problems not meeting user expectations and causing quality concerns can lead to frustration, dissatisfaction, and a loss of motivation. For instance, one user expressed disappointment, stating, "Sadly, despite walking and running approximately 8,000 steps, the device failed to record the number of kilometers I covered" (Olsen et al., 2019). Another user admitted, "When using the app, I felt quite limited in my skills... probably due to my lack of interaction with it. I could sync it and view data, but I didn't do much else with the app" (Nguyen et al., 2017).

These examples highlight how difficulties in using the device, technological failures, and quality issues can undermine users' competence needs and contribute to frustration and demotivation. When users encounter challenges that hinder their effective use of fitness technology, it can diminish their confidence in using the device to achieve their goals.

4.4.2 Lack of ability to perform the exercise

Some users have expressed concerns regarding how fitness technology can make them feel incapable of performing exercises or engaging in physical activities. Users' needs may go unmet due to limited physical ability, pain, or tight schedules, as the device features do not align with their competence needs. In particular, users find it challenging when they experience pain during physical activity, which restricts their range of motion and demotivates them from staying engaged. For instance, when a user cannot reach the daily goal of 10,000 steps due to the difficulty level or knee pain, their expected needs remain unfulfilled. For example, one user expressed frustration, saying, "It was frustrating: ...my knees hurt, and I couldn't manage 10,000 steps!" (Elnaggar et al., 2021). Another user mentioned, "Well, 10,000 steps per day are unrealistic, and I start to think, "I won't make it anyway," so it should be a more achievable goal" (Ummels et al., 2020).

These examples illustrate how users' competence needs are frustrated when they face physical challenges or limitations that hinder their ability to exercise or meet specific goals. When users feel incapable of achieving set targets due to pain, restricted movement, or other physical constraints, it leads to demotivation and dissatisfaction.

4.5 Relatedness needs (satisfied)

4.5.1 Easier to get/keep in contact with other users

Human beings have an inherent need for socialization and interaction (Ryan & Deci, 2000). Technological advancements throughout history have aimed to increase connectivity and improve communication among people, facilitating intergenerational interactions (Pan et al., 2017). In many cases, individuals rely on social feedback to determine whether to continue engaging in a behavior or discontinue it (Hamari & Koivisto, 2015b; Teng, 2017) and to assess their progress and behavior (Fishbach & Finkelstein, 2011). When users have the chance to connect with others who share similar goals and experiences, it fosters a sense of belonging, encourages accountability, and builds a supportive network. Sharing experiences, challenges, and support among peers can be motivating and inspiring, leading to continued engagement with fitness technology (Szinay et al., 2021). Users also frequently mention their enjoyment of interacting with peers through the app, including participating in challenges with friends (Ridgers et al., 2018). While some studies on social influences within social communities have suggested limited effects on post-adoption behavior on these platforms (Shiau et al., 2018), research on social influences in the context of motivational IS consistently indicates a positive connection between social influences/feedback and intentions to continue using adopted systems (Hamari & Koivisto, 2015b; Huang et al., 2018; Osatuyi & Qin, 2018).

4.5.2 Positive feedback and notification

One primary purpose of feedback is to reduce the discrepancies between intended and actual behavior (Hattie & Timperley, 2007), guiding individuals toward desired performance (Fishbach & Finkelstein, 2011). Motivational research has long explored feedback's potential for driving behavioral change (e.g., Custers & Aarts, 2005). Positive feedback and notifications from fitness apps enhance users' motivation and sense of connection, contributing to a positive user experience. Users find push notifications throughout the day helpful in reminding them to stay active (Elnaggar et al., 2021). Additionally, motivational feedback and graphics that provide users with a percentage ranking for the day prove effective in keeping users engaged (Hardcastle et al., 2018). Users also appreciate the visual aspects of apps. Incorporating images and colors, rather than just numbers, enhances the overall appeal of the app. This perception of hedonic value stimulates continued engagement among self-tracking users (Szinay et al., 2021). Informational feedback holds particular importance, as a meta-analysis suggests it may have a stronger impact on behavior than other feedback forms (Hattie & Timperley, 2007).

4.5.3 Competition as an encouraging factor

Fitness technology facilitates connections between users and like-minded individuals, promoting information sharing and social feedback (Oinas-Kukkonen et al., 2010). This social feedback often

involves elements of social comparison and competition, which have been recognized as powerful motivators (Hamari & Koivisto, 2015b; Venkatesh & Davis, 2000). Merely observing friends' lifestyles through online sharing can inspire individuals to commit to goals or align their behavior with their social group (Shiau et al., 2018). Social feedback, for various reasons, significantly influences motivation, making it a commonly employed motivational tool in information systems (Osatuyi & Qin, 2018).
Users find competition and comparing their physical activity with others to be highly motivating, enhancing their sense of competence and overall user experience. As one user emphasized, "Seeing each other's results triggered us all" (Rönkkö, 2018). This highlights how competition and result comparison fulfill users' competence needs, providing relevance and benchmarks for self-monitoring. Comparing progress with others allows users to assess their performance, fostering a drive for improvement and accomplishment. Furthermore, users value the interactive aspects of fitness technology, such as participating in challenges with other users (Ridgers et al., 2018). In addition, competition, as an integral part of fitness technology, successfully satisfies users' competence needs. By offering opportunities for performance comparison and friendly competition, fitness technology elevates users' motivation, drive, and overall satisfaction with the platform. This interplay between social feedback, competition, and motivation underscores the significance of these elements in the fitness technology usage.

4.6 Relatedness needs (frustrated)

4.6.1 Competition as a deterrent factor

While social feedback in fitness technology is often viewed as positive, it can also evoke negative emotions like failure, envy, or disappointment (Krasnova et al., 2015; Pan et al., 2017), potentially demotivating users. Friendly competition can serve as a motivator for some users, but for others, it can have adverse effects, causing feelings of discouragement, stress, and disconnection from peers (Steinert et al., 2018). For instance, one user stated, "I found it stressful to see how physically active others were in the app, leading to dissatisfaction with my own results" (Kerner et al., 2019). This demonstrates how excessive or discouraging competition can frustrate the relatedness needs of fitness technology users. The pressure to compete and fear of falling behind can result in stress, dissatisfaction, and reduced engagement.

4.6.2 Inappropriate notification and feedback

Individuals often seek informational feedback from their environment to evaluate their behavior (Hamari & Koivisto, 2015a). Informational feedback provides objective information on specific matters, such as health reports or performance measures (Hattie & Timperley, 2007; Fishbach & Finkelstein, 2011). However, not all feedback and notifications in fitness technology are well-received. Some users perceive them as inappropriate and negative experiences, feeling pressured to engage in physical activity due to app notifications, which can lead to demotivation. For instance, a user mentioned, "I thought that was a bit cheap because I have been busy all day, and now I am finally sitting down, and it wants me to move again" (Nguyen et al., 2017). Another user found the reminders too simplistic and even rude, saying, "It buzzed at you and went MOVE . . . even had an exclamation mark, it is like "seriously," you get slightly offended" (Hardcastle et al., 2018). Some users expressed dissatisfaction with the messages, stating, "The messages were not helpful or motivating. Need more specific input and interaction" (Elnaggar et al., 2021). Another user mentioned, "The device does not give feedback or provide me with any chart about my progress" (Elnaggar et al., 2021).
These examples demonstrate how inappropriate notifications and feedback can frustrate the relatedness needs of fitness technology users, undermining their motivation and connection with the technology. It is crucial to provide feedback in a respectful, relevant, and helpful manner to enhance motivation and user satisfaction (Fishbach & Finkelstein, 2011; Hattie & Timperley, 2007).

5 Discussion of Findings

Our systematic literature review explored the experiences of fitness technology users through the lens of SDT, aiming to categorize these experiences based on satisfied and frustrated BPNs. Our investigation revealed that the design of motivational IS, encompassing hedonic, utilitarian, and social features, significantly shapes users' motivation. Fitness technology based IS have become intricate and pervasive tools, yielding a range of intended and unintended consequences for users. This complexity transforms IS user experiences into ambivalent ones, characterized by a blend of positive and negative aspects rather than a strictly positive or negative user experience. Ambivalence in this context refers to a state of mind where individuals simultaneously hold both positive and negative orientations toward an object, resulting in mixed thoughts and feelings or a 'love-and-hate' relationship with the object (Ashforth et al., 2014).

Ambivalence is particularly noteworthy in the post-adoption stage of IS use, where users engage more deeply and extensively with IS affordances, sometimes exceeding the intended terms of use set by designers (Burton-Jones & Straub, 2006; Jasperson et al., 2005). For example, in our study, we identified that messages and feedback are often recognized as drivers that create value for users. However, users also report feeling pressured by app notifications or receiving inappropriate feedback, which can frustrate their relatedness needs in the context of fitness technology. Similarly, while users often find competition and comparing their physical activity with others encouraging, these practices can also lead to negative experiences such as feelings of failure, envy, and disappointment.

Our research highlights that positive and negative experiences are inherently multi-dimensional and subjectively determined by individual users. For instance, notifications and messages are regarded as positive experiences and motivators for physical activity by some users, while they are perceived as negative experiences by others. Our study reveals that not only can users simultaneously experience both positive and negative aspects, but what constitutes a positive experience for one user may be seen as a negative experience by another. In this context, our research aligns with and extends prior findings (Lintula et al., 2018; Vartiainen and Tuunanen, 2016), emphasizing the crucial role of understanding users' experiences in service design and provision. Our findings underscore that users' positive and negative experiences significantly influence their decision to continue using the device or discontinue its usage.

Our research also indicates that specific design features can evoke distinct emotions and user experiences. Features related to competition, which foster a sense of relatedness among users, not only introduce a social dimension to the device but also contribute to an enjoyable overall experience. This dual nature underscores how the social element of the device is closely intertwined with the hedonic aspect, ultimately enhancing user satisfaction and engagement. Additionally, research in the field of gamification suggests that social motivation is often facilitated by gamification mechanics, particularly through social experiences such as competition or cooperation between users (Chen et al., 2014; Morschheuser et al., 2017). Moreover, feedback in the form of graphs and colors serves to provide users with informational feedback while contributing to their hedonic experience. As a result, these two types of feedback are closely intertwined, making it challenging to separate them (e.g., Huang et al., 2018). Individuals often experience affective feedback concurrently with various types of feedback (Fishbach & Finkelstein, 2011), not limited solely to affective feedback. Affect is intricately woven into all aspects of our activities and perceptions, suggesting that the same mechanisms that enable users to experience informational feedback also lead to affective experiences.

We suggest that users who perceive their fitness technologies as satisfying their BPNs are more likely to continue using them. Conversely, users who find that their fitness technologies frustrate their BPNs are more likely to discontinue use. This proposition aligns with findings from previous research. For instance, Rodrigues et al. (2019) demonstrated that BPNs frustration directly and indirectly influences the intention to exercise. Additionally, Bartholomew et al. (2011) found a positive association between BPNs frustration and eating disorders, which are negative health-related behaviours. Furthermore, another study on fitness technology revealed that the satisfaction of the competence need is positively

associated with intentions to continue using such technologies, while competence frustration does not significantly impact these intentions (Rockmann, 2019).

These findings lend support to our proposition that BPNs frustration is negatively associated with, and BPNs satisfaction is positively associated with, intentions to continue using fitness technology. In addition, research consistently demonstrates the significance of perceived autonomy, competence, and relatedness support in predicting both technology continuance intentions (Roca & Gagné, 2008) and exercise continuance (Vlachopoulos & Michailidou, 2006). In the context of exercise, a study found that competence is positively associated with effort, leisure-time physical activity, and intentions to engage in more physical activity (Taylor et al., 2010). Satisfaction of the relatedness need is a key predictor of persistence in exercise (Edmunds et al., 2007), and autonomy and competence are related to leisure walking behavior (Niven & Markland, 2016). Competence support has been identified as a crucial driver of physical activity (Vlachopoulos & Michailidou, 2006). As a result, motivation in general, and BPNs specifically, have been consistently associated with technology use and continuance.

Drawing from the above findings from the reviewed literature, we propose a conceptual framework for understanding fitness technology persistence that is presented in Figure 2.

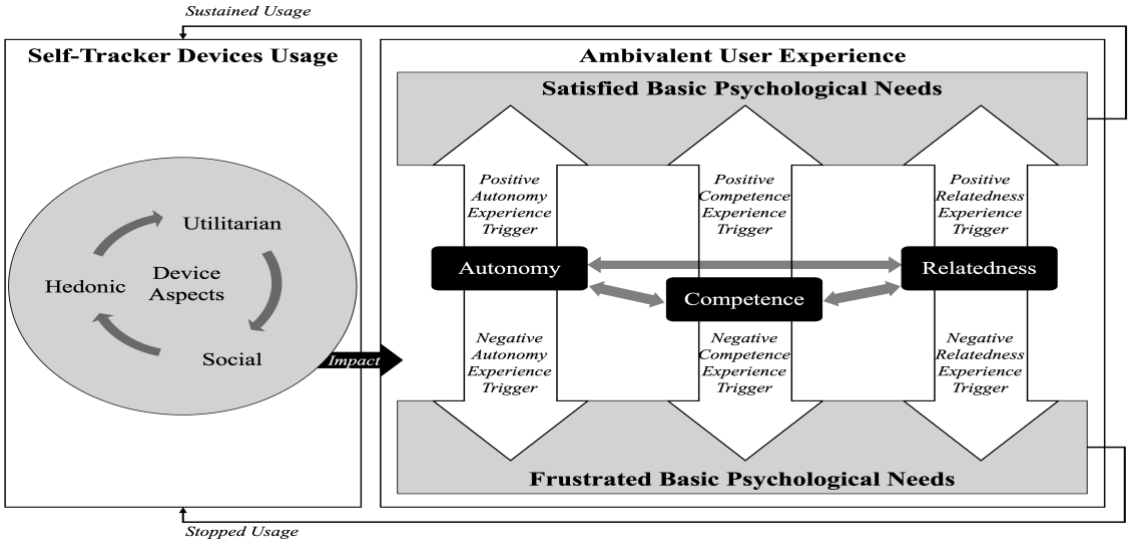

Figure 2. Framework for Understanding Fitness Technology Use Persistence

Our conceptualization emphasizes that interaction with self-tracking devices triggers both positive and negative experiences. Three aspects of self-tracking devices - hedonic, social, and utilitarian - collectively impact the user experience (shown on the left side of the figure with black arrows). This triggers both positive and negative experiences and leads to an ambivalent user experience (shown on the right). The ambivalent user experience is caused by simultaneously receiving triggers for satisfied and frustrated BPNs (shown as gray rectangles on the right). The three BPNs of autonomy, competence, and relatedness are interconnected (black rectangles with grey arrows); the user can perceive positive or negative experience triggers for each BPN (shown by white upwards and downwards arrows). For example, setting one's own goals can act as a positive autonomy experience trigger, while feelings of pressure during use trigger a negative autonomy experience. It is evident that positive and negative user experiences with these types of devices are strongly correlated with the satisfaction of BPNs. As long as satisfied BPNs outweigh the frustrated ones, the device remains in use. However, a shift towards frustrated BPNs can lead to the discontinuation of self-tracking device usage.

It is important to note that our research did not take into account the viewpoints of individuals who utilize wearable technology in clinical care settings. There is a possibility that individuals who employ wearable devices for specific health objectives may require a distinct set of predictors, however, our framework may apply to clinical settings where wearable technology use is driven by recovery needs; although motivations differ, they relate to SDT's basic psychological needs (autonomy, competence, and

relatedness), and their frustration could critically impact health-—justifying further comparative research.

6 Conclusions

This work provides significant contributions to the field of Information Systems theory. Firstly, the novel contribution lies in the conceptual framework we have developed. This framework integrates and extends the Self-Determination Theory within the IS domain, providing a comprehensive model for understanding the nuanced user experiences with fitness technologies. It offers actionable insights for designing systems that cater to the complex interplay of users' psychological needs. In addition, this study illuminates the widespread occurrence of ambivalence among users of information systems and emphasizes its significance in understanding the behaviors exhibited by users after adopting technology. This addition holds great significance due to the prevailing tendency in the existing literature to embrace one-dimensional perspectives on technology use. We argue that there is a necessity for a more nuanced and complex examination of the various consequences, both positive and negative, that arise for users. The complexity associated with our findings is acknowledged since they demonstrate that a widespread feeling of ambivalence towards the usage of IS exists. In light of these recent developments, it is essential to embrace multidimensional theoretical frameworks that may effectively explain the complex and intertwined attitudes and emotions exhibited by users towards the use of technology. This becomes particularly relevant in the context of a study on the post-adoptive stage of information systems utilization, whereby people are increasingly exposed to the divergent aspects of technology, particularly fitness technology. Therefore, our study makes a valuable contribution to the IS literature. Previous research has primarily centered on understanding how motivational processes managing exercise behavior relate to the specific features of fitness technologies that individuals use (James et al., 2019a; James et al., 2019b). Besides, some studies have examined how diverse aspects of fitness technology usage, such as recognition and rewards, impact outcomes such as continued engagement, either through individuals' desire for exercise or by influencing their satisfaction or frustration with competence needs (Rockmann, 2019; Whelan & Clohessy, 2020). These previous investigations have shed light on the interplay between people's motivation for exercise and their utilization of fitness technology, as well as how the use of fitness technology can, in turn, influence motivation to engage in exercise.

Our findings offer actionable insights for fitness technology design and represent a significant advancement in IS literature by detailing how a Self-Determination Theory-based framework can explain and predict user engagement patterns, thereby enhancing system design strategies. Our study also offers valuable insights into the design of fitness technology systems that aim to improve users' BPNs and enable sustained device usage. Typically, organizations and service providers tend to view users' orientations toward their systems in a univalent manner, either as entirely positive or negative. Usually, mixed attitudes are perceived as resistance or problematic behavior, leading to organizational approaches that aim to standardize users' patterns of system use (Ilie & Turel, 2020). However, our study highlights the importance of adopting a multifaceted view of post-adoptive IS use. Rather than interpreting ambivalence as resistance, it should be seen as a valid reason for variations in users' patterns of IS use. This broader viewpoint can inform the development of policies, training, and services tailored to ambivalent users, ultimately improving the IS use experience for this segment of users.

In addition, it is imperative for designers of fitness technologies and services to give priority to the fulfilment of users' informational, affective, and social requirements, as highlighted by Fang et al. (2017) and Osatuyi and Qin (2018). Instead of providing an excessive variety of features and feedback, it is essential to determine the motivating designs that are compatible with particular types of features, and thereafter establish a correspondence between user preferences and design choices (Hamari et al., 2018; Willemsen et al., 2016). One effective design pattern to ensure that all system users profit from a system is to connect a diverse set of features, providing users with a range of choices that align with their preferences. Nevertheless, it is essential to strike a balance. The provision of an excessive number of features and various forms of feedback can result in an overwhelming amount of information and a complex user interface, which may have the unintended consequence of encouraging users to persist in

their use of the device (Willemsen et al., 2016). Hence, it is essential for designers to properly select and arrange elements to optimize the user experience while avoiding excessive complexity. We recommend fitness technology developers focus on creating more personalized and user-centric apps that cater to users' basic psychological needs of autonomy, competence, and relatedness, thereby promoting sustained engagement. Additionally, our research can guide health promotion initiatives by integrating these user-centered design principles into fitness programs, potentially increasing physical activity levels across diverse populations.

There are various limitations associated with our analysis. The research included in this analysis was published in the English language and was done in countries located in the Western part of the world. Hence, it is possible that the outcomes may not comprehensively reflect nations characterized by diverse cultural backgrounds, disparate accessibility to wearable technology, and varying socio-economic status. Furthermore, it is important to note that each study analyzed a unique device or a specific collection of devices, so limiting the likelihood of doing direct comparisons between studies. In our findings, we focused on the social impact originating from the device and its users. Future research should aim to distinguish the 'gimmick effect,' where initial fitness technology use is driven by non-user social influences and observe how this evolves into a more device-related experience over time. In conclusion, the participants in our study who were of advanced age were not included due to the assumption that they would have restricted proficiency in technology and potentially possess particular requirements and expectations in relation to the utilization of wearable devices. Therefore, we suggest that future research should examine and contrast the experiences of older users and adults in the context of wearable devices, either as distinct studies or through a comparative approach.

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