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The Dynamics of IT Use: Uncovering the Interplay between the Perception of IT Events, Emotions, and Cognitive Absorption over Time

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Short Paper

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Abstract

Emotions triggered by IT events have a decisive influence on IT use. Previous literature has focused on one point in time studies investigating the relationship between emotions and IT use. However, the process of perceiving an IT event, leading to emotions and changes in IT use proceeds dynamically over time. This research in progress paper concentrates on this process. We investigate how the change in perception of an IT event affects emotions and IT use over time. Therefore, we develop an online experiment simulating time pressure as an example of an IT event. During the experiment, data is collected at four different points in time. The data will be analyzed with a multivariate longitudinal latent growth model. We aim to enhance the current literature by capturing the dynamic changes in perceiving IT events, emotional responses, and subsequent changes in IT use over time.

Keywords: IT use, emotions, cognitive absorption, time pressure, latent growth model

Introduction

Extent information systems (IS) literature shows that emotions alongside cognitive beliefs have a crucial influence on IT use (Beaudry and Pinsonneault 2010; Compeau et al. 1999; Stein et al. 2015). Emotions refer to a neurophysiological state that can be consciously experienced as an unreflected feeling that combines hedonic and excitatory expressions (Russell 2003). Emotions can be positive and negative (Russell 2003). Positive emotions (e.g., happiness, enjoyment) have a predominantly positive influence on IT use, and negative emotions (e.g., anxiety, anger) are a correspondingly negative one (Beaudry and Pinsonneault 2005; Stein et al. 2015). Emotions are emitted when users encounter certain IT events (Ortiz de Guinea and Webster 2013). IT events are relevant stimuli caused by IT, such as the discovery of new IT features or malfunctioning IT. Users' perception of an IT event can trigger specific emotions, subsequently leading to changes in IT use (Beaudry and Pinsonneault 2010). Current research on emotions in IT use indicates that the type of emotion depends on whether the IT event is perceived as a threat or opportunity and whether it is perceived to be under one's control or not (Beaudry and Pinsonneault 2010; Ortiz de Guinea and Webster 2013; Stein et al. 2015). Past literature explains well how IT events elicit different

emotions that affect IT use behavior between persons, meaning that the dependencies between the constructs are investigated at one specific point in time (Beaudry and Pinsonneault 2010).

However, when examining the impact of emotions and their relationship with IT use, it is essential to acknowledge the associated process and the variation over time because the perceptions of users are dynamic and lead to varying emotional reactions as well as corresponding changes in IT use (Beaudry and Pinsonneault 2005, 2010). Changes in IT use can then affect how users interpret and understand an IT event, which can change the perception of the IT event (Beaudry and Pinsonneault 2005). Thus, a feedback loop from IT use to the perception of an IT event exists. A one-time view of emotions and its impact on IT use cannot explain why and how IT use changes dynamically over time. A one-time view only captures a particular situation at a specific point in time. For this reason, a dynamic view is necessary to understand changes over time (Venkatesh et al. 2021). So far, there have been few studies that have focused on changes in the perception of IT events, emotions, and IT use over time (Benlian 2015; Ortiz de Guinea and Webster 2013; Weinert et al. 2022), which focus on changes in outcome variables (e.g., exhaustion), IT feature use and transition of IS use patterns over time. Our study aims to enhance the current literature by capturing the dynamic process of perceiving an IT event, the resulting emotional responses, and changes in IT use. With that, we intend to offer a more comprehensive understanding of the dynamics among these constructs over time. Accordingly, our research question is as follows:

How does the change in perception of an IT event affect emotions and IT use over time?

To answer the research question, we draw on the literature on emotions and IT use (Beaudry and Pinsonneault 2010; Stein et al. 2015). The following explains the theoretical background, research model, methodology, and the expected results and contributions.

IT Events, Emotions, and IT Use

Previous literature shows that *IT events* evoke emotions that affect IT use (Ortiz de Guinea and Webster 2013). IT events are relevant stimuli caused by IT, such as the discovery of new IT features or malfunctioning IT (Ortiz de Guinea and Webster 2013). While an initial trigger often corresponds with an IT event, it is not static but develops dynamically over time (Ortiz de Guinea and Webster 2013; Peterson 1998). IT events can cause emotional user reactions, such as frustration and anger (Bagozzi et al. 1999; Ortiz de Guinea and Webster 2013). The literature provides several definitions of emotions (Zhang 2013). We define *emotions* as a neurophysiological state that can be consciously perceived as a fundamental, unanalyzed sensation that blends hedonic and arousal components (Russell 2003). Emotions are a state of mind that prepares and activates one for action and helps prioritize and organize behavior to optimize individual adaptation to environmental demands (Bagozzi et al. 1999). In this way, emotions can influence behavior and act as a compass for a person's beliefs and thinking (Beaudry and Pinsonneault 2010; Gratch and Marsella 2004). A certain emotion is elicited depending on whether an IT event is perceived as a threat or an opportunity and whether it is perceived to be in one's control (Beaudry and Pinsonneault 2010). Emotions have two continuous dimensions: One dimension comprises the emotion an individual feels (valence) on a continuum between pleasure and displeasure (Russell 2003). The second dimension describes the level of psychological arousal (or activation) between arousal and quietness (Russell 2003). Emotions can change rapidly and are influenced by continuous fluctuations in the relationship between the individual and their environment (Lazarus and Folkman 1984). While emotions occur over a short period of time, they can be distinguished from moods, which are relatively enduring (Scherer 2005). Previous research indicates that emotions significantly impact IT use (Beaudry and Pinsonneault 2010; Bhattacherjee et al. 2018; Dinger et al. 2023). Most studies investigating the influence of emotions on IT use are at one specific point in time (Beaudry and Pinsonneault 2010). *IT use* comprises three dimensions: system, user, and task (Burton-Jones and Straub 2006). There are several constructs (e.g., IS-related cognitive absorption, breadth of use, duration of use) that measure IT use with varying degrees of richness (Burton-Jones and Straub 2006). We focus on IS-related cognitive absorption because it is a rich measure of IT use that comprehensively reflects both the system and the users (Burton-Jones and Straub 2006). The third dimension (task) is determined by our experimental setting. IS-related cognitive absorption is a state in which the user is fully involved in using IT (Agarwal and Karahanna 2000). Such a state is often associated with the enjoyment and the user perception of a manageable IT (Agarwal and Karahanna 2000).

The occurrence of an IT event, the associated emotions, and the impact on IT-related cognitive absorption is a dynamic and iterative process (Beaudry and Pinsonneault 2005, 2010). When IT is used adaptively, for example, to restore emotional stability, it can potentially alter a user's perception of the IT event (Beaudry and Pinsonneault 2005). This can prompt a reevaluation of the IT event and initiate a change in the emotional reaction, leading to further change in IT-related cognitive absorption (Beaudry and Pinsonneault 2005, 2010). First studies on the dynamic character of emotional reactions investigated the impact of arousal and exhaustion caused by repeated IT interruptions on performance over time and studied how emotions change over time before and after an IT event occurred (Ortiz de Guinea and Webster 2013; Weinert et al. 2022).

Research Model and Hypotheses Development

In the following, we develop our research model (see Figure 1). We concentrate on IT events that enhance time pressure, such as executing intricate tasks that necessitate a quick response while working with an IT system. Research underscores that users are mindful of time during IT use (Venkatesh et al. 2021) and that IT events that can cause time pressure frequently occur (Benlian 2022; Roberts 2007). For this reason, we focus on time pressure as a specific example of an IT event. Following the guidance of past literature, we divide emotions into negative and positive emotions (Dinger et al. 2023; Ortiz de Guinea and Webster 2013). IT use involves a user interacting with IT and a task being performed over time (Burton-Jones and Straub 2006). We concentrate on IS-related cognitive absorption as a rich measure of IT use, which considers both the user and the system when measuring IT use (Burton-Jones and Straub 2006). We use it to measure IT use in our research model.

Changes in the perception of IT events over time

First, we focus on how the perception of an IT event changes over time. IT use research on emotions indicates that the perception of an IT event changes dynamically over time (Beaudry and Pinsonneault 2005; Weinert et al. 2020). Changes in the perception of an event can occur during a persistent situation and can change within seconds (Lazarus and Folkman 1984). Therefore, we propose that the perception of an IT event, here time pressure, changes dynamically over time. If time pressure caused by an IT event is perceived as taxing individual resources of a user, the condition leads to adaptation of the user behavior (Lazarus and Folkman 1984; Maule et al. 2000). Research shows that individuals who experience time pressure adapt their behavior, for example, by working faster and processing information more selectively (Maule et al. 2000). Various studies show that adaptation behaviors lead to a reduction in the perceived demand (Beaudry and Pinsonneault 2010; Pirkkalainen et al. 2019; Salo et al. 2020). We transfer this relationship to the IT use context. The initial perception of time pressure after the first encounter with the IT event is high since no adaptation has occurred yet. Over time, the time available to complete tasks will be increasingly perceived as sufficient due to the user's adaptive behavior in using IT. Consequently, perceived time pressure decreases over time. Based on this argumentation, we propose the following hypotheses:

H1: The initially high perceived time pressure caused by the IT event <u>decreases</u> in the course of the IT event due to adaptation behavior in IT use.

Influence of the perception of an IT event on positive and negative emotions

Psychology literature indicates that perceived time pressure influences emotions (Maule et al. 2000). When an IT event that causes time pressure initially occurs, we suggest that it is responsible for a user's initial emotional state. Studies imply a negative effect of time pressure on positive emotions (Essl and Jaussi 2017; Maule et al. 2000; Rastegary and Landy 1993). This influence can be explained by psychological reactions caused by time pressure. Time pressure occurs when the time available to process tasks is perceived as insufficient (Rastegary and Landy 1993). This leads to increased pressure to adapt processing behavior to meet the expectations of task completion within the available time (Hockey 1997; Maule et al. 2000). The perception of not being able to meet expectations could have a negative impact on positive emotions. Findings from psychology show that cognitive capacities can be exceeded when decisions must be made under time pressure (Maule et al. 2000; Svenson and Maule 1993). Users may experience a decrease in positive emotions as confidence in the quality of their work is reduced. This is because information is only selectively considered as cognitive capacity is depleted (Svenson and Maule 1993). Based on these

psychological mechanisms, we suggest that the perception of time pressure may be negatively associated with positive emotions. Therefore, we hypothesize that:

H2a: Users with a higher initial level of perceived time pressure will exhibit a lower initial level of positive emotions than users with a lower initial level of perceived time pressure.

Studies imply that high time pressure leads to negative emotions (Essl and Jaussi 2017; Maule et al. 2000; Rastegary and Landy 1993). The effect can be clarified through the psychological responses triggered by time pressure. Exceeded cognitive abilities can trigger negative emotions as users who perceive time pressure tend to assign greater significance to negative information and are more affected by the possibility of failing (Svenson and Maule 1993). Under extreme time pressure, this can even result in nightmarish thoughts corresponding with negative emotions (Lazarus and Folkman 1984). Drawing on these mechanisms, we propose that the perception of time pressure could be linked with negative emotions:

H2b: Users with a higher initial level of perceived time pressure will exhibit a higher initial level of negative emotions than users with a lower initial level of perceived time pressure.

In the following, we consider how the trajectory of perceived time pressure affects the trajectory of positive and negative emotions. Studies indicate that time pressure has different effects on emotions, depending on the intensity of perceived time pressure (Kummer and Mendling 2021). As time pressure decreases over time due to dynamic adaptation behaviors, users perceive the time available to complete IT-related tasks as more sufficient (Beaudry and Pinsonneault 2005; Rastegary and Landy 1993). As users perceive the time available as more sufficient, they are more likely to process information more comprehensively to complete IT-related tasks (Maule et al. 2000; Svenson and Maule 1993). These mechanisms could increase positive emotions as confidence about the quality of the processed IT-related tasks increases (Rastegary and Landy 1993). Therefore, we argue that as perceived time pressure decreases, positive emotions increase, leading to the following hypothesizes:

H3a: Users with a steeper downward trajectory of perceived time pressure will exhibit a stronger increase in positive emotions than users with a less steep downward trajectory of perceived time pressure.

Next, we consider how the trajectory of perceived time pressure affects the trajectory of negative emotion. As adaptive behaviors evolve over time, leading to a reduced perception of time pressure, individuals tend to regard the available time for processing IT-related tasks as sufficient (Beaudry and Pinsonneault 2005; Rastegary and Landy 1993). At the same time, users place less emphasis on negative information related to potential failure and how to prevent failure (Rastegary and Landy 1993; Svenson and Maule 1993). Therefore, negative emotions associated with the possibility of failure could decrease. At the same time, the urge to change one's behavior is reduced, which could also reduce negative emotions (Hockey 1997; Maule et al. 2000). On this basis, we argue that negative emotions decrease as perceived time pressure decreases. This leads to the following hypotheses:

H3b: Users with a steeper downward trajectory of perceived time pressure will exhibit a stronger decrease in negative emotions than users with a less steep downward trajectory of perceived time pressure.

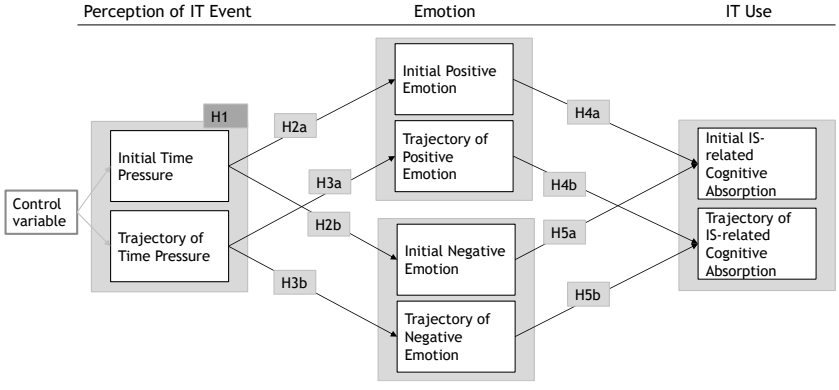

Figure 1. Research Model

Influence of emotions on IS-related cognitive absorption

Research indicates that emotions impact cognitive absorption (Scherer and Tran 2001). Therefore, we propose that emotions are responsible for changes in IS-related cognitive absorption and that the initial level of emotions influences the initial level of IS-related cognitive absorption. By focusing on the effect of the initial level of positive emotions on the initial level of IS-related cognitive absorption, studies indicate a positive impact on IS-related cognitive absorption (Beaudry and Pinsonneault 2010; Compeau et al. 1999; Compeau and Higgins 1995; Scherer and Tran 2001). The positive relationship between positive emotions and IS-related cognitive absorption can be explained by the psychological effects of positive emotions. Suppose a user experiences positive emotions through the use of IT. In that case, this leads to the user being willing to use IT more intensively to expand further the positive emotional effects of IT use (Beaudry and Pinsonneault 2005). Studies show positive emotions increase engagement and attention breadth (Rowe et al. 2007). Dinger et al. (2023) further indicate that positive emotions directly influence the intention to explore in the context of IT use. Since IT users experience positive emotions during use, they may enjoy using it more, be more engaged, and pay more attention (H4a). Furthermore, we consider how the trajectory of positive emotion influences the trajectory of IS-related cognitive absorption. We propose that users who faster perceive an IT event causing time pressure as less demanding will have increasing positive emotions (Lazarus and Folkman 1984; Rastegary and Landy 1993). As positive emotions lead to users being more engaged and having higher attention (Rowe et al. 2007), the increased positive emotions will lead to deeper involvement with IT, thus increasing IS-related cognitive absorption. The increasing positive emotions lead the users to use IT more intensively, and users have a more positive intention to use IT (Dinger et al. 2023; Scherer and Tran 2001). For example, when users perceive increasing positive emotions, they can delve more deeply into IT use (H4b).

H4a: Users with a higher initial level of positive emotion will exhibit a higher initial level of IS-related cognitive absorption than users with a lower initial level of positive emotion.

H4b: Users with a steeper upward trajectory of positive emotions will exhibit a stronger increase in IS-related cognitive absorption than users with a less steep upward trajectory of positive emotions.

By focusing on the effect of the initial level of negative emotions on the initial level of IS-related cognitive absorption, studies indicate a negative effect on IS-related cognitive absorption (Beaudry and Pinsonneault 2010; Compeau et al. 1999; Compeau and Higgins 1995; Scherer and Tran 2001). The negative relationship between negative emotions and IS-related cognitive absorption can be explained by the psychological effects of negative emotions. Negative emotions arise when danger or negative consequences are expected (Scherer and Tran 2001). When an individual experiences emotions related to fear or anxiety during IT use, it causes them to psychologically distort from IT to avoid the danger or negative consequences (Beaudry and Pinsonneault 2010; Lapointe and Rivard 2005). Thereby, anxiety has been shown to negatively affect the attention users pay to tasks, causing them to divert their attention to off-task activities (Venkatesh 2000). Thereby, users may be less involved and concentrated on IT use. Because IT users experience negative emotions while using IT, they may enjoy using it less, be less engaged, and pay less attention while using it (H5a). In addition, we evaluate how the trajectory of negative emotions influences the trajectory of IS-related cognitive absorption. We propose that users who faster perceive an IT event causing time pressure as less demanding have decreasing negative emotions (Lazarus and Folkman 1984; Rastegary and Landy 1993). As negative emotions lead to users psychological distance from and avoiding IT use, as well as reduced attention (Rowe et al. 2007; Venkatesh 2000), the decreased negative emotions will help reduce the negative impact of negative emotions on IT use, and thereby lead to deeper involvement with the use of IT. For example, when users perceive decreasing negative emotions, they can delve more deeply into IT use (H5b).

H5a: Users with a higher initial level of negative emotions will exhibit a lower initial level of IS-related cognitive absorption than users with a lower initial level of negative emotions.

H5b: Users with a steeper downward trajectory of negative emotions will exhibit a stronger decrease in IS-related cognitive absorption than users with a less steep downward trajectory of negative emotions.

Methodology

Experimental Design

The online experiment follows a within-subject design encompassing the factor of an IT event that comprises executing tasks within a limited time frame in an IS, as well as four repetitions, including no encounter with the IT event and three analogous encounters with the IT event. All participants in the study received the treatment. The experiment includes a baseline to ensure that each participant serves as their own control and then receives three treatments. During the baseline, the participants complete a round without a time limit. Following the baseline, all participants underwent the same treatment, i.e., experienced the same IT event three times in succession.

Technology, Tasks, Manipulation, and Measurement

We created a system resembling MS Outlook to simulate a real business scenario. Labvanced.com (Finger et al. 2017) is used to create the experiment, which enables the web-based creation and editing of experimental content via a graphical user interface. We designed an interface that mimicked the look and functionality of an email inbox, which is commonly used in most companies. Through the interface, participants can receive work orders via email comprising intelligence test exercises, such as solving arithmetic problems. These tasks are presented within standard email frameworks and are kept at an easy to medium level of difficulty. This was done to avoid changing the participants' perception of the IT event due to the complexity of the tasks. The paper is based on a previous experimental manipulation in which time pressure was manipulated (Pearsall et al. 2009). The participants are provided tasks to complete within four minutes, which is hardly possible in the given time (Pearsall et al. 2009). In addition, during each round, a timer indicates the time left to complete the tasks. Time pressure is evaluated by items adapted by Gray and Durcikova (2005). For the measurement of positive and negative emotions, the Basic Positive and Negative Emotion Scale is used, which is part of the PANAS-X scales (Watson and Clark 1999). For IS-related cognitive absorption, we use the items from Burton-Jones and Straub (2006), who adapted their items from Agarwal and Karahanna (2000). Perceived control is considered in the model as a time-invariant covariate for the perception of time pressure. Perceived control was assessed using four items from Major et al. (1998) and Bala and Venkatesh (2015). The items are minimally adapted to the context of our experiment, namely the work in an email inbox.

Procedure

The process consists of four stages: pre-experimental stage, baseline, experimental stage, and post-experimental stage, and is shown in Figure 2. The first stage, the pre-experimental stage, involves introducing the participants to the framework and functionalities of the experiment. During this stage, the participants are familiarized with the experimental setup and provided with instructions on how the experiment will proceed. Participants then complete a round of tasks in the email inbox without manipulation. We then collect data on perceived time pressure, emotions, and IS-related cognitive absorption, as well as control variables, to capture the baseline. Then, the experimental stage begins. Participants receive various work orders by email messages, which they must complete. There is a time limit of four minutes to complete the tasks. During one repetition, email messages keep arriving in the inbox. There are about seven to eight emails with work orders in one repetition. When the participants have completed all the work orders or the time is up, the round is finished, and the second survey follows. The surveys during the experimental phase ask about time pressure, positive and negative emotions, and IS-related cognitive absorption. This process is repeated a total of three times. Finally, there is the post-experimental phase. In this stage, demographic information (age, gender, level of education) is collected.

Pre-experi-mental stage	Baseline		Experimental stage						Post-experi-mental stage
Introduction	Task block without manipulation	Survey 1	Task block 1	Survey 2	Task block 2	Survey 3	Task block 3	Survey 4	Survey 5

Figure 2. Experimental Procedure

Analysis

First, we ensure the validity and reliability of the data and calculate the descriptive statistics of the baseline and individual stages. The paper employs a multivariate longitudinal latent growth model to test our hypotheses. Latent growth models enable measuring changes in a latent variable over time, validating causal models to explain such changes, and evaluating their impact on outcome variables within a single structural model (Diallo and Morin 2015). For that, the approach integrates the variables' initial level and

trajectory over time. Three different models are assessed in this study to find the optimal trajectory of change in perceived time pressure, IS-related cognitive absorption, and negative and positive emotion: A no-growth model, a linear-growth model, and a quadratic-growth model. These nested models are compared by applying chi-square difference tests. For the analysis of the data, we plan to use SPSS Amos 26.

Discussion, Expected Results, and Contribution

Previous research on the interface between IT use and emotions has focused primarily on one point in time studies. However, it must be considered that emotions depend on the perception of IT events and that the perception of IT events can change dynamically over time (Beaudry and Pinsonneault 2005, 2010). The current paper focuses on the dynamic relationship between these constructs by examining how users' perception of an IT event changes and how this affects emotions and IT use over time. We refer to theoretical findings from psychological research to account for changes in the perception of an IT event and explain its influence on emotions and IT use over time. In doing so, we expect to contribute to the literature.

First, research on the perception of IT events has primarily been conducted through qualitative and one-point-in-time studies (Beaudry and Pinsonneault 2005). Building upon this literature, our study aims to contribute by investigating how the perception of an IT event related to time pressure changes over time. While previous research demonstrates that users' perception of an IT event increases (Beaudry and Pinsonneault 2005) when encountering an IT event, we complement this by providing insights into the intra-individual changes in the perception of an IT event over time. We expect that an IT event is initially perceived as impactful but that this perception diminishes over time. We could contribute by showing that when analyzing the perception of an IT event, it is necessary to distinguish between the initial encounter with the IT event and the subsequent interval in which the IT event lasts.

Second, previous research has focused on how emotions arise before and after an IT event (Ortiz de Guinea and Webster 2013). Our results could show that the initial perception of an IT event and the change (i.e., trajectory) significantly influences emotions and, thus, IT use over time. We expect that an IT event will initially positively influence negative emotions but that this impact will decrease over time as the perception of the IT event decreases. We expect an opposite influence on the relationship between an IT event and positive emotions over time. Thus, it may be the marginal change in users' perception of an IT event - not their perception at a single point in time - that affects their emotional state and, thus, their IT use over time. By elucidating the dynamic nature of this relationship, our research aims to provide insights into the initial emotional influence of IT events and their dynamic influence over time.

Third, our results may show that IT use is influenced by the time-dependent perception of positive and negative emotions. We extend the literature by theoretically and empirically demonstrating that positive and negative emotions' time-dependent effect influences changes in IT use. The influence of emotions on IT use has so far been investigated at one point in time studies (Beaudry and Pinsonneault 2010)**.** Previous results of some emotions, such as anxiety, on IT use are ambiguous (Compeau and Higgins 1995; Todman and Monaghan 1994). Adaptation behaviors may have mediated the connection between emotions and IT use over time, which could have negated the initial impact of the emotion (Beaudry and Pinsonneault 2010). Our results will contribute to the literature by showing how the initial value and the changes in positive and negative emotions influence IT use over time. Our findings could, therefore, contribute to clarifying how positive and negative emotions impact IT use over time, considering changes in the influence of emotions on IT use over time.

Conclusion

Emotions triggered by IT events have a decisive influence on IT use. Previous literature has focused on a one-time view to investigate the relationship between emotions and IT use. However, the process of perceiving an IT event, leading to emotions and changes in IT use proceeds dynamically and varies over time. This research in progress paper concentrates on this process. We investigate how the change in perception of an IT event affects emotions and IT use over time. Therefore, we develop an online experiment simulating an IT event and collect data at multiple points in time. We aim to enhance the current literature by capturing the dynamic changes in perceiving IT events, emotional responses, and subsequent changes in IT use over time.

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