COPING WITH THE DARK SIDE OF INFORMATION TECHNOLOGY

THEORETICAL FOUNDATION AND EMPIRICAL EVIDENCE

Christoph Weinert
University of Bamberg

Including a dedication by Prof. Dr. Tim Weitzel

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Dedicated to my parents
Joachim und Dorothea

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Christoph Weinert

DEDICATION BY PROF. DR. TIM WEITZEL (WIDMUNG)

Die jüngere IS-Literatur hat grundlegende Beiträge zum Erkennen der Dark Side of IT Usage, ihrer Treiber und Konsequenzen gelegt. Wichtige Ergebnisse, die u.a. auch am ISDL-Lehrstuhl entstanden sind, umfassen im betrieblichen Kontext den Zusammenhang zwischen Technostress und Arbeitsleistung bzw. -zufriedenheit[1] oder im privaten Kontext Ursachen und Arten von Facebookstress[2] sowie - auch als Teil dieser Arbeit – die aufgrund von Technostress notwendige Erweiterung des bekannten IT-Nutzungszyklus[3].

Doch betroffene IT-Nutzer erleiden nicht einfach Technostress, sie reagieren auf Stressoren (wie die in der Arbeit beschriebenen „IT events“) mit bestimmten Verhaltensstrategien, die im Kern entweder das Problem oder die emotionalen Folgen dieser IT-Events adressieren. Hier besteht erheblicher Forschungsbedarf, und genau hier setzt die Dissertationsschrift von Dr. Weinert an. Er integriert die klassische psychologische Coping-Literatur in den jungen IS-Forschungsstrang zur Dark Side of IT Usage und untersucht theoretisch wie empirisch Copingmechanismen, also Ansätze des Umgangs mit IT-bedingtem Stress. Diese Dissertation geht damit einen deutlichen Schritt weiter als die gängige Technostress-Forschung und fragt nicht nur, was Technostress auslöst, sondern wie die betroffenen IT-Nutzer Technostress mitigieren können.

Die Arbeit besticht trotz des sehr neuen und komplexen Themas auf dem Grat zwischen mehreren wissenschaftlichen Disziplinen durch theoretische Tiefe, methodische Ernsthaftigkeit und eine Vielzahl potentiell weitreichender und relevanter Ergebnisse. Dr. Weinert stößt dabei viele neue thematische, theoretische und methodische Türen in der IS-Forschung auf. Gleichzeitig weist die Arbeit eine außergewöhnliche Methodenvielfalt auf (Experiment, Längsschnittanalyse, qualitative und quantitative Querschnittsanalyse, HLM). Damit gelingen Vorstöße zu theoretischen Neuerungen, die sonst eher selten möglich sind, ebenso wie eine Vielzahl interessanter und relevanter, teils sehr konkreter Einsichten. Die Ergebnisse reichen von Work-Life-Problemen bei IT-Fachkräften über Stressoren und Konsequenzen bei beruflicher IT-Nutzung bis zur Wirkung unterschiedlicher Coping-Mechanismen im Umgang mit Technostress und Stressoren und Konsequenzen bei privater IT-Nutzung.

Ein starker theoretischer Beitrag der Arbeit ist auch der umfassende theoretische Rahmen, der einerseits den Stand der IS-Forschung sehr gut abbildet und andererseits die sozialpsychologischen Phänomene um Technostress herum und die dieses Phänomen berührenden Theorien aus benachbarten Disziplinen integriert. Damit ist diese Arbeit einer der sehr wenigen relevanten aktuellen Versuche weltweit, einen theoretischen und methodischen Bezugsrahmen aufzubauen und ernsthafte Beiträge zu beruflichem wie privatem Technostress zu leisten, die letztlich das Potential haben, für jeden Menschen relevant zu sein. Welcher der derzeit entstehenden Ansätze sich mit welchen Argumenten durchsetzen wird, bleibt abzuwarten. Die Beiträge in der vorliegenden Arbeit haben aber das Potential, diese Pfade mitzugestalten. Beispielsweise ist der ISJ-Artikel (Artikel 4) schon jetzt einer der meistzitierten Artikel des ganzen Journals in den letzten fünf Jahren.

Diese Arbeit ist eine Pflichtlektüre für jeden Forscher und Praktiker im Bereich Technostress und modernes IT-Management.

Tim Weitzel

[1] Maier, C., Laumer, S., Eckhardt, A., and Weitzel, T.: Analyzing the impact of HRIS implementations on HR personnel's job satisfaction and turnover intention. The Journal of Strategic Information Systems 22 (3), 193-207.
[2] Maier, C., Laumer, S., Eckhardt, A., and Weitzel, T.: Giving too much social support: social overload on social networking sites. European Journal of Information Systems 24 (5), 447-464.
[3] Maier, C., Laumer, S., Weinert, C., and Weitzel, T.: The effects of technostress and switching stress on discontinued use of social networking services: a study of Facebook use. Information Systems Journal 25 (3), 275-308

GERMAN SUMMARY (ZUSAMMENFASSUNG)

Neben vielen positiven Effekten der Informationstechnologie (IT)-Nutzung wie z.B. die Steigerung von Produktivität, Effizienz und Effektivität von Organisationen (Brynjolfsson und Hitt 1996, Brynjolfsson und Hitt 2003) hat die IT-Nutzung auch eine sog. dunkle Seite (D'Arcy et al. 2014a; Pirkkalainen und Salo 2016; Tarafdar et al. 2015a). Diese dunkle Seite der IT-Nutzung umfasst u.a. als negativ bewertete IT-Events, die mit der IT-Nutzung zusammenhängen und sich auf das Wohlbefinden von Nutzern und Organisationen auswirken (Tarafdar et al. 2015b; Tarafdar et al. 2015a). Als Konsequenz für Organisationen zeigen sich wesentliche Risiken für die Innovationsfähigkeit und Produktivitätsgewinne. Somit sind Organisationen damit konfrontiert, dass die positiven Effekte, welche sie von ihren IT-Investitionen erwarten, verringert werden (Tarafdar et al. 2015a). Des Weiteren kann die dunkle Seite der IT-Nutzung das Wohlbefinden von IT-Nutzern beeinträchtigen (Tarafdar et al. 2015a). Zum Beispiel sind Personen weniger zufrieden und engagiert (z. B. Maier et al. 2014; Ragu-Nathan et al. 2008), erschöpft (Ahuja et al. 2007; Ayyagari et al. 2011; Moore 2000) und könnten ebenfalls unter einem Burnout leiden (Srivastava et al. 2015; Weinert et al. 2015b).

Jedoch zeigt die Psychologie, dass Individuen versuchen, negative Aspekte zu bewältigen indem sie sogenannte Coping-Strategien anwenden (Lazarus und Folkman 1984). Verglichen mit der psychologischen Coping-Literatur ist der Forschungsstrang der dunklen Seite der IT-Nutzung relativ jung und unerforscht (Pirkkalainen und Salo 2016). Daher ist bisher wenig darüber bekannt, wie IT-Nutzer mit den negativen Auswirkungen der dunklen Seite der IT-Nutzung umgehen. Obwohl die IT-Nutzung viele Probleme löst, kann sie auch viele andere negative IT-Events verursachen (z. B. Overby et al. 2010). Die Coping-Literatur zeigt, dass Individuen negative Aspekte bewerten, um zu entscheiden, welche Coping-Strategien sie anwenden sollen (Lazarus und Folkman 1984). Um zu verstehen, wie sich IT-Nutzer in Situationen verhalten, in denen sie mit IT-Events konfrontiert sind, liefert die Coping-Theory hilfreiche Erkenntnisse. In diesem Fall kann Coping eine Schlüsselverbindung zwischen der dunklen Seite der IT-Nutzung und dem Wohlbefinden von Nutzern sowie der Aufrechterhaltung und Steigerung von Effizienz und Effektivität darstellen (Bala und Venkatesh 2015; Beaudry und Pinsonneault 2005). Folglich ist Coping sowohl für Nutzer als auch für Organisationen von großer Bedeutung. Es umfasst alle Maßnahmen, die Nutzer und Organisationen ergreifen können, um die dunkle Seite der IT-Nutzung zu bewältigen, und um ihre produktive Arbeit aufrechtzuerhalten oder zu steigern. Aus diesen Gründen lautet die Forschungsfrage der Dissertation:

Wie bewältigen Nutzer die dunkle Seite der IT-Nutzung?

Für die Beantwortung dieser Forschungsfrage ist die Dissertation in vier Kapitel gegliedert. Das erste Kapitel konzentriert sich auf die dunkle Seite der IT-Nutzung, insbesondere auf die Untersuchung der Charakteristika (z. B. technische und arbeitsbezogene) und Antezedenzien von IT-Events. Darüber hinaus wird die Beziehung zwischen Charakteristika, IT-Events und Nutzerreaktionen in verschiedenen Kontexten untersucht. Das zweite Kapitel konzentriert sich auf die Konsequenzen der dunklen Seite der IT-Nutzung. Kapitel drei betrachtet die Bewältigung der dunklen Seite der IT-Nutzung und untersucht die Auswirkungen von Coping-Strategien auf IT-Events, Nutzerreaktionen und Konsequenzen. Dabei werden sowohl die kognitiven Bewertungsprozesse als auch unterschiedliche Coping-Strategien betrachtet. Kapitel vier konzentriert sich auf longitudinale Ansätze, um die langfristigen Auswirkungen der Bewältigung der dunklen Seite der IT-Nutzung besser zu verstehen.

Die Ergebnisse der Dissertation zeigen, dass die Quelle der dunklen Seite in Form von IT-Events durch unterschiedliche Charakteristika in verschieden Kontexten beeinflusst wird. Die Konsequenzen sind weitreichend, da IT-Nutzer durch die Wahrnehmung von IT-Events und den daraus resultierenden Nutzerreaktionen aufhören IT zu nutzen. Dies ist z.B. für soziale Netzwerke verheerend, da diese somit Nutzer verlieren. Die Dissertation zeigt, dass die IT-Nutzung auf einem reflektiven und intuitiven System manifestiert ist. Außerdem gibt es intuitive Faktoren, welche die IT-Nutzung beeinflussen. Des Weiteren zeigt die Dissertation, dass Coping Strategien psychologische und physiologische Nutzerreaktionen sowie Konsequenzen wie Performance beeinflussen. Der Effekt von Coping-Strategien hängt jedoch von

interindividuellen Unterschieden ab. Außerdem sind nicht alle Coping-Strategien gleich, sondern können gemäß ihrer Methode (z. B. Verhalten oder Wahrnehmung) und des Fokus (z. B. Vermeidung oder Annäherung) strukturiert werden. Überdies zeigen die Ergebnisse, dass IT-Nutzer auf IT-Events mit proaktivem Coping reagieren, während sie auf Nutzerreaktionen mit reaktivem Coping reagieren. Hinsichtlich der longitudinalen Auswirkungen der Bewältigung der dunklen Seite der IT, zeigt die Dissertation, dass sich Nutzer an wiederholte IT-Events sowohl gewöhnen als auch dafür sensibilisiert werden. Dies zeigt sich in sinkenden physiologischen Nutzerreaktionen und steigenden psychologischen Nutzerreaktionen. Darüber hinaus zeigt die Längsschnittuntersuchung, dass Coping-Strategien nicht nur die Nutzerreaktionen und Konsequenzen reduzieren, sondern auch den Coping-Prozess selbst beeinflussen.

Mit den im Rahmen dieser Dissertation erzielten Ergebnissen können entsprechende Erkenntnisgewinne für die Forschung und Praxis der Wirtschaftsinformatik abgeleitet werden. Zusammenfassend bietet die Dissertation einen evidenzbasierten Beitrag zur Diskussion, wie unterschiedliche Charakteristika und Kontexte für die Wahrnehmung von IT-Events und deren Konsequenzen verantwortlich sind. Die Differenzierung in ein reflektives und intuitives System werden der zukünftigen Wirtschaftsinformatikforschung dabei helfen, die theoretischen Grundlagen der dunklen Seite der IT-Nutzung voranzutreiben, um besonders intuitive Coping-Strategien zu erforschen. Die Coping-Struktur sowie Klassifikation der Coping-Strategien in vier verschiedene Coping-Familien erweitern die aktuelle Forschung der Wirtschaftsinformatik, da die Klassifikation eine bessere Vergleichbarkeit der Effekte von Coping-Strategien ermöglicht. Ebenfalls können die identifizierten Coping-Familien besonders Organisationen dabei helfen, Trainings- und Schulungsangebote zu verbessern und auszuwählen. Die Dissertation trägt zur Forschung bei, indem sie eine Antwort gibt auf die Frage nach der Art und Weise der Bewältigung der dunklen Seite der IT. IT-Nutzer reagieren proaktiv auf IT-Events und reaktiv auf Nutzerreaktionen. Für die Wirtschaftsinformatik zeigt dies, dass der mildernde Effekt von Coping-Strategien nur durch longitudinale Untersuchungen offengelegt werden kann. Die Dissertation konzentriert sich deshalb auch auf longitudinale Effekte, indem ein wiederholtes IT-Event betrachtet wird. Hierbei erweitert die Dissertation die Forschungsergebnisse der Wirtschaftsinformatik im Hinblick auf zwei Reaktionsmuster (Gewöhnung und Sensibilisierung), welche zeigen, dass sich Nutzerreaktionen über die Zeit verändern. Darüber hinaus trägt die Dissertation zur Wirtschaftsinformatikforschung bei, indem sie darlegen kann, dass Coping-Strategien im Zeitverlauf auch einen Einfluss auf die kognitive Beurteilung der IT-Events haben. Dies bedeutet, dass der Coping-Prozess sehr zeitabhängig ist.

Das allgemeine Ziel der Dissertation ist darin begründet, die Art und Weise der Bewältigung von IT-Nutzern mit den Auswirkungen der dunklen Seite der IT-Nutzung zu verstehen. Hierbei kann abschließend festgehalten werden, dass Coping eine Schlüsselfunktion zwischen der dunklen Seite der IT-Nutzung und gesunden sowie produktiven IT-Nutzern darstellt.

Introductory Paper

1 INTRODUCTION

Besides the beneficial effects of information technology (IT) use in terms of increasing the productivity, efficiency, and effectiveness of organizations (Brynjolfsson and Hitt 2003; Hitt and Brynjolfsson 1996) IT use also has a 'dark side' (D'Arcy et al. 2014a; Pirkkalainen and Salo 2016; Tarafdar et al. 2015a). Previous literature indicates that users spend on average 28 percent of their workday on interruptions, which leads to financial costs for organizations because users need approximately 20 minutes to resume their primary task after such events (D'Arcy et al. 2014a). Moreover, in a 2017 study, nearly one-fifth of Americans identified IT use as a source of stress. One of the most stressful events is when the IT does not work appropriately (American Psychological Association 2017).

The dark side of IT use has an impact on the well-being of users and organizations (Tarafdar et al. 2015b; Tarafdar et al. 2015a). For example, the dark side of IT use reduces organizational innovativeness and limits some of the productivity gains that organizations expect from their investment in IT (Tarafdar et al. 2015a). For users, the dark side of IT use can even harm their well-being (Tarafdar et al. 2015a). Users show different responses; for example, some are less satisfied and committed to their organization (e.g., Maier et al. 2014a; Ragu-Nathan et al. 2008), are exhausted (Ayyagari et al. 2011; Moore 2000), and might also suffer from IT-related burnout (Srivastava et al. 2015; Weinert et al. 2015c).

However, psychological literature claims that individuals also tend to cope with negative events (Lazarus and Folkman 1984). Compared to psychological coping literature, the research stream on the dark side of IT use is relatively young and unexplored (see Pirkkalainen and Salo 2016). Thus, so far, little is known about how IT users cope with the dark side of IT use. Even though IT use solves many problems it may create also many other negative events (e.g., Overby et al. 2010). Coping literature suggest that individuals evaluate the negative situations to decide how to cope with them (Lazarus and Folkman 1984). Thus, to understand how IT users, behave in situations when being confronted with negative events coping theory provides helpful insights. So, coping represents one key link between the dark side of IT use and the health of users as well as the maintenance and increase of efficiency and effectiveness (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005). Consequently, coping is highly relevant for users as well as organizations, as the concept comprises what users and organizations can do to overcome or manage the dark side of IT use to maintain or increase their productivity. Hence, the overall research question of the dissertation is as follows:

How do users cope with the dark side of information technology use?

To respond to that research question, the dissertation combines two research streams. The first research stream focuses on the dark side of IT use. The dissertation takes a stimulus–response perspective on the dark side of IT use by concentrating on the process encompassing IT events, their resultant user responses, and their outcomes. This perspective is used because in the context of coping, users evaluate IT events to decide how to cope with negative effects (Beaudry and Pinsonneault 2005). IT events[4] occur for example when IT does not behave as expected (e.g., computer breakdowns, interruptions, complexity; Ortiz de Guinea 2016; Ortiz de Guinea and Webster 2013) and its resultant responses and outcomes. The perception of these IT events is initiated by different characteristics (e.g., related to technology, personality, work) and engenders psychological and physiological user responses (Ortiz de Guinea and Webster 2013). IT events and the resulting user responses (e.g., psychological and physiological), which on their own depict a threat to the user, also affect different outcomes such as reduced task performance, for example (e.g., Addas and Pinsonneault 2018; Ortiz de Guinea and Webster 2013; Tams et al. 2014; Tarafdar et al. 2007).

The second research stream focuses on coping literature. The transactional process of coping indicates that users encounter IT events, which they appraise cognitively to determine an appropriate coping strategy (Beaudry and Pinsonneault 2005). Numerous coping strategies exist (Skinner et al. 2003), which either aim

[4] Different types of IT events exist. Besides the discrepant IT event, which is investigated here, there are expected IT events representing ordinary events, characterized by a match between the expectations of the user and the performance of the IT, and discovery IT events, unexpected positive events characterized by the discovery of new functionality of the technology (Ortiz de Guinea and Webster 2013).

to manage the problem or handle the resulting emotions. According to coping theory, the transactional process is highly time dependent, such that the effects of the different coping strategies change the situation at hand. This leads to a reappraisal of the situation (Folkman 1982).

In sum, to investigate how users cope with the dark side of IT use, this dissertation combines the stimulus–response perspective of the dark side of IT use, concentrating on the process of 'characteristics—IT events—responses—outcomes' with the transactional process of coping, encompassing the process of 'IT events—appraisal—coping strategies—reappraisal.' Thereby, the dissertation investigates how the transactional process of coping influences the stimulus–response perspective of the dark side of IT use.

Cumulatively, the dissertation encompasses the present introductory paper as well as eleven papers, which provide more detailed insights into the dark side of IT use and, more importantly, how users cope with it (see Figure 1). This introductory paper demonstrates the relevance of the research and gives an overview about the theoretical foundation applied in the different papers. In addition, related research concerning coping and the dark side of IT use are outlined. Based on the extent of previous literature several research gaps are identified, which are answered in the eleven papers. Overall, the content of the eleven papers is structured into four different chapters. Chapter One focuses on the dark side of IT use in particular on the investigation of the characteristics and antecedents of IT events (e.g., technical and work-related characteristics). In addition, the 'characteristics—IT event—responses' relationship is investigated between different contexts (*Paper I–III*). Chapter Two focuses on the outcomes of the dark side of IT use (*Paper IV and V*). Chapter Three concentrates on the coping efforts to manage the dark side of IT use. Thereby, this chapter consider the cognitive appraisal processes as well as different coping strategies (*Paper VI–IX*). Chapter Four focuses on longitudinal approaches to shed more light on the long-term effects of coping with the dark side of IT use (*Paper X and XI*).

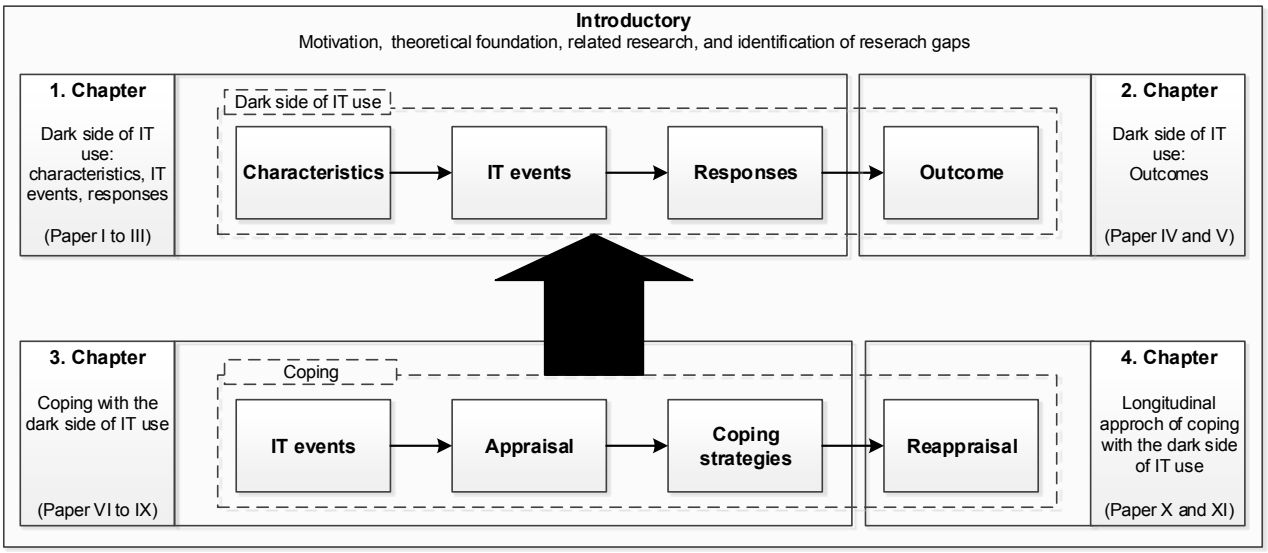


Figure 1: Structure of the dissertation

The remainder of the introductory paper is as follows. In §2, the theoretical foundations of the dissertation are demonstrated as well as related research focusing on coping with the dark side of IT use. Moreover, based on a literature analysis, significant research gaps are identified. In §3, the methodologies applied in the dissertation are explained. Thereby, the research approaches and designs, measurements, and collection methods used in the dissertation are explained. §4 deals with the validity and reliability of the studies and comprises the statistical methods applied in the dissertation. §5 demonstrates the main research results of each of the eleven papers. The contributions and implications of the dissertations are presented in §6. Limitations are shown in §7, future research in §8, and a short conclusion is given in §9.

2 THEORETICAL FOUNDATION AND RELATED RESEARCH

The dissertation uses different theories and theoretical models as theoretical lenses to understand how users cope with the dark side of IT use. First, the introductory paper gives an overview about the research on the dark side of IT use. Second, significant theories and models from coping research are presented. Third, a literature overview about coping with the dark side of IT use is given based on which different research questions are developed. Lastly, a summary of the theoretical foundation and related research is demonstrated.

2.1 THE DARK SIDE OF IT USE

The dark side of IT use comprises the negative events that are related with IT use and have an impact on the well-being of individuals and organizations (Tarafdar et al. 2015b; Tarafdar et al. 2015a). Key negative phenomena are for example, technostress, addiction, overload, anxiety, or the misuse of IT (Pirkkalainen and Salo 2016; Tarafdar et al. 2015a). However, this dissertation takes a stimulus–response perspective on the dark side of IT use, by concentrating on the process embracing characteristics, IT events, responses, and outcomes because in the context of coping users evaluate such IT events to decide how to cope (Beaudry and Pinsonneault 2005). A large and growing body of literature on the dark side of IT use (perhaps even unintentionally) is based on this stimulus–response approach (Watson and Graumann 2000), where users encounter different negative IT events, leading to negative responses and outcomes (Ortiz de Guinea 2016; Ortiz de Guinea and Webster 2013). These can be IT events occurring when IT does not behave as expected, or when a user is not able to use the IT appropriately (Ortiz de Guinea 2016; Ortiz de Guinea and Webster 2013).

By focusing on IT events, the dissertation concentrates only on some key negative phenomena of the dark side of IT use by focusing on IT events resulting from IT use, which are the primary ones investigated in technostress research and also concern overload and anxiety. Besides this, the dissertation focuses on IT events resulting due to IT changes. Other negative phenomena from the dark side of IT use such as addiction or misuse of IT, are not addressed within this dissertation.

The **stimulus–response perspective taken on the dark side of IT use** is shown in Figure 2 and explained in the following by focusing first on the IT event[4], second on user responses, and lastly on different outcomes.

IT events are negative events that occur when IT does not behave as expected, or when a user is not able to use the IT appropriately. IT events involve a problem, a misunderstanding, or a difficulty with the IT being used (Ortiz de Guinea 2016; Ortiz de Guinea and Webster 2013). The literature indicates that different types of IT events exist, such as those resulting due to IT use (e.g., overload, role conflict, insecurity, uncertainty) and those resulting due to IT changes (e.g., IT implementations, changing IT, malfunctions) (Weinert 2018). *IT events due to IT use* are characterized by problems and difficulties that result from IT usage. For example, several investigations focus in an organizational context on overload, invasion, complexity, insecurity, and uncertainty (Ragu-Nathan et al. 2008; Tarafdar et al. 2007; Tarafdar et al. 2010; Tarafdar et al. 2011; Tarafdar et al. 2014). Additional IT events due to IT use have been investigated such as work–home conflict, work overload, and role ambiguity (Ayyagari et al. 2011). In a private context, the focus is on, beside the above-mentioned, social overload, information overload, and communication overload (Maier et al. 2014a). *IT events due to IT changes* are characterized by new IT implementations and technical issues. Examples are IT implementations in an organizational context (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005, 2010; Bhattacherjee et al. 2017) or IT malfunctions in terms of computer breakdowns (Riedl et al. 2012, 2013). IT events result in different user responses, which are explained as follows.

Two main user **responses** are differentiated, psychological and physiological. *Psychological responses* reflect the state of mind at a conscious level (Tams et al. 2014). They are the outcomes of an interaction between environmental demands and an individual's conscious evaluations (Cooper et al. 2001). For example, the evaluation of IT events triggers psychological responses such as emotions (Beaudry and

Pinsonneault 2010; Stein et al. 2015), computer-related thoughts (Ortiz de Guinea and Webster 2013), reduced satisfaction and commitment of the personnel (e.g., Maier et al. 2014a; Ragu-Nathan et al. 2008), emotional exhaustion (e.g., Ahuja et al. 2007; Ayyagari et al. 2011; Moore 2000), poor job engagement or even burnout (e.g., Srivastava et al. 2015; Weinert et al. 2015c).

Physiological responses include bodily responses to IT events, for instance, cardiovascular, biochemical and gastrointestinal symptoms (Cooper et al. 2001). These responses are based on two major systems in the brain: the autonomous nervous system (ANS) and the hypothalamus-pituitary-adrenal axis (HPA axis) (Tams et al. 2014). The HPA axis plays a primary role in the body's reactions to stimuli by balancing hormones released by the adrenaline-producing adrenal medulla and the corticosteroid-producing adrenal cortex (Riedl 2013). The activation of the ANS leads to emotional sweating, pupil dilation, a faster heartbeat as well as an increase in the cortisol level (Riedl 2013). Unlike psychological strain, physiological strain may be experienced at an unconscious level (Monat et al. 2007; Riedl 2013). Examples of physiological responses are high arousal (Ortiz de Guinea and Webster 2013), increased cortisol (Riedl et al. 2012), increased alpha-amylase production (Galluch et al. 2015), or increased skin conductance (Riedl et al. 2013). These different user responses, in turn, influence several outcomes, which are described next.

Outcomes include behaviors such as lower performance levels, mistakes, errors, absenteeism and turnover (Addas and Pinsonneault 2018; Cooper et al. 2001; Ortiz de Guinea and Webster 2013; Tarafdar et al. 2010). In addition, outcomes also encompass different IT usage patterns such as automatic and adjusting IT use (Ortiz de Guinea and Webster 2013).

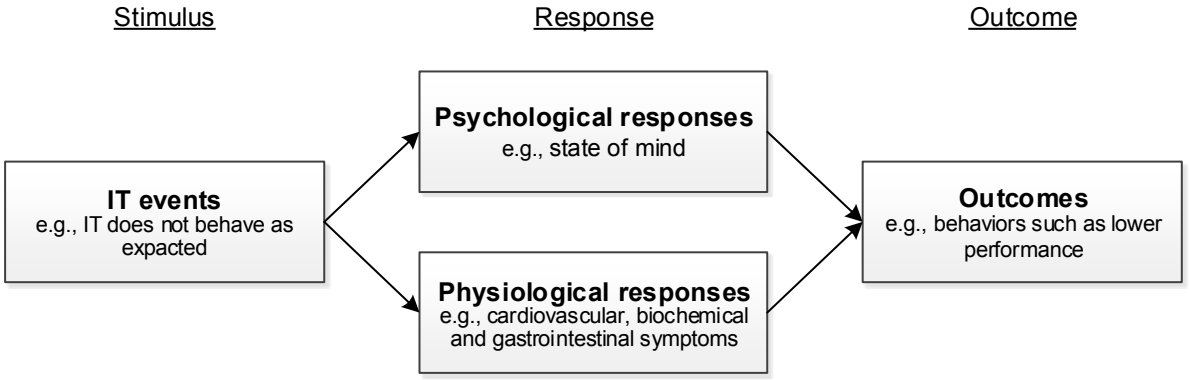


Figure 2: The stimulus–response perspective of the dark side of IT use

2.2 COPING RESEARCH

Information system (IS) coping research is rooted in psychology and build upon the coping theory (Folkman et al. 1986). Based on the general theory several IS models have been specified such as the coping model of user adaptation (CMUA) (Beaudry and Pinsonneault 2005) and the model of technology adaptation (Bala and Venkatesh 2015) have been developed. These three models are described in the following.

2.2.1 General coping theory

Coping[5] is a function of behavioral, cognitional, and perceptual efforts to handle threatening demands (Lazarus and Folkman 1984; Pearlin and Schooler 1978). Coping theory states that users go through a cognitive *appraisal process* involving primary and secondary appraisal, which results in the selection of coping strategies (Lazarus and Folkman 1984). Users cognitively appraise the situation to understand whether it is relevant to their well-being and in what ways (Folkman et al. 1986). Each situation may contain different events as the foundation of cognitive appraisal (Schuster et al. 2003). During *primary appraisal*, the events are evaluated as irrelevant, benign/positive, or threatening. Users evaluate the potential negative

[5] Here in the Introduction, the terms coping and adaptation behaviors are used interchangeably because coping is defined as adaptation process (Skinner et al. 2003), whereas adaptation behaviors are defined as behavior to cope with IT events (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005).

consequences of being threatened by events, and thus primary appraisal represents the extent of how dangerous a user perceives the events (Lazarus and Folkman 1984). During *secondary appraisal*, the user's ability to handle the perceived events is assessed. Users assess the available action options and consider what they can do to cope. Users evaluate their ability to avoid the events (Lazarus and Folkman 1984).

Based on the strength of the events (primary appraisal) and their ability to handle the events (secondary appraisal), each user selects a c*oping strategy*, which includes the behavioral and cognitive efforts to handle the event. Users rely on these two cognitive processes to perform different coping strategies (Lazarus and Folkman 1984). Numerous coping strategies exist (Skinner et al. 2003), which either aim to manage the problem or handle the resulting emotions. Problem-focused coping (PFC) aims to mitigate the problem and determine the direct problem, such as by active coping or instrumental support. Emotion-focused coping (EFC) aims to regulate emotions tied to the event by trying to change them, e.g., acceptance and positive reinterpretation (Lazarus 1993).

Reappraisal[6] is a reevaluation process where individuals appraise the situation again based on new information from the environment or their reaction (Lazarus and Folkman 1984). In other words, reappraisal differs from a cognitive appraisal, specifically in that it follows and modify an earlier cognitive appraisal (Lazarus and Folkman 1984). Thereby, reappraisal considers temporal developments and indicates that individuals repeatedly reappraise their circumstances (Folkman 1982). Individuals perform the process of cognitive appraisal, coping, and reappraisal repeatedly (Folkman 1982). For example, individuals cognitively appraise a situation for the first time and perform different coping strategies, which change the situation such that the individual has new information and reappraises the situation differently.

Figure 3: Transactional theory of coping (based on Lazarus and Folkman (1984))

2.2.2 IS coping models

The general coping theory explained in Section 2.2.1 above has been contextualized to the IS discipline. Two main IS coping models exist—coping model of user adaptation (CMUA) and model of technology adaptation behaviors—which are described in the following.

The CMUA states that the evaluation of the IT event starts with primary appraisal, in which users assess the IT event as either a threat or opportunity. The assessment of the IT event follows an evaluation of the control and the resources users have to estimate the coping possibilities. The different assessments lead to four different adaptation strategies, benefits maximizing, benefit satisficing, disturbance handling, and self-preservation, each of which contain different coping strategies that in turn influences three consequences (e.g., an individual's efficiency, effectiveness, and minimization of the negative consequences of the IT event).

Benefits maximizing strategies are performed when users appraise the IT event as an opportunity and have high control over the situation. The coping efforts are mainly problem-focused and aim to maximize the efficiency and effectiveness for the user and to take full advantage of the opportunities offered by the IT event. Users who appraise the IT event as an opportunity and have low control over the situation apply a *benefit satisficing* strategy, which includes only limited problem and emotion-focused acts that have limited effect on individual efficiency and effectiveness. *Disturbance handling* is used when users appraise the IT event as a threat and feel that they have high control over the situation and hence perform problem- and emotion-focused efforts. Problem-focused efforts are those that manage the situation and increase individual efficiency and effectiveness, and emotion-focused efforts minimize the expected negative consequences and

[6] It should be noted that despite the same name, the phenomenon of reappraisal is very different from the coping strategy called reappraisal. The first is the temporal development of cognitive appraisal, which is explained herein. The second is a defensive reappraisal, which depicts a specific coping strategy consisting of any effort made to reinterpret the past more positively (Lazarus and Folkman 1984).

restore emotional stability. *Self-preservation* strategies are applied when users appraise the IT event as a threat and feel that they have low control over the situation. This strategy includes mainly emotion-focused efforts and aims at restoring emotional stability and reducing the tensions emanating from the IT event.

Moreover, the adaptation process is highly iterative and changes over time. The adaptation strategies and the outcomes influence the appraisal process of users, which leads to a reappraisal of the situation. For example, users appraise the IT event and in turn perform different adaptation efforts, which change the technology or the environment such that users reappraise the IT event (illustrated in Figure 4 by the feedback arrows from the strategies and outcomes to the appraisal process).

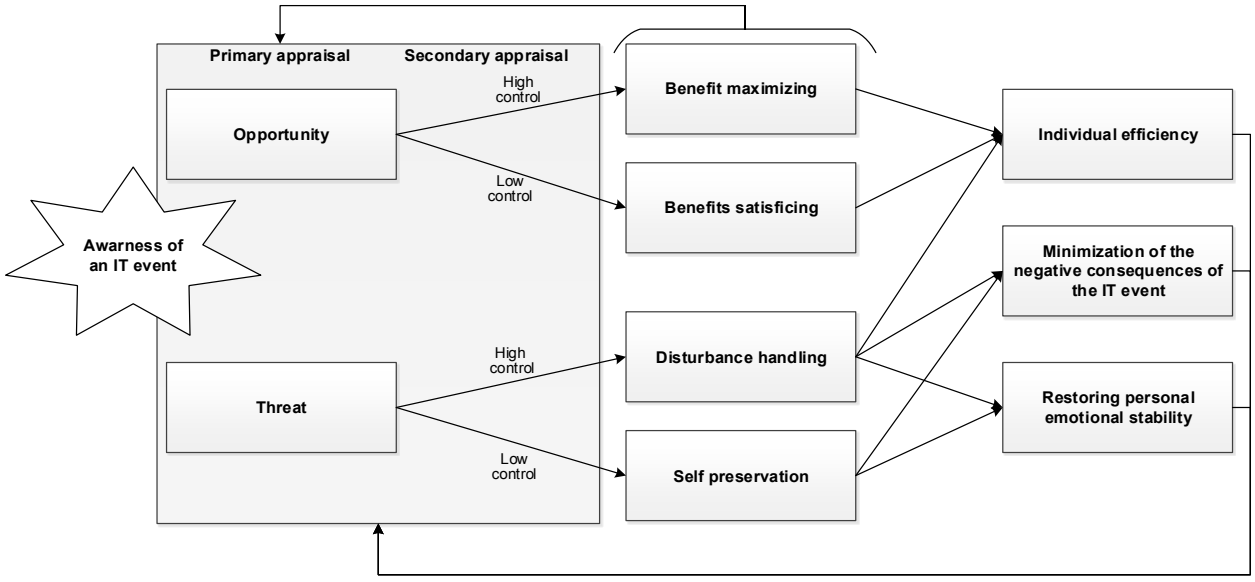


Figure 4: Coping model of user adaptation (CMUA) (based on Beaudry and Pinsonneault 2005)

The model of technology adaptation behaviors (Bala and Venkatesh 2015) is one theoretical explanation of how users appraise and cope with IT events such as IS implementations. The model states that cognitive appraisals and coping strategies in terms of technology adaptation behaviors are a key linking mechanism between IT events in terms of newly implemented IS and job outcomes. Consistent with prior theories, the model, shown in Figure 5, posits that users cognitively appraise the IT event, which in turn determines different coping strategies in terms of technology adaptation behaviors to increase job outcomes.

Cognitive appraisal is conceptualized as both a primary appraisal encompassing perceived opportunity and threat and as a secondary appraisal considering perceived controllability. During the primary appraisal, users evaluate the *perceived opportunity* of the IT event in terms of the newly implemented IS. Thereby, users evaluate the degree to which they think that the new IS offers them a chance for success (Bala and Venkatesh 2015), although users may perceive a chance for success in several aspects of their work following an IS implementation, such as personal growth, gain, reward, mastery, or job performance. They are likely to develop a holistic assessment of opportunity when they first encounter an IS in their work environment (Beaudry and Pinsonneault 2005). Also, users evaluate the *perceived threat* of the IT event in terms of the newly implemented IS. Users evaluate the degree to which they think that the new IS harms his or her well-being, personal gain, or growth (Bala and Venkatesh 2015). For example, users may think that the IS is degrading their performance and status in the organization, because their roles in business processes may change after the implementation. During the secondary appraisal, users evaluate the *perceived controllability* about the IT event in terms of the newly implemented IS. Here, users evaluate the extent of their ability and resources to deal with the new IS (Bala and Venkatesh 2015). Perceived behavioral control, self-efficacy, and facilitating conditions have significant conceptual similarities (Venkatesh et al. 2003).

The appraisal process is on the one hand influenced by *implementation characteristics*. Two types of implementation characteristics are considered: experiential engagements and psychological engagements. The former represents characteristics that involve behaviors of users during IT implementation such as user participation and training effectiveness. The latter are the characteristics that measure psychological association of users within IT implementation such as user involvement and management support (Barki and Hartwick 1994). Both characteristics influence the above-described appraisal process.

On the other hand the appraisal process also determines coping strategies in terms of technology adaptation behaviors. Technology adaptation behaviors are specific behaviors that users perform to cope with a newly implemented IS. The model of technology adaptation indicates that cognitive appraisal determines four different coping strategies in terms of technology adaptation behaviors: exploration-to-innovate, exploitation, exploration-to-revert, and avoidance.

Exploration-to-innovate is the extent to which a user is attempting to find, extend, and modify IS features to accomplish their tasks in an innovative manner. Exploration-to-innovate is conceptually similar to feature extension, feature exploration, and infusion or emergent use of IS (Jasperson et al. 2005; Thatcher et al. 2011). For example, users might discover the new IS and find a new way to do their work tasks. *Exploitation* is the extent to which a user uses a set of recommended IS features to perform their portfolio of tasks. This behavior is similar to previously investigated behaviors such as exploitive system use (Burton-Jones and Straub 2006), feature adoption (Jasperson et al. 2005), and routine use of an IS (Thatcher et al. 2011). For example, users who perform exploitation behaviors use a set of IS features that they learned from others (e.g., peers, supervisors, help desk). They use these features on a regular basis to accomplish their work tasks. *Exploration-to-revert* occurs when a user tries to find, develop, and modify IS features based on their work processes or habits related to the old processes and IS (Bala and Venkatesh 2015). This behavior is similar to workarounds (Laumer et al. 2017), where users instead of learning the new return to what they had done in the past. One example is that users pull data from the new system and use the old system to perform their analyses. *Avoidance* is the extent to which a user tries not to use the new IS to perform their work tasks (Bala and Venkatesh 2015). An example is users who do not use the new IS at all because they think that they can accomplish their work tasks efficiently without using the new IS.

These adaptation behaviors are a key linking mechanism between IT events and job outcomes such as job performance and satisfaction.

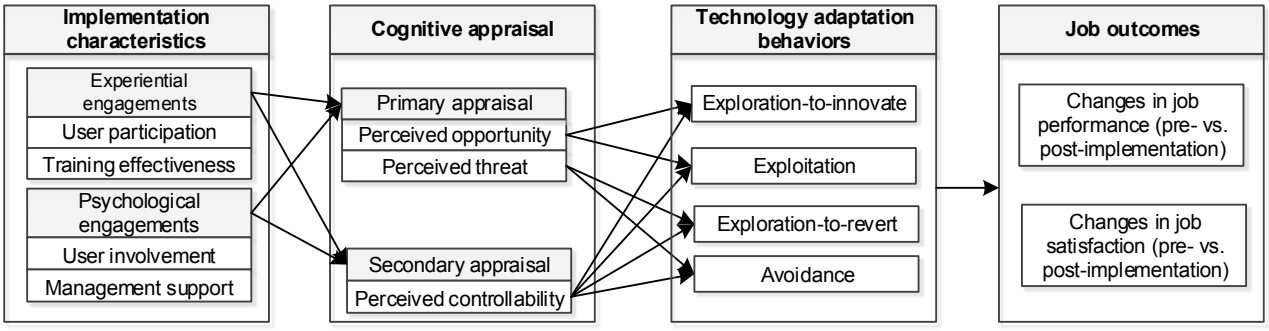


Figure 5: Model of technology adaptation behavior (based on Bala and Venkatesh 2015)

2.3 Related Work on IS Coping and The Dark Side of IT Use[7]

The next section gives an overview of that literature that is concerned with IS coping and the dark side of IT use. As explained in Section 2.1, the dissertation focuses on two strands of research on the dark side of IT use: the first, which concentrates on IT events due to IS use; the second, which focuses on IT events due to IS changes. Consequently, the related work on coping with the dark side of IT use in the rest of the dissertation also concentrates on these two research strands. In the present section, the literature review only

[7] This section contains text passages from my previously published articles: (Weinert 2018).

contains papers that consider coping and the dark side of IT use, because coping can only be investigated when there is something to cope with. The literature is analyzed according to the structure of coping described in Section 2.2, by focusing on the IT event, appraisal process, coping strategies, and outcomes.

Within the first strand, an early examination developed a conceptual model of technostress and coping. (Weinert et al. 2013b). They theorized that primary and secondary appraisal leads to PFC and EFC, which in turn influences technostress. In particular, they assumed that coping moderated the relationship between IT events and strain responses, which are the psychological and physiological responses to the IT event.

Some investigations have validated these influences empirically. It is suggested that the application of coping strategies regarding method control and resource control moderate the relationship between overload and conflict and psychological and physiological strain responses. Coping had no effect on the relationship between overload and conflict and psychological responses, whereas resource control decreased the relationship between overload and physiological responses and method control decreased the relationship between conflict and physiological responses (Galluch et al. 2015). Previous research also examined whether coping influences anxiety, stress, and depression among IT personnel. Five different coping strategies were studied: social support, active coping, cognitive avoidance coping, self-controlling coping, and accepting responsibility coping. The findings indicated that active coping had no significant effect on anxiety, stress, and depression, whereas all other coping strategies positively affected these dependent variables (Love et al. 2004).

In addition, research suggests that the effect of IT events in terms of technostress creators (overload, invasion, complexity, insecurity, uncertainty) on job burnout, as well as on job engagement, is moderated by dominant personality traits such as openness-to-experience, neuroticism, agreeableness, conscientiousness, and extraversion. Their findings showed that extraversion reduced the effect between IT events and job burnout and neuroticism reduced the effect between IT events and job engagement. Agreeableness increased the relationship between IT events and job burnout, and openness enhanced the effect of IT events on job engagement (Srivastava et al. 2015). A recent investigation examined whether emotion-focused coping strategies such as distress, venting and distancing from IT moderated the relation between an IT event in terms of its being a technostress creator and responses to it (Pirkkalainen et al. 2017). Also, they investigated the role of IT control in this context. Their results showed that distress venting reduces the effect of IT events in terms of technostress creators on psychological responses but only when users have low IT control. Furthermore, they revealed that distress venting has a direct positive effect on strain such that the higher the level of distress venting, the higher the intensity of the psychological response.

The technostress concept has been extended to the domain of IT security. D'Arcy et al. (2014b) investigated overload, complexity, and uncertainty, which creates stress in users. It was theorized that security-related stress (SRS) influences information security policy (ISP) violations and that coping mediates this relationship. In particular, it was assumed that the EFC strategy—moral disengagement—mediates the relationship between SRS and ISP violation intention. Their results showed that moral disengagement increased ISP violation intention significantly and indicated that moral disengagement plays a mediating role between SRS and ISP violation intention. Herrington et al. (2007) identified in their qualitative study five different IT events experienced by students in their computer program, namely demanding coursework, lack of confidence, time requirements, unbalanced life, and difficult professors. Students coped with these IT events by applying avoidance, comedic displacement, planning, and realism. Based on these results, a framework was developed to indicate how students cope with IT events and remain within the computing discipline.

The second research strand focuses, for example, on the CMUA (see Section 2.2.2), which has been conceptually developed such that an additional examination validates its statistical robustness (Elie-dit-Cosaque 2007; Elie-Dit-Cosaque and Straub 2011). Their results show that the four strategies of adaptation (benefits maximizing, benefits satisficing, self-preservation, and disturbance handling) are empirically distinct from each other and the appraisal process leads to the theorized adaptation strategies.

The application of the CMUA in the context of emotions shows that coping strategies such as venting, seeking social support, and distancing mediate the relationship between negative emotions (anger, anxiety) and IT use, whereas task adaptation and seeking instrumental support mediate the relationship between positive emotions (happiness, excitement) and IT use (Beaudry and Pinsonneault 2010). Stein et al. (2015) extended this study and investigated how users cope with uniform and mixed emotions and how these coping strategies are reflected in patterns of IT use; their results indicate that users cope with mixed emotions by applying combined coping strategies. A recent investigation is based on the CMUA to predict usage behavior in mandated situations where users have no free decision whether or not to use the IS (Bhattacherjee et al. 2017). They concentrated on an implementation of an IS and propose, based on the appraisal process, four different user responses such as engaged, compliant, reluctant, or deviant. For example, they argue that users appraising the IS as a threat have a low-control response in a deviant way by using workarounds, whereas users appraising the IS as an opportunity have a high-control response engagingly by experimenting with the IS.

Besides the CMUA, an early study investigated whether the appraisal of a new IT determines one's coping acts and whether different coping behaviors lead to various levels of integration of IT (Beaudry and Pinsonneault 2001). It was hypothesized that a new IT appraised as a threat will lead one to apply more user coping activities (e.g., learning new skills), whereas a new IT appraised as an opportunity will lead one to apply more IT-work system coping acts (e.g., modifying the IT itself). Furthermore, user coping acts are hypothesized to be associated with a higher level of integration between IT and the user, leading to a greater level of integration between IT and the working system.

Furthermore, research has examined how users cope with the situation when free trial software restrictions are worse than expected and how coping influences purchase decision making (Hock-Hai and Xue 2007). The researchers focused on the coping strategies rational thinking and action coping. The results demonstrate that action coping increases willingness to pay and that rational thinking has no effect on willingness to pay but positively influences action coping. Also, coping theory has been used to develop a theoretical framework that unpacks and traces the processes by which IT comes to influences organizational actors' identity (Nach and Lejeune 2009). Alternatively, it has been applied to understand why mobile application users do not complain about highly negative incidents. An explorative analysis revealed several PFC strategies (switching the app, fixing the app, waiting for updates, adapting to the app) and EFC strategies (downplaying the role of the app, overstating the needed effort, online/offline venting, blaming the device/oneself, empathizing with the app provider) that explain why users do not complain (Salo et al. 2015). Also, the literature suggests that PFC redirects thoughts from the task an individual is currently working on to the IT event. Results show that IT events lead to computer-related thought and adaptation behavior (Ortiz de Guinea and Webster 2013).

In sum, two strands of literature exist. One focuses on IT events due to IT use, whereas the second concentrates on IT events due to IT change. Table 1 gives an overview of the current literature focusing on coping with the dark side of IT use based on which, several research questions were developed and are presented in the next section.

Table 1. Overview of the results within the research stream of IT adoption and usage (based on Weinert 2018)

IT event	Appraisal 1.	Appraisal 2.	Coping Strategy	Outcome (variables are highlighted)	Reapp-raisal	Reference
RESEARCH STRAND FOCUSING ON IT EVENTS DUE TO IT USE (MOSTLY TECHNOSTRESS)						
IT-related issues	×	×	Social support (EFC)	Social support is related with high *anxiety*, high *stress*, and high *depression*.	×	(Love et al. 2004)
	×	×	Active coping (PFC)	Active coping has no significant relationship with *anxiety*, *stress*, and *depression*.	×	
	×	×	Cognitive avoidance coping (EFC)	Cognitive avoidance coping is related to high *anxiety*, high *stress*, and high *depression*.	×	
	×	×	Self-controlling coping (EFC)	Self-controlling coping is related with high *anxiety*, high *stress*, and high *depression*.	×	
	×	×	Accepting responsibility coping (EFC)	Self-controlling coping is related with high *anxiety*, high *stress*, and high *depression*.	×	
Security-related stress (overload, complexity, uncertainty)	×	×	Moral disengagement (EFC)	Moral disengagement increases the *information security policy violation intention,* and it mediates the relationship between security-related stress and *information security policy violation intention*.	×	(D'Arcy et al. 2014b)
Overload	×	×	Method control (PFC)	Method control increases the relationship between overload and *physiological strain responses (alpha-amylase)*.	×	(Galluch et al. 2015)
	×	×	Resource control (PFC)	Resource control decreases the relationship between overload and *physiological strain responses (alpha-amylase).*	×	
Conflict	×	×	Method control (PFC)	Method control decreases the relationship between conflict and *physiological strain responses (alpha-amylase).*	×	(Galluch et al. 2015)
	×	×	Resource control (PFC)	Resource control increases the relationship between conflict and *physiological strain responses (alpha-amylase).*	×	
Technostress creators (overload, invasion, complexity, insecurity, uncertainty)	×	×	Conscientiousness (EFC)	Conscientiousness has no effect on *job burnout* or on *job engagement*.	×	(Srivastava et al. 2015)
	×	×	Extraversion (EFC)	Extraversion reduces the effect of technostress creators on *job burnout*.	×	
	×	×	Openness (EFC)	Openness increases the effect of technostress creators on *job engagement.*	×	
	×	×	Neuroticism (EFC)	Neuroticism increases *job burnout* and decreases *job engagement* as well as reduces the effect of technostress creators on *job engagement*.	×	
	×	×	Agreeableness (EFC)	Agreeableness increases *job engagement* and the relationship between technostress creators and *job burnout*.	×	
Technostress creators (overload, invasion, complexity, insecurity, uncertainty)	×	×	Distress venting (EFC)	Distress venting reduces the relation between technostress creators and strain (emotional exhaustion) and increases strain (emotional exhaustion) directly.	×	(Pirkkalainen et al. 2017)
	×	×	Distancing from IT (EFC)	Distancing from IT has no significant effect.	×	
RESEARCH STRAND FOCUSING ON IT EVENTS DUE TO IT CHANGES						
New IT appraised as threat	×	×	user coping act (PFC)	User coping act has no significant effect on *user integration.*	×	(Beaudry and Pinsonneault 2001)
New IT appraised as opportunity	×	×	IT-work system coping act (PFC)	IT-work system coping act has no significant effect on *IT-work system integration*.	×	(Beaudry and Pinsonneault 2001)
Negative disconfirmation on time and functional restriction	×	×	Rational thinking	Rational thinking has no significant effect on *willingness to pay* but a positive effect on *active coping.*	×	(Hock-Hai and Xue 2007)
	×	×	Active coping (PFC)	Active coping increases the *willingness to pay.*	×	
Negative emotions with new or changing IT	×	×	Venting (EFC)	Venting increases *seeking social support*.	×	(Beaudry and Pinsonneault 2010)
	×	×	Seeking social support (EFC)	Seeking social support increases *IT use.*	×	
	×	×	Distancing (EFC)	Distancing decreases *IT use*.	×	
Positive emotions with new or changing IT	×	×	Task adaptation (PFC)	Task adaptation increases *IT use*.	×	(Beaudry and Pinsonneault 2010)
	×	×	Seeking instrumental support (PFC)	Seeking instrumental support increases *task adaptation*.	×	
IT implementation	✓	✓	Avoidance (PFC)	Avoidance has no significant effect on *job performance* and *job satisfaction.*	×	(Bala and Venkatesh 2015)
			Exploration-to-innovate (PFC)	Exploration-to-innovate increases *job performance* and *job satisfaction.*	×	
			Exploitation (PFC)	Exploitation increases *job performance* and *job satisfaction*.	×	
			Exploration-to-revert (PFC)	Exploration-to-revert decreases *job performance* and *job satisfaction.*	×	
IT system implementation	✓	✓	Engaged response	×	×	(Bhattacherjee et al. 2017)
			Compliant response		×	
			Reluctant response		×	
			Deviant response		×	

Note: × = has not been considered; Only articles by which an IT event and a corresponding coping strategy could be identified are listed.

2.4 RESEARCH QUESTIONS

Based on the theoretical background, the IS coping model, and the related work the dark side of IT use and coping are each understood as a process encompassing different parts which influence each other. To investigate these dependencies between these two processes the overall research question aiming to answer how users cope with the dark side of IT use is broken down into four more specific research questions (RQ). The first research question focuses on the dark side of IT use to understand its source in more detail by investigating the different characteristics influencing IT events across various contexts. The second research question focuses on organizationally relevant outcomes as coping depicts one link between the dark side of IT use and healthy users and productivity gains for organizations. The third research question concentrates on the effect of coping strategies on the dark side of IT use in terms of IT events, responses to them as well as on outcomes such as performance, as the process of coping and the process of 'IT events—responses—outcomes' is developing over time. Therefore, the fourth research question takes a longitudinal approach to focus on reappraisal and coping as well as repeated IT events and the resultant responses. Each research question is developed in detail in the following.

In the context of coping with the dark side of IT use, this dissertation concentrates especially on the source of the dark side of IT use by looking at different IT events. The literature demonstrates that IT events result in different psychological and physiological responses and, in turn, in different outcomes (Beaudry and Pinsonneault 2005; Ortiz de Guinea and Webster 2013). However, only a few papers focus on the antecedents of such IT events (Ayyagari et al. 2011; Galluch et al. 2015). To cope with IT events, it is one condition to understand the formation of IT events, as the literature indicates that technology or personality characteristics prejudice IT events and their effects (Ayyagari et al. 2011; Srivastava et al. 2015) (see Table 1). Additionally, the contexts in which IT events are perceived are essential to understanding how users might cope with the dark side of IT use, because many studies indicate that the assumptions of theories and empirical results might differ depending on the context (Johns 2006, 2017; Te'eni 2015). Consequently, the effects of characteristics (e.g., related to technology, personality, work) on IT events across various contexts are essential to understanding how users cope, such that the first research first question is:

RQ1: How do these different characteristics influence IT events across various contexts?

Coping is especially important in an organisational context as it depicts a link between the dark side of IT use and the achievement of growth in organizational efficiency and effectiveness (Bala and Venkatesh 2015). For example, the dark side of IT use decreases the efficiency and productivity of users as well as whole organizational units (Pirkkalainen and Salo 2016), where coping strategies might reduce the effect of the dark side of IT use and increase productivity (Bala and Venkatesh 2015). For example, IT use is one organizationally relevant outcome, as a user might stop using IT because of IT events and its response (Turel 2014) (see Table 1). Moreover, in the context of IT use, recent studies build upon the dual process theory (Kahneman 2011) suggesting that users behave according to a reflective and intuitive system (e.g., Ferratt et al. 2018; Soror et al. 2015; Turel and Qahri-Saremi 2017). The reflective system is characterized as controlled, rational, and conscious, whereas the intuitive system is characterized as uncontrolled, associative, and unconscious (Gawronski and Creighton 2013; Kahneman 2003; Stanovich and West 2000).[8] However, most of the coping theories and models such as the CMUA (see Section 2.2) and the related research (see Section 2.3) are based only on the reflective system and neglect the intuitive system.

[8] According to (Stanovich and West 2000), the systems can also be called system 1 and system 2 (Kahneman 2011), associative system and rule-based system, heuristic processing and analytic processing, tacit thought processes and explicit thought processes, implicit cognition and explicit learning, experiential system and rational system, automatic processing and controlled processing, as well as the automatic activation and conscious processing system.

For example, past coping literature (e.g., Beaudry and Pinsonneault 2005, 2010) indicates that users perform coping strategies against IT events to increase their IT usage behavior, whereas organizationally relevant outcomes might have a reflective and an intuitive manifestation. To shed light on organizational outcomes and more on the intuitive system, the second research question is:

RQ2: How are organization-related outcomes influenced by IT events and the resultant user responses and how and what role do the intuitive systems play in the context of the dark side of IT use?

As explained above, IT events and resultant user responses (Ortiz de Guinea and Webster 2013; Riedl et al. 2012, 2013; Tams et al. 2014), which on their own depict a threat to the user's well-being and mental health (Tarafdar et al. 2015a) also affect user behavior, as it reduces the task performance of users and may result in monetary consequences for organizations (e.g., Addas and Pinsonneault 2018; Ortiz de Guinea and Webster 2013; Tams et al. 2014; Tarafdar et al. 2007). However, despite the negative monetary consequences for organizations and psychological consequences for users, only a few studies focus on coping strategies against IT events and the resultant user responses (e.g., Beaudry and Pinsonneault 2005). Table 1 reflects that the current body of IS coping literature is relatively small. As the dark side of IT use depicts a serious threat for individuals and organizations because it reduces the productivity and innovation of individuals and harms their well-being (Tarafdar et al. 2015a), it is highly relevant for individuals as well as organizations to understand what and how users can cope with IT events, user responses, outcomes as well as moderate their dependencies. Therefore, the third research question is:

RQ3: How do coping strategies influence IT events, user responses, and outcomes?

Research on the dark side of IT use demonstrates that the work environment of users is disrupted by IT events (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005; Ortiz de Guinea and Webster 2013). Coping literature notes that when users face IT events, they appraise these situations, which results in the use of different coping strategies (Lazarus and Folkman 1984). However, the IS literature treats appraisal and coping as a static process (Bala and Venkatesh 2015), whereas the psychological literature shows that it instead depicts a continuance process of 'appraisal—adaptation—reappraisal' unfolding over time (Folkman 1982; Lazarus and Folkman 1984).

For example, the literature shows that IT events such as computer breakdowns do not occur only once. Computer systems that crashed once had a probability of one in 3.3 of crashing a second time (Nightingale et al. 2011). Also, during the implementation of a new IS or modification towards an IS, users might not only encounter adverse situations once, but instead encounter the new IS over and over as implementation phases take months if not years to complete (Sykes et al. 2009; Sykes et al. 2014; Sykes 2015; Sykes and Venkatesh 2017). Current IS literature concerning IT events mostly only concentrates on one encounter with an IT event (e.g., Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005; Bhattacherjee et al. 2017; Ortiz de Guinea and Webster 2013) and neglects the longitudinal change of responses. Moreover, the previous literature primarily concentrates on the 'IT event—response' relationship and neglects reappraisal (see Table 1), which takes the temporal development of the appraisal process into consideration. Hence, the fourth research question is:

RQ4: How do user appraise, respond, and cope with the dark side of IT use over time?

2.5 SUMMARY

To examine how users, cope with the dark side of IT use, the theoretical foundations and related literature is the research on the dark side of IT use is demonstrated. Next, major coping theories and models are explained, and the related literature concerning IS coping is outlined. Based on the literature overview, four different research questions are developed.

3 METHODOLOGY

The dissertation uses numerous different approaches and methods to answer the research questions and close the research gaps. Figure 6 gives an overview of the methodologies used in this dissertation by specifying the research approaches, research methods, measurements, and data collection timing. Each aspect of the methodology is described in the following sections. Two popular research approaches are distinctly seen in the IS literature—quantitative (empirical) and qualitative (non-empirical) (Chen and Hirschheim 2004),[9] both of which are described first. Second, each of these research approaches contains one or more research methods. In addition, this dissertation follows the distinction between research methods and data collection techniques suggested by Harrison and Wells (2000). Thereby, research methods (e.g., laboratory experiments, surveys) are *"strateg[ies] for carrying out research to inform and increase knowledge within a particular situation"* (Harrison and Wells 2000, p. 4). Third, each research method can thereby use several data collection techniques (e.g., questionnaires, interviews) (Harrison and Wells 2000), which then demonstrated. Moreover, data collection timing determine the timing of the data collection techniques, differentiating between longitudinal data collection and cross-sectional data collection (Recker 2013), which are described last.

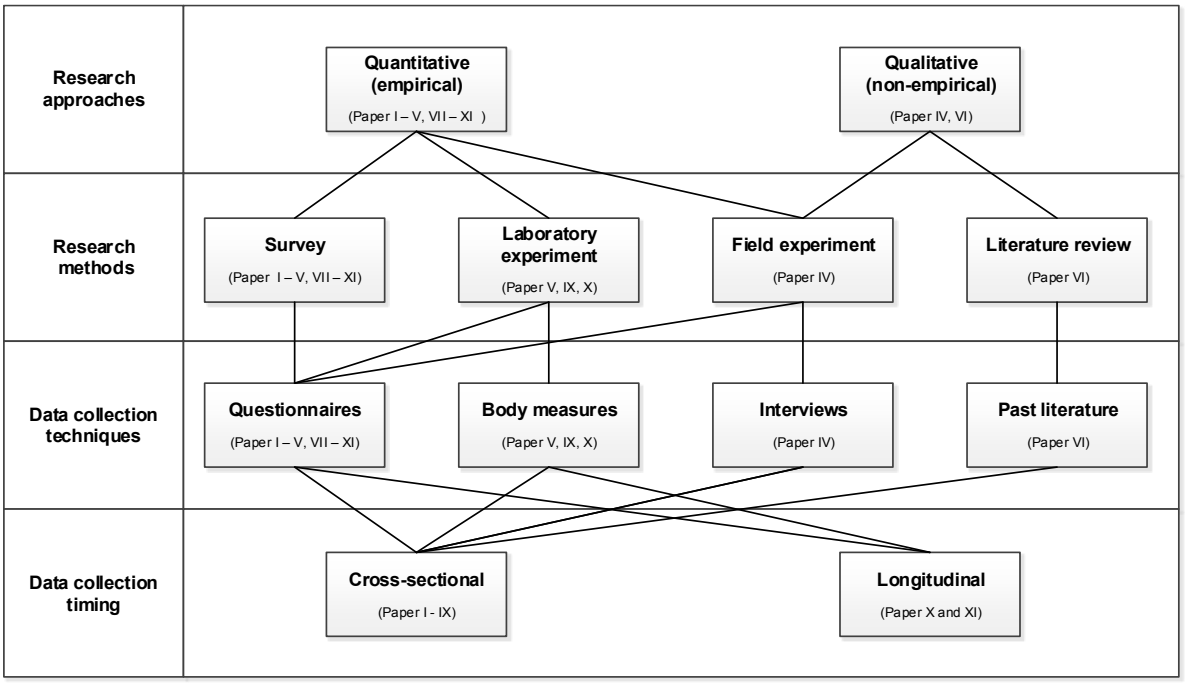


Figure 6: Overview of the methodology used in the dissertation[10]

3.1 RESEARCH APPROACHES

Two main research approaches are distinct in the literature – quantitative (empirical) and qualitative (non-empirical), which are also the most popular forms in IS research (Chen and Hirschheim 2004). The quantitative or empirical research approach, which *"typically uses numerical analysis to illustrate the relationship among factors in the phenomenon studied"* (Chen and Hirschheim 2004, p. 205) and the qualitative and non-empirical approach, which *"emphasizes the description and understanding of the situation behind the factors*" (Chen and Hirschheim 2004, p. 205; Recker 2013). Both are explained in the following.

[9] Some researchers suggest that quantitative and qualitative approaches can be both empirical and non-empirical (Kupfer 2008). However, as this dissertation contains only quantitative empirical and qualitative non-empirical research, only these two approaches are considered. A third approach is mentioned in literature, called mixed methods, representing studies using quantitative and qualitative approaches (Chen and Hirschheim 2004; Venkatesh et al. 2013). Examples of the latter include field experiments, which are quantitative and qualitative if they use interviews and questionnaires.

[10] Notably, numerous combinations of research approaches, research methods, data collection techniques, and data collection timing are generally possible. Thereby each level can have more specifications such that for example, mixed method approaches exists which uses quantitative and qualitative approach and more research methods or data collection techniques exist, which however have not been applied in the dissertation.

3.1.1 Quantitative (empirical) research approach

The quantitative (empirical) research approach is based on numerical data and statistical analysis to understand, explain, predict, or control the relationship between different constructs of interest to examine real-world phenomena and construct and validated theories about them (Chen and Hirschheim 2004; Holz et al. 2006; Recker 2013). In particular, *"numbers are used to represent values and levels of theoretical constructs and the interpretation of the numbers is viewed as strong scientific evidence of how a phenomenon works"* (Recker 2013, p. 66). Quantitative methods enable research to uncover hidden truths and bring them to awareness. The basics of knowledge are formed by observations and experience of empirical facts (Recker 2013). Within the dissertation, most of the papers, i.e., **Paper I–V** and **VII–XI,** follow a quantitative approach.

3.1.2 Qualitative (non-empirical) research

Qualitative (non-empirical) research approach allows researchers to study social and cultural phenomena (Harrison & Wells 2000), and is appropriate for exploratory research where the phenomenon is uncovered, complex, multifaceted, yet not fully understood, and not well researched (Alavi and Carlson 1992; Recker 2013). Hence, this approach is used for theory building, to develop concepts, and emphasize ideas based on their exploratory nature (Alavi and Carlson 1992; Chen and Hirschheim 2004; Recker 2013). From a measurement perspective, the significant characteristics of such an approach are the collection of extensive narrative data in non-numerical form such as "text" (Holz et al. 2006; Recker 2013). This approach is based on ideas, frameworks, speculations (Alavi and Carlson 1992) to interpret the captured text about what individuals have said, done, believed or experienced about the phenomenon (Recker 2013). A qualitative research approach is applied in this dissertation in **Paper IV** and **VI.**

In sum, the distinction between quantitative and qualitative research approach is that quantitative approaches focus on numbers and aims to validate theories, and qualitative approach focus on "text" which represents what people have said, done, believed or experienced about a particular phenomenon to develop theories.

3.2 Research Methods

The present dissertation uses several quantitative and qualitative research methods (e.g., surveys, use of laboratory experiments, field experiment, literature analysis), which are explained in the following.

3.2.1 Survey

The survey method is used to answer research questions such as "what", "how", and "why" something is happening. They explanatory nature indicates that the method aims to test theories and hypothetical causal relations between theoretical constructs (Recker 2013). This research method is characterized by involving no control or manipulation of independent variables, such that it includes no treatments (Recker 2013). Surveys can capture large amounts of data (Alavi and Carlson 1992; Chen and Hirschheim 2004). This research method contains collecting data from a random sample of participants in field settings through data collection techniques such as mailed questionnaires, online questionnaires, telephone interviews, or less frequently through structured interviews or published statistics.

The majority of the papers in the dissertation use this research method, to capture the perception of IT events, the subjects' psychological responses, outcomes, as well as appraisal and coping strategies. One way to recruit participants was using annual human resources (HR) studies conduced by our department, which questioned the 1,000 largest organizations in Germany[11] as well as several thousand job candidates (see Appendix A, Table 12 and Table 13 for an overview). The participating individuals were asked to take additional surveys or they were asked to give our chair permission to invite them to participate in future surveys. Moreover, results out of the annual HR studies were used as complementary data source. For example, Paper I uses households and work characteristics captured by the annual studies and matched with

[11] Largest German companies that generate more than 50 million euros in sales and employ more than 250 people.

the survey of the specific study. The annual surveys were also used to pre-test measures and research models. Moreover, the survey method used within each paper is briefly described and summarized in Table 2.

Paper I surveyed users from several firms via an online survey. The institute cooperates with a HR organization that provides HR services to both organizations and users. At total of 1,000 users from the customer database of the project partner were randomly selected, and the hyperlink to the questionnaire sent out. In all, 834 responses were be received, which reflects a response rate of 83.4 percent. The research is based on the responses from 542 users who submitted complete surveys and who had the requisite level of work experience.

Paper II is based on an online survey, in an attempt to reach a high number of individuals using Facebook to investigate the influences of social interaction overload of Facebook users on satisfaction and continuous usage intention. A total of 800 e-mail invitations were sent out. The e-mail addresses were collected over the last years on two different ways. First, some individuals allowed us during our annual study to contact them for subsequent studies and therefore specified their e-mail addresses after they took part in the annually HR surveys. Second, individuals had the possibility to enter their e-mail address into an online list that can be used for upcoming surveys. In all, 451 responses out of the 800 invitations were received. The research was then based on the answers of 246 individuals who answered the survey completely without missing values and were users of Facebook.

Paper III used a survey to collect perceptions about enterprise resource planning (ERP) systems within different organizations. The first organization is in the automotive industry and has more than 3,000 users and a sales volume of around 400 million Euros. The second organization is a German health insurance company with more than 5 million customers. A total of 163 users of Organizations One and 81 users of Organization Two were invited to participate in the survey. All users worked in the same branch and had to use SAP for their daily work. In all, 152 individuals of Organization One (response rate: 93.25%) and 75 individuals of Organization Two (response rate: 92.59%) completed the survey, with less than five percent missing values. The surveyed users in both organizations were knowledge workers, who use SAP as part of their daily working processes. Particularly, SAP is the only ERP system used in both organizations, such that it is mandatorily and frequently used by the users sampled.

Paper IV used five surveys to capture IT events, user responses, and user behavior at various points in time. Participants were recruited by using advertisements on notice boards at a German university, by publishing advertisements on Facebook, and by sending an email to registered participants of a subject database. The university had established a database of voluntary participants that can be used by researchers as a recruiting channel to announce upcoming studies, which several hundred individuals. A total of 82 individuals took part voluntarily in the study.

Two surveys were conducted in **Paper V**, in addition to a laboratory experiment, described below (Section 3.2.2). The participants were students attending the university. To increase participation, each participant received five euros as an allowance; 106 participants were recruited. Here the surveys were pre-experimental, performed direct before the laboratory experiment, and post-experimental, performed two weeks after the laboratory experiment. In the pre-experimental survey, the participants are asked about their beliefs and intentions towards the IT system. The post-experimental captured the behavior of the participants such as IT use and IS habit.

Paper VII and **Paper VIII** were based on the same data sample to investigate coping behavior. Users of different organizations were surveyed through an online survey. To recruit the participants, a database of users working at different organizations was used to send a hyperlink to the questionnaire. The database contains around 500 possible participants. In addition, the survey was promoted in several interest groups on Facebook and other social media platforms such as LinkedIn. In total, 194 responses were received with 110 answers used as several answers had to be deleted due to missing values.

Paper IX used a pre- and post-experiment survey to capture psychological user responses. To recruit participants, the study was promoted in different lectures of the department and advertised on several Facebook groups. To increase participation, every participant received a meal voucher from the local cafeteria. A total of 80 subjects filled out the survey, which is an appropriate sample size comparable to previous studies that measure physiological responses objectively in IS research (Eckhardt et al. 2012; Minas et al. 2014; Riedl et al. 2013; Teubner et al. 2015). The final sample contained 73 subjects because some participants were excluded based on measurement problems and missing values.

Paper X was based on a survey where participants were students and staff members of an university. Overall, 107 participants filled out the survey but the answers of seven participants were dropped because of problems within the study such that the total sample contains 100 participants. A particular characteristic of this survey was that it was based on the continuance state sampling (CSS; Larson and Csikszentmihalyi 2014; Ortiz de Guinea and Webster 2013; Sembill et al. 2008) method. The objective of this method is to capture the emotional state of the participants in everyday situations. In this method, the questions to measure emotional state are based on a specific scenario. Hence, participants where surveyed not only one time rather seven times to measure their responses towards a repeated IT event.

Paper XI conducted a longitudinal study comprising three surveys in the university library, which had recently implemented an enterprise content management (ECM) system (Laumer et al. 2013). The library provided a list of all users who were identified as a user of the ECM system. As an online survey was conducted, each employee was personally invited to all three surveys such that the data of each survey could be connected with each other. The university library has 90 permanent users who have been invited to the study. Given the study duration was two months with three points of measurement, it was not feasible to have all invited users participate throughout the study. Overall, the three surveys had an entire response rate of 66.6 percent.

Table 2: Survey details and objectives

Papers	Research context	Research objectives	Participants
Paper I	IT in general	The investigation of different work home conflict dimensions and their influences on user responses.	542
Paper II	Social network sites (Facebook)	The examination of online-social network-specific, and online-social network-specific communication characteristics influences the perception of social interaction overload and the effect on satisfaction and continuous usage intention.	246
Paper III	ERP systems	The investigation of whether the characteristics of ERP systems are stressful stimuli for IT users.	227
Paper IV	Social network sites (Facebook)	The evaluation of technology and switching stimuli on user responses predict discontinues usage behaviour.	82
Paper V	Social network sites (Facebook)	The investigation of the negative and positive implicit attitudes on IT usage.	106
Paper VII	IT in general	Contextualization of coping in the domain of technostress.	110
Paper VIII	IT in general	The evaluation of how whether individuals respond to IT events and user responses proactive or reactive.	110
Paper IX	Enterprise content management (SharePoint)	The evaluation of different coping strategies on user responses.	73
Paper X	Enterprise content management (SharePoint)	The investigation of habituation and sensitization of user responses while encountering a repeated IT event.	100
Paper XI	Enterprise content management (SharePoint)	The examination of reappraisal of an IT event over time.	59

3.2.2 Laboratory experiments

Laboratory experiments are especially suitable for the examination of the stimulus–response relationship, because external factors in such a laboratory environment can be eliminated or controlled, and the stimulus is mostly manipulated such that there is no doubt that the response results arise precisely out of such stimuli (Alavi and Carlson 1992; Harrison and Wells 2000; Recker 2013). Laboratory experiments are characterized by the *"identification of precise relationships between variables in a designed, controlled [environment]"* (Harrison and Wells 2000, p. 15).

A laboratory experiment is comprised of manipulations or treatments, experimental designs, and factorial designs. A *manipulation or treatment* is how the independent variable is operationalized into data (Recker 2013). Two major *experimental design* exist: the subject-within design and the subject-between design (Broota 1989). The former, the subject-within design, indicate that each subject is assigned and hence observed in each treatment of the experiment (Broota 1989). For example, imagine investigating whether the partaking coffee influences IT usage. Therefore, two treatments are needed. One, where subjects have to drink coffee and a second where the subjects get no coffee. Within the subject-with design, each subject is assigned to all treatments such that they have to drink coffee in the first treatment and get no coffee in the second treatment (see Figure 7, left). The later, the subject-between design, implies that each subject is assigned and observed only to one of the several treatment conditions (Broota 1989). For example, there are again two treatments. One, where subjects have to drink coffee and a second where the subjects get no coffee. In the subject-between design, a subject is assigned to one of such treatments such that a subject either must drink or drink no coffee (see Figure 7, right).

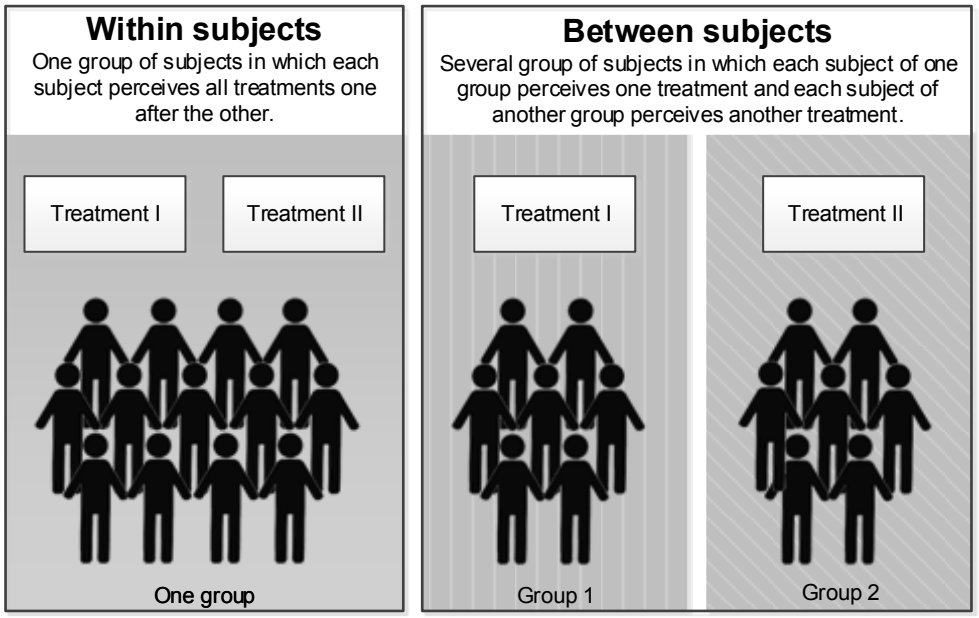


Figure 7: Experimental design[12]

Factorial design determines how many independent variables are considered and manipulated in the experiment. A factor refers to an independent variable which is manipulated by the facilitator to operationalize and simulate the independent variable (Broota 1989). Several factorial designs exist such as the one-factorial design, the uni-factorial design, and the multi-factorial design, which are described below.

The one-factorial design is the simplest form and encompasses exactly one factor with two factor levels. One factor level represents the treatment, the other, the control group. For example, the first-factor level designates that the subjects have to drink coffee, and the other specifies that they have to drink no coffee (see Figure 8).

The uni-factorial design comprises one factor with more than two factor levels. This design contains two or more treatments that are compared with each other. For example, a uni-factorial design might have one factor with four factor levels such as coffee, cappuccino, espresso, and the control group where subjects do not have to drink caffeine (see Figure 8).

The multi-factorial design involves more than one factor. Each factor denotes an independent variable, and each factor level describes a manipulation or treatment (Recker 2013). For example, a 2 x 2 multi-factorial design comprises two factors (represented by the amount of numbers) such as coffee and milk, each with two factor levels (represented by the count of the numbers) such as coffee and no coffee and milk and

[12] Based on: https://o.quizlet.com/-sWWKwSlDzdupkeRyUGL-A.jpg Accessed October 10, 2018.

no milk. Hence, the combination of the two factors and their factor-levels result in four different treatments. The first in which the subject drink coffee and milk. The second where the subjects drink only milk. The third in which the subject drink only coffee and the last, the control group, in which the subjects do not drink milk or coffee (see Figure 8).

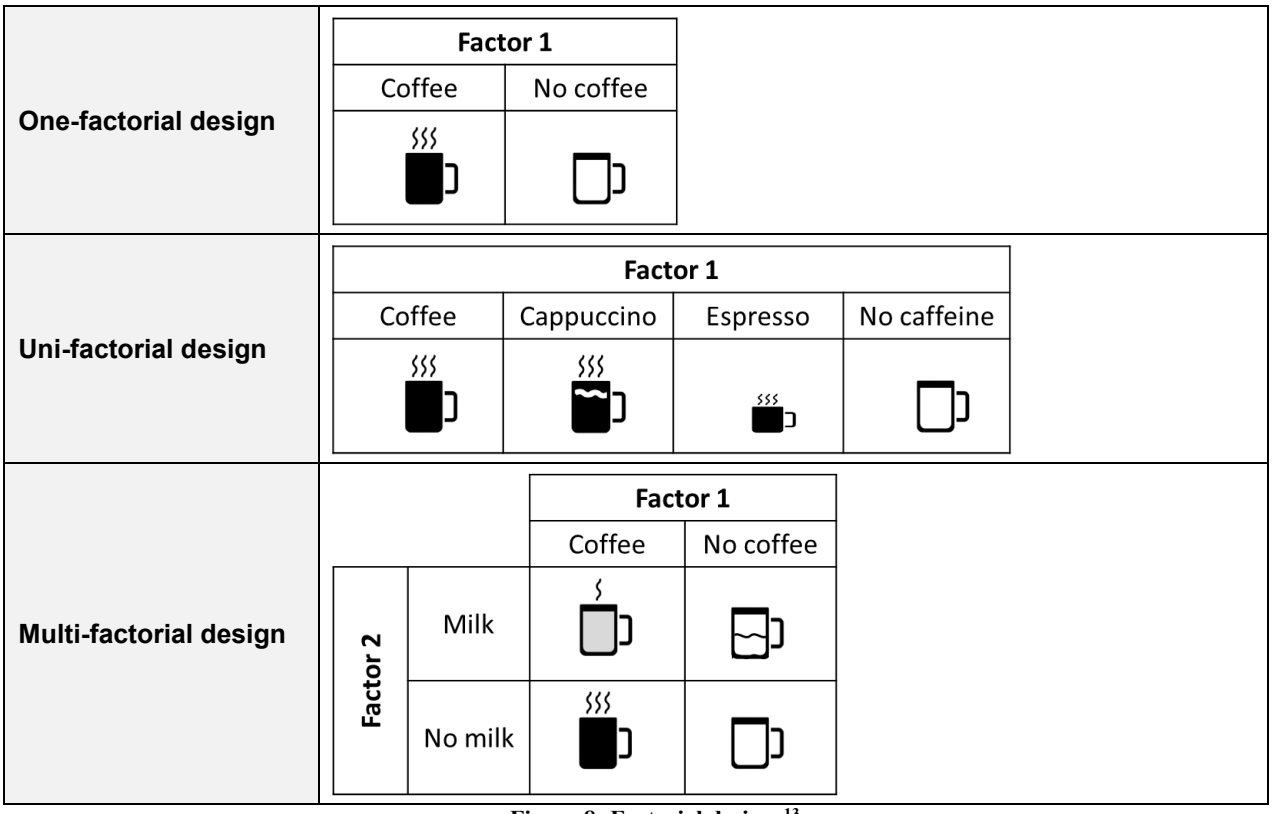


Figure 8: Factorial designs[13]

In sum, laboratory experiments are particularly suitable for stimuli–response examination as the stimuli can be manipulated and external factors can be eliminated or controlled. The manipulation of the independent variable, the experimental design, and factorial design determine the architecture of the experiment. In this dissertation, **Paper V, X,** and **IX** use laboratory experiments, which are described below.

Paper V uses among others a subject-within laboratory experiment design for data collection. Subjects are isolated from each other in the laboratory and completed the experiment independently. The laboratory procedure is classified into two stages because the order of implicit and explicit measurement is essential (Karpinski and Steinman 2006) such that implicit effects are first measured and the explicit effects second. In the first stage**,** the implicit attitudes have been captured by asking the subjects to participate in a single category implicit association test (SC-IAT; Karpinski and Steinman 2006), which captures the response time to measure (fast) automatic associations towards target objects (see Section 3.3.2.2). Here the subjects are manipulated by their perceptions of the target object in terms of Facebook. After the SC-IAT, participants filled out a questionnaire that captured their explicit attitudes and intentions towards Facebook.

Paper IX uses a 2 x 3 factorial between-subject design. The design considers an IT event factor named "stressor" with two-factor levels (techno-stressor/non-stressor) and a coping-strategy factor named "social support" with three factor levels (no support/emotional support/instrumental support). The independent variable in terms of techno unreliability has been manipulated by simulating a one-minute computer freeze during which input via mouse or keyboard was impossible and accompanied by an immediate visual response on the screen. The objective was to replicate precisely the way a user perceives the behavior of a system during a lockup, using a short script for the MS-based GNU GPL application AutoHotkey.

[13] Based on: http://141.76.19.82/mediawiki/images/thumb/9/98/Mehrfaktoriell_Beispiel_Glas.jpg Accessed October 10, 2018.

Paper X uses a two-factorial (2 x 7) subject-within design, encompassing the factors IT event with two factor levels (IT event, non-IT event) and encounter with seven factor levels (no encounters to six encounters). As the paper follows a subject-within design, all participants encounter all treatments. The experiment contains one control group and six treatments. During the first treatment, the participants did not perceive an IT event and consequently are not able to habituate or sensitize towards the IT event. This treatment was needed to capture a baseline in an unmanipulated situation. Subsequently, six IT event encounters followed in which the subjects always encountered the same IT event. Thereby the independent variable was manipulated. A computer breakdown was chosen as the IT event and hence independent variable (Riedl et al. 2012). A 20-second system freeze during which input via mouse or keyboard is impossible was simulated. To manipulate the habituation level, the subjects were repeatedly exposed to the same stimulus in terms of the computer breakdown as in prior investigations (e.g., Rankin et al. 2009) and tried to keep the working environment stable.

3.2.3 Field experiment

Field experiments are quite similar to laboratory experiments, but not conducted in a laboratory environment, instead in the natural setting for the phenomenon of interest (Alavi and Carlson 1992). The main differences are that the real-world in which the field experiment is conducted is not as easy to control as the laboratory environment. Field experiments are however also defined by the manipulation, the independent variable, the experimental design, and the factorial design and the attempts to control the most critical intervening variables (Chen and Hirschheim 2004).

The dissertation encompasses two papers in which a field experiment was conducted. **Paper IV** uses a field experiment that manipulates the independent variable in form of taking away the participants' Facebook account to investigate how discontinuous usage intentions are influenced by stress associated with using social networks sites (SNS) and switching to alternatives. Participants stayed in their natural environments and were measured while having no access to their Facebook account. **Paper XI** focused on reappraisal of an IT event. The employees of a German university library were manipulated by a new implementation of an IS. The participants were questioned in their natural working setting at three different points in time to investigate how the IS has been reappraised.

3.2.4 Literature analyses

Paper IV undertakes a literature analysis, which focuses on coping with IT events. The literature analyses is based on the process advocated by vom Brocke et al. (2009) and Webster and Watson (2002). Vom Brocke et al. (2009) suggest the following five steps to conduct a structured literature analysis: (1) definition of review scope, (2) conceptualization of topic, (3) literature search, (4) literature analysis and synthesis, (5) research agenda (vom Brocke et al. 2009).

Step (1) is to define the scope of the review by classifying the present research into the taxonomy proposed by Copper (1988) and shown in Figure 9. The focus of the literature review can be specified by its focus, goals, organization, perspective, audience, and coverage.

Characteristics	**Categories**			
Focus	**research outcomes**	research methods	theories	**applications**
Goal	**integration**	criticism	central issues	
Organization	historical	**conceptual**	methodological	
Perspective	**neutral representation**		espousal of position	
Audience	**specialized scholars**	general scholars	practitioners/politicians	general public
Coverage	exhaustive	exhaustive and selective	**representative**	central/pivotal

Figure 9. Taxonomy of a literature review (based on Cooper 1988)

Step (2) is the conceptualization of the topic, which was done by building upon coping theory (Lazarus and Folkman 1984). *Step (3),* the literature search, considered the sources, which are in this case selected based on the Senior Scholars' Basket of Journals.[14] Also, hits resulting from a query using the keywords coping, problem- and emotion-focused coping, and coping strategies are presented for each journal or conference (ICIS, ECIS, AMCIS). The decision of whether an identified article was analyzed in detail was made based on the title and the abstract. Subsequently, a backward and forward search was conducted (Webster and Watson 2002). The backward search started by reviewing the references of the papers identified to detect further articles of interest. The forward search focused on the identification of the papers that were cited as the key papers in the literature search. In *Step (4),* the identified literature on the topic is analyzed alongside the coping theory and synthesized by identifying the IT event, the appraisal process, coping strategies, and outcomes. Based on the synthesis of the literature several research gaps have been identified, *step (5)* was conducted by developing a research agenda.

3.3 Data Collection Techniques

As briefly mentioned above, the above-described research methods uses one or more data collection techniques, which are explained in more detail in the following subsections.

3.3.1 Questionnaire

The questionnaire is the medium between the researcher and the participant. Through this data collection technique, researchers aim to obtain the average response of participants by formulating different questions that can be answered by all participants using the same scale. Thus, the questions have to be always asked in the exact same way. Two types of questionnaires are differentiated. The first type are questionnaires that are intended for self-completion (Brace 2008), for example, online questionnaires that the participants fill out at a computer, or paper-based questionnaires that have to be completed by hand. The second type are questionnaires intended to be administered by an interviewer, for example, in a face-to-face interview or by telephone (Brace 2008). Self-completion questionnaires have been used in **all papers** of this dissertation, except for **Paper V**.

3.3.2 Body measures

The NeuroIS field introduces body measures to the IS discipline, which has provided the discipline with new possibilities to better understand human IS behavior (Dimoka et al. 2010; Dimoka et al. 2012; Riedl et al. 2014; Riedl and Léger 2016). Several physiological measures exist (see Dimoka et al. 2012; Riedl and Léger 2016). Here, the dissertation uses two different methods, namely electrodermal activity and response times, which are explained below.

3.3.2.1 Electrodermal activity[15]

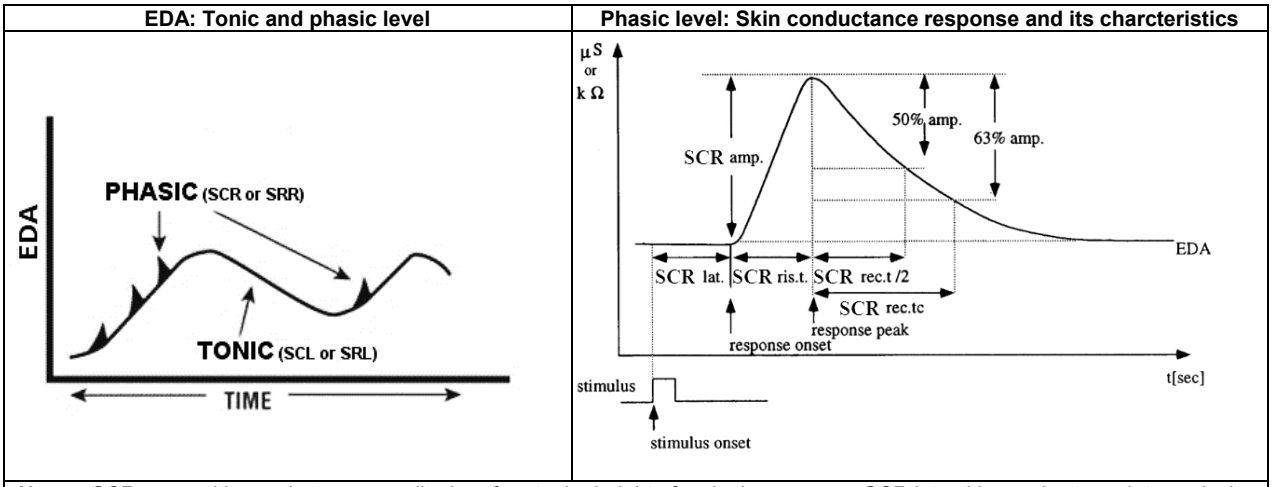
Electrodermal activity (EDA) is the general term for all electrical phenomena, including all active and passive electrical properties, which can be traced back to the skin and its appendages (Boucsein 2012). Past research indicates how such EDA enriches the current body of research in the discipline (Weinert et al. 2015b).

Behind the physiology of EDA are three different pathways that extend from the central nervous system to the sweat glands (Boucsein 2012; Dawson et al. 2007). These pathways promoted by encountering stimuli, which leads to an activation of the eccrine sweat glands causing a sweat secretion. Humans have two different kinds of sweat glands, which differ in location and function (Dawson et al. 2007). Apocrine sweat glands are more likely influenced by hormones rather than by neurons and have a thermoregulatory function. Eccrine sweat glands are more interesting from a psychophysiological perspective, because they are located in the palms of the hand and soles of the feet and are influenced more by emotional stimuli (Dawson et al. 2007).

[14] http://aisnet.org/general/custom.asp?page=SeniorScholarBasket Accessed October 10, 2018.
[15] This section contains text passages from my previously published articles: (Weinert et al 2015b).

For recording EDA, two small electrodes are placed at the surface of the skin, across which flows a low electrical current. These two electrodes measure a change of the electrical properties of the skin in response to different stimuli (Boucsein 2012; Dawson et al. 2007). Two primary methods of EDA recording exist: the **endosomatic method,** which does not use an external current for measuring and recording the potential of the skin (SP) and the **exosomatic method** which uses an external, low electric current flowing across the skin. The latter is able to capture skin resistance (SR) and skin conductance (SC). These two measures are based on Ohm's law, *"which states that the skin resistance (R) is equal to the voltage (V) applied between two electrodes placed on the skin surface divided by the current (I) being passed through the skin; that is, R=V/I"* (Dawson et al. 2007, p. 204). Consequently, skin resistance can be captured by measuring the voltage between the electrodes while keeping the current constant. In contrast, skin conductance can be captured by measuring the current flow while keeping the voltage constant (Dawson et al. 2007).

EDA is divided into a tonic and a phasic level (see Figure 10 (left)). The **tonic electrodermal measurement** is *"the absolute level of resistance or conductance at a given moment in the absence of a measurable phasic response"* (Dawson et al. 2007, p. 201). In other words, tonic values represent EDA over a longer period of time and are referred to as skin resistance level (SRL) or skin conductance level (SCL). The **phasic electrodermal measurement** takes the increases in resistance or conductance into consideration, which occurs in the tonic phase, mostly triggered by different stimuli. Increases in resistance are called skin resistance responses (SRR), and increases in conductance are labeled as skin conductance responses (SCR). The ideal phasic SCR is shown in Figure 10 (right).



Notes: SCR amp.: skin conductance amplitude refers to the height of a single response; SCR lat.: skin conductance latency is the time from the stimulus onset to the response onset in the case of a specific stimulus; SCR ris.t.: skin conductance rise time is the time from the onset of a response to its maximum; SCR rec: indicating the time that is needed to recover; SCR rec.t/2: time that is needed to recover 50%; SCR rec.tc: time that is needed to recover 63%; NS.SCR: non-specific response

Figure 10: (left) EDA (based on Shimell 2002); (right) phasic SCR (based on Boucsein (2012, p. 154))

Paper IX uses EDA. During the whole experiment, SC was measured as evidence of physiological arousal. An exosomatic SC method was used, which applies direct current to the skin. Two electrodes were installed on the palmar surface of participants' non-dominant hand to measure the low-level voltage between these electrodes. Participants' SC values were measured once per second using a MentalBioScreen K3 device and recorded in microsiemens (µS). This paper measures the tonic part of EDR by computing the skin conductance level (SCL).

Paper X decomposes SC into its tonic and phasic components. In line with past IS literature (Riedl et al. 2013; Teubner et al. 2015), the paper measures the phasic part of EDA by drawing on SCR to measure arousal after each manipulation. In line with Teubner et al. (2015), the paper draws on the amplitude of an SCR (SCR.amp), which refers to the height of a single response (Boucsein 2012), as the proxy for the extent of instant arousal and a reflection of short bursts of sympathetic activity (Dawson et al., 2011). As SCR.amps values are frequently skewed, a transformation algorithm has been performed as suggested previously (e.g., Dawson et al. 2007; Teubner et al. 2015), transforming all the SCR.amp values by log(x+1).

3.3.2.2 Response time

The measurement of response time is used twice within the dissertation, first to capture unconscious factors on the intuitive system such as implicit attitudes by conducting a *single category implicit association test (SC-IAT)*. Factors on the intuitive system are not measurable by introspection. The SC-IAT builds upon the implicit association test (IAT) which has been developed by Greenwald et al. (1998) to capture implicit attitudes, by measuring their underlying automatic associations between various stimulus objects and various evaluative attributes (Greenwald et al., 1998). The test has been used especially in the context of racism to examine whether individuals unconsciously associated negative factors with colored persons. This data collection technique has obtained prominence, as it has been used in several experiments, such as a project conducted at Harvard University, which aims to obtain insight into implicit social cognition. The second time response time was applied to measure *task performance* of individuals by capturing their working time.

As **Paper V** concentrates only on one IS, the **SC-IAT** (Karpinski and Steinman 2006)) was used, which measures the strength of evaluative associations with a single target object. The SC-IAT is used to capture implicit attitudes towards Facebook. This test records the reaction times in milliseconds from the onset of the task display to the response. The SC-IAT approach states that the faster individuals associated stimuli (words on a screen that have positive or negative connotations) with the target object, the higher is the implicit attitude (Greenwald et al. 1998; Karpinski and Hilton 2001). The detailed procedure of the SC-IAT is explained below.

The test contains one **target object** and two **attributes** (see Table 3), such as positive and negative meaning words. The target object as well as the positive and negative meaning words are represented by several stimuli. **Paper V** adapted the SC-IAT to the study purpose by considering Facebook as target object and two attributes in terms of positive and negative meaning word. To represent Facebook as target object, words and images are used as stimuli, which are adopted from Greenwald et al. (1998) to represent positive and negative associations (see Table 3). The SC-IAT is conducted by using an online-based SC-IAT.

Table 3: Target, attributes and their stimuli

Target object	Stimuli
Facebook	Social network site, post, comment, event, private message, birthday reminder, chat, group
	 
Attributes	**Stimuli**
Positive words	caress, freedom, health, love, peace, cheer, friend, heaven, loyal, pleasure, diamond, gentle, honest, lucky, rainbow, diploma, gift, honor, miracle, sunrise, family, happy, laughter, paradise, vacation
Negative words	abuse, crash, filth, murder, sickness, accident, death, grief, poison, stink, assault, disaster, hatred, pollute, tragedy, bomb, divorce, jail, poverty, ugly, cancer, evil, kill, rotten, vomit, agony, prison

The SC-IAT is structured as shown in Figure 3. The target object (e.g., Facebook) and the attributes (e.g., positive and negative) are presented in the left and right upper corners of a computer screen. Thereby, throughout different stages, the target object and one of the two attributes (e.g., positive and negative) are displayed in the same corner. Stimuli regarding the target object and both attributes (e.g., positive and negative; see Table 3) are randomly presented in the middle of the screen such as the stimulus "social network site" representing the target object (see Figure 3). Subjects are instructed to assign these stimuli to the related category in the left or right upper corner by pressing designated keys on the keyboard (e.g., "e" for the left and "i" for the right category). For example, "social network site" represents a stimulus of the target object Facebook (see Table 3) and should, therefore, be assigned to the left category by pressing the key "E" because Facebook is shown in the left upper corner. In assigning the stimulus, participants should react as fast as possible and make as few errors as possible, which occur when stimuli are assigned to an incorrect category

such as the assignment of "social network site" to the right category which does not contain Facebook. An "X" is displayed when a response is incorrect, and the subjects must correct their answer (see Figure 3). The stimuli presented in the middle of the screen are randomly picked out of all stimuli representing Facebook, or the positive and negative meaning words (see Table 3).

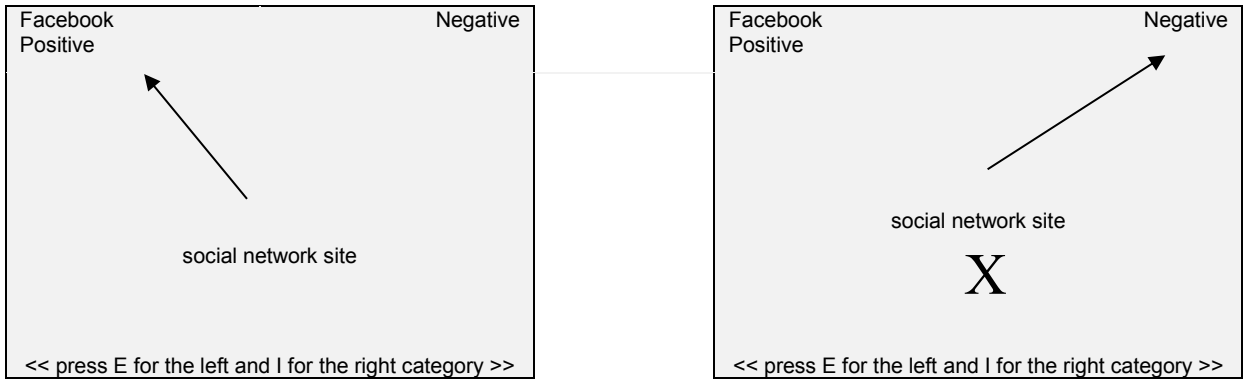


Figure 11: Example of a computer screen of the SC-IAT with a correct response (left) and an incorrect response (right)

The SC-IAT procedure encompasses four different blocks (see Table 4). Each block starts with instructions describing the target object for each block and the designation of response keys on the keyboard to the categories (left or right). Also, the combination of the target and the meaning words in the left or right upper corner changes across the blocks. An overview of each block its goals and the assignment and pairing for the left and right key is given in Table 4.

Table 4: Structure of the SC-IAT

Block	No. of stimuli	Goal	Left key	Right key
1	24	Practice: learning the meaning words and stimuli dimension	Facebook + positive meaning words	Negative meaning words
2	72	Test: target and meaning words pairing 1	Facebook + positive meaning words	Negative meaning words
3	24	Practice: learning to switch the spatial location of the construct	Positive meaning words	Facebook + negative meaning words
4	72	Test: target and meaning words pairing 2	Positive meaning words	Facebook + negative meaning words

The SC-IAT procedure aims to investigate implicit attitudes towards Facebook. The target object Facebook is used in combination with positive meaning and negative meaning words. **Paper V** used the SC-IAT procedure to operationalize positive implicit attitudes by revealing the association between Facebook and positive meaning words and to operationalize negative implicit attitudes by revealing the association between Facebook and negative meaning words.

Task performance consists of behaviors carried out to complete a job (Meister 1986). When studying task performance, one's measures must reflect the task under consideration. For the purpose of **Paper IX** and **X**, performance was assessed as an outcome, because the individual user has complete control of her task and one's output does not depend on other people (Burton-Jones and Straub 2006). In line with Cody et al. (2015), the outcome of the task and/or completion time for all tasks have been considered by drawing on video analysis. **Paper IX** measured task performance as the completion time of each task in seconds (Gattiker and Goodhue 2005). **Paper X** measured task performance as the completion time of each task and also considered the outcome of each task. The ability of the participants to complete the tasks with no errors or errors is defined as an outcome. Incorrect task outcomes are evaluated with a time penalty required to complete the task. Errors resulted in a time penalty of 1 standard deviation added to their time; this standard deviation was derived from the participants' times that had completed the task (Cody et al. 2015).

3.3.3 Interview

Interviews are a measurement technique that captures data from questions posed to respondents by an interviewer. Interviews can be structured, semi-structured, or unstructured (Holz et al. 2006; Recker 2013). The annual studies in the recruiting context also contain, besides the survey, several case studies (see Appendix A, Table 14 for an overview) that are used to obtain insight into the issues resulting from IT use. Moreover, within the dissertation, **Paper IV** used interviews. A total of 37 participants, while currently not using SNS, were interviewed via semi-structured interviews to explore negative perceptions and experiences of SNSs. The critical incident technique (Flanagan 1954) is applied, which suggests to first ask the participants about critical incidents and second question the participants regarding significant positive and negative reactions to such critical incidences. At least two researchers conducted the interviews (Eisenhardt 1989). Each interview is recorded and then transcribed and analyzed with MAXQDA (VERBI Software). In addition, diary entries from the participants are used to obtain additional insights (Yin 2009).

3.3.4 Past literature

Past literature[16] is a data collection technique *"that is based mainly on the review of existing literature"* (Palvia et al. 2004, p. 529). It is the basis for summarizing the state of the art in a field of research, integrating existing scientific knowledge to develop theory, discovering innovative knowledge, identifying open issues, and developing research agendas or criticizing existing research streams (Houy et al. 2015). The existing literature is not all equal; there are articles of high and article of low quality. Within the IS context, IS researchers regularly evaluate the quality of journals within the discipline to create rankings (vom Brocke et al. 2009). Different rankings exist such as a German ranking called VHB-Jourqual-3[17] or the more internationally-based AIS Senior Scholars' Basket of Eight journals.[18] This dissertation assesses the existing literature in **Paper VI** by conducting a structured literature analysis.

3.4 Data Collection Timing

Two distinct data collection timing protocols were used – cross-sectional and longitudinal – which are explained in the following.

3.4.1 Cross-sectional

Cross-sectional research is defined as *"research that collects data through one snapshot at a particular point of time"* (Chen and Hirschheim 2004, p. 206). In cross-sectional research, the relationship between the dependent and the independent variables is assumed to be time-invariant (i.e., static) (Zheng et al. 2014). This type of research focuses on the inter-individual differences, i.e. differences observed between individuals (Bialystok and Craik 2006; see Figure 12). In the dissertation, **Papers I–III** and **Papers VII–IX** conduct cross-sectional research by measuring data at one specific point in time.

Research that involves more than one single measurement period are named multiple snapshots and are still cross-sectional in nature. Multiple snapshots might contain different experiments, treatments or subjects (Chen and Hirschheim 2004). **Paper IV** contains a four-wave study where in waves one and two technology and switching beliefs are captured, and in wave three the intention to discontinue, and in wave four the discontinued usage behavior. Similarly, **Paper V** measures implicit and explicit attitudes, beliefs, intentions in a first wave of data collection and captures in a second wave the usage behavior and habit.

3.4.2 Longitudinal

Longitudinal research is defined *"as research that evolves over an uninterrupted period of time and focuses on process"* (Chen and Hirschheim 2004, p. 206). Longitudinal research *"captures the dynamic forces that affect a variable's longitudinal trajectory and how the relationship between two variables changes over time"* (Zheng et al. 2014, p. 547). In this case, individuals are measured repeatedly over time

[16] See Venkatesh et al. (2013, p. 29); Also called library research (Palvia et al. 2004)
[17] https://vhbonline.org/vhb4you/jourqual/vhb-jourqual-3 Accessed October 10, 2018.
[18] https://aisnet.org/page/SeniorScholarBasket Accessed October 10, 2018.

(Diggle et al. 2013). The main advantage of longitudinal studies is that they can distinguish changes over time within individuals (Diggle et al. 2013). In contrast to cross-sectional research, longitudinal research can examine intra-individual differences, which are differences that are observed within the same individual when they are assessed at different times or in different situations (e.g., Benlian 2015; Bialystok and Craik 2006; see Figure 12).

This dissertation contains two papers conducting longitudinal research. **Paper X** concentrates on the intra-individual differences among individuals regarding different user responses, while encountering a repeated IT event. The trajectory of such user responses was investigated over six measures across time. In addition, **Paper XI** focuses on the reappraisal of IT events and measured the evaluation of an IS implementation three times in a period of six weeks.

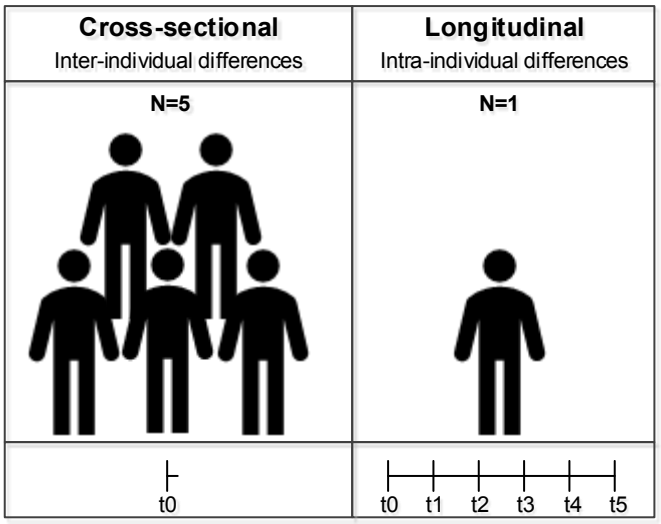


Figure 12: Data collection timing[19]

4 DATA ANALYSIS

The section illuminates the validity and reliability which must be established for each methodology described above in order to draw statistically valid conclusions from them. Subsequently, different biases are explained that predict issues in empirical research. Lastly, the statistical methods used in the cumulative dissertation are described.

4.1 VALIDITY AND RELIABILITY

Establishing measurement validity and reliability is not optional but strongly mandatory for all kinds of research (Recker 2013). It is a given that *"any inferences or conclusions drawn from unreliable or invalid measures are meaningless"* (Recker 2013, p. 71). The objective of validity and reliability is to provide the reader and researcher a high degree of confidence that the selected methods contain a high degree of scientific truth (Straub et al. 2004). Thereby, validity focuses on the issue of measurement between constructs, whereas reliability concentrates on the problems of measurement within a specific construct (Straub et al. 2004). In particular, validity *"describes whether the data collected really measure what the researcher set out to measure"* (Recker 2013, p. 70), and reliability is defined as *"the extent to which a variable or set of variables is consistent in what it is intended to measure"* (Recker 2013, p. 69)

The difference between reliability and validity is commonly explained by means of the example of archery. In this metaphor, the different items of a construct are compared to arrows that are shot at a target. Five arrows representing a measurement (e.g., five items) are presented as black circles at the target. The mean of all five measures is shown as the cross. Validity describes how close the cross (e.g., mean of the

[19] Based on: https://www.frontiersin.org/files/Articles/156937/fimmu-06-00531-HTML/image_m/fimmu-06-00531-g001.jpg Accessed October 10, 2018.

five items) is to the bull's eye. The closer the cross to the bull's eye, the higher the validity. The reliability is the extent to which the five arrows are close a part to each other. The measure is reliable when all arrows are close together. Figure 13 shows the different scenarios of validity and reliability. In Figure 13(a), reliability is given as all arrows are close together, and validity is given as the cross is close to the bull's eye. The measurement is reliable but not valid as the cross is not close to the bull's eye, see Figure 13(b). In Figure 13(c), the measurement is not reliable nor valid as the cross is not in the center and the circles are not close together. Also, Figure 13(d) is empty because the measure cannot be valid when it is not reliable (cf. Hair et al. 2017; Sarstedt and Mooi 2014).

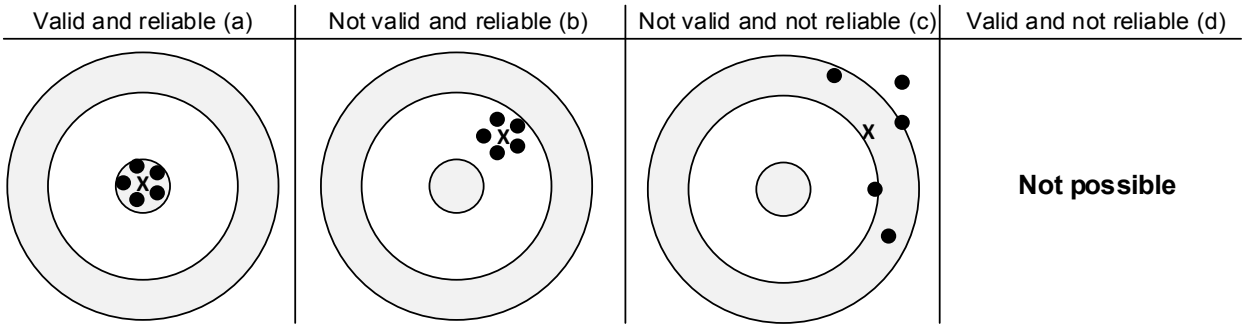


Figure 13: Reliability and validity (based on Sarstedt and Mooi 2014)

Different types of validity exist. One focuses on the issue of shared meaning and other on the problem of accuracy (Recker 2013). The papers of the dissertation use several validity and reliability measurements, which are shown in Figure 14 and explained in the following.

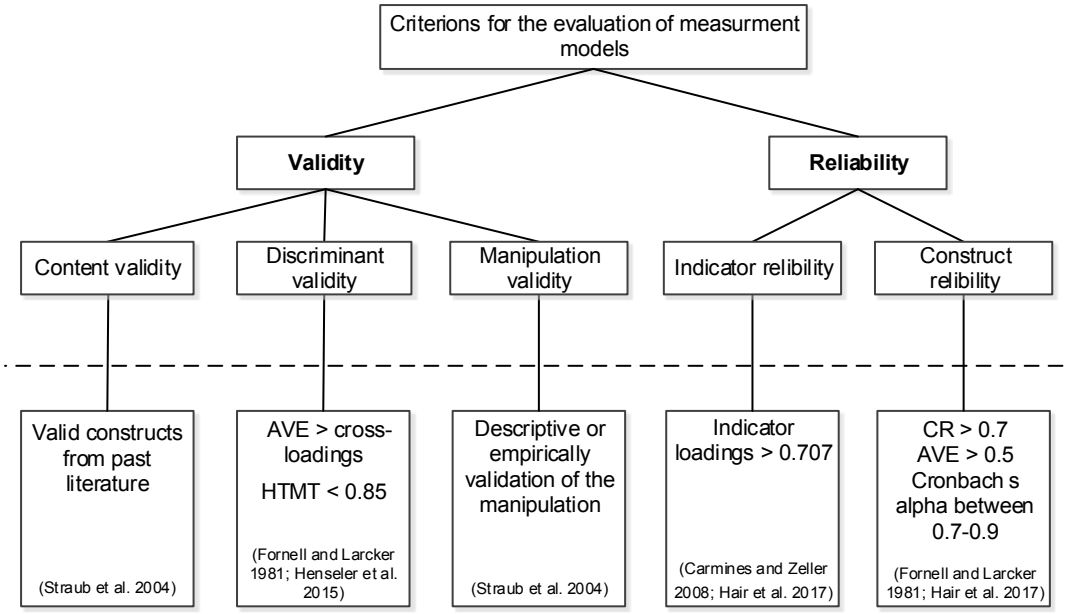


Figure 14: Validity and reliability measures used within the papers of the dissertation (based on Hair et al. 2017; Straub et al. 2004)

4.1.1 Content validity

The underlying question of content validity is whether the questionnaire items *"pull in a representative manner from all of the ways that could be used to measure the content of a given construct*" (Straub et al. 2004, p. 384). Researchers have to define first what they aim to measure and discuss what is included and what not to assess content validity (Sarstedt and Mooi 2014). To ensure content validity, the relevant dissertation papers (i.e., **Paper I–V and VII–XI**) used mainly items that have been used in prior research articles and each item was discussed and reviewed within the project team and in some cases with the managers of cooperation partners.

4.1.2 Discriminant validity

Discriminant validity reflects the extent to which items differ from other items (Campell and Fiske 1959). The primary aim is to statistically establish that the items measuring one construct have similar scores, while they have different scores than items from other constructs (Recker 2013). There are several ways to assess discriminant validity. One is the Fornell-Larcker criterion, which compares the square root of the average variance extracted (AVE) with the corresponding construct correlations. Thereby, the square root of AVE should be greater than the corresponding construct correlations (Fornell and Larcker 1981; Hulland 1999). In addition, Henseler et al. (2015) state the Fornell-Larcker criterion do not detect a lack of discriminant validity in each case. Hence, they propose the heterotrait-monotrait rario (HTMT) (Henseler et al. 2015). This approach estimates the true correlation between two constructs when they were perfectly measured (i.e., if they were perfectly reliable). HTMT values should be lower than 0.85. For very similar constructs a value of 0.9 is still acceptable.

Consequently, values above 0.9 suggest a lack of discriminate validity between the constructs. To establish whether this effect is statistically significant a bootstrapping procedure is used. The constructs lack discriminant validity when the resulting confidence interval contains the value 1.0. On the contrary, when the value 1.0 is not within the confidence interval the two constructs of interest are empirically different (Henseler et al. 2015). Discriminant validity is established in **Papers I–V** and **VII–XI**, all of which follow a quantitative approach.

4.1.3 Manipulation validity

Manipulation validity (needed in research methods such as laboratory and field experiments) assess whether the treatment groups but not the control group have been faithfully manipulated (Recker 2013). In other words, it attempts to ensure that the subjects are manipulated as intended (Straub et al. 2004). The validity can be proven descriptive or empirically. A common form of verification is a simple question in a post-experimental questionnaire that directly asks the subjects if they have experienced the manipulation. In addition, the manipulation can be evaluated in a more sophisticated way, using ANOVA, discriminant analysis or other techniques (Straub 1989; Straub et al. 2004).

In the dissertation **Paper IX** and **XI** control for manipulation validity. Both use several questionnaire items to ask the subject directly whether they were aware of the manipulation. Additionally, the manipulation validity is in both cases also empirically controlled by applying one or more ANOVAs (see Section 4.3.1. for more details).

4.1.4 Indicator reliability

The indicator reliability represents the size of the outer loading (Hair et al. 2017). High outer loadings on a construct demonstrate that the associated items have much in common. The outer loadings reflect the rate of the variance of an indicator that comes from the latent variables. To ensure that 50 percent or more of the variance is explained by the indicators, each value should be at least 0.707 (Carmines and Zeller 2008; Hair et al. 2017). All other items which have not fulfilled this threshold should be removed from the model (Bagozzi et al. 1991; Hair et al. 2011). Indicator reliability is established in **Papers I–V and VII–XI**, which all follow a quantitative approach.

4.1.5 Construct reliability

The construct reliability aims to evaluate internal consistency of the latent variable (Hair et al. 2017). Two criteria can be evaluated to verify construct reliability. The first is the Fornell and Larcker criterion, which determines construct quality, using composite reliability (CR), which should be at least 0.7 and average variance extracted (AVE), which should be at least 0.5 (Fornell and Larcker 1981). The second criteria is the traditional Cronbach's Alpha value, which should be between 0.7 and 0.9 (Hair et al. 2017). Construct reliability is established in **Papers I–V and VII–XI**, which all follows a quantitative approach.

4.2 ACCOUNTING FOR POSSIBLE BIASES

Throughout the dissertation, two different kinds of biases are attempted to be accounted for. The first, common method bias, accounts for the distortion of empirical results within self-reported measurements. The second, measurement invariance, accounts for distortion of measurement meanings across groups and times within self-reported measurements.

4.2.1 Common method bias

A potential issue with subjective or self-reported measures is common method bias (CMB), which is defined as the variance that is *"attributable to the measurement method rather than to the constructs the measures are assumed to represent"* (Podsakoff et al. 2003, p. 879). Different methods exist to evaluate the extent of CMB, for example, the Harman's single factor test (Harman 1976) and the unmeasured latent marker construct (ULMC) (Liang et al. 2007). The Harman's single factor test suggests that if a single factor accounts for the majority of the variance among the items, then it is concluded that a substantial amount of common method variance is present. Contrary, if one factor will account less than 50 percent of the variance, CMB is of no great concern (Harman 1976).

The ULMC suggests including an additional factor—named the CMB factor—into the partial least squares (PLS) model, which contains each indicator of the origin model. The remaining factors are transformed into single-item constructs, and the ratio of R^2 with the CMB factor is compared with the R^2 without the CMB factor. If the R^2 with the CMB factor is significantly higher than the R^2 without the CMB factor, CMB might be in issue. The value of the CMB factor ratio can be compared with the ratios in prior research using this approach (Liang et al. 2007). Noteworthy is that the methods contain several flaws (Chin et al. 2012; Schwarz et al. 2017). In the present cumulative dissertation **Paper I–V and VII–XI** controlled for CMB.

4.2.2 Measurement invariance

Measurement invariance must be controlled when the same latent variable is compared across different groups of individuals or across time. If researchers aim to compare results between groups or time they have to make sure such the meaning of the measurement is equal in the groups and that the meaning is not changing within the time period. Hence, one concern before comparing data across groups or time is ensuring measurement invariance. *"The examination of measurement invariance […] is one component used to gather score validity evidence and to evaluate construct-irrelevant variance (e.g., group membership)"* (French and Finch 2006). In other words, it represents whether the items of a latent variable have similar meanings across groups or measurement occasions. The understanding of the items might be different across groups because the groups are different in terms of culture, age, gender etc., or the meaning of the items changes over time. The underlying question that is aimed to be answered by the measurement invariance is whether the measurement between groups or time is distorted by the influences of culture, gender, or ethnicity such that different groups interpret the measurement differently or such that the measurement is different over time (Vandenberg and Lance 2016).

The dissertation contains the assessment of measurement invariance across groups as well as time. **Paper I** considers the work and private context and differentiates between several groups and **Paper XI** focuses on the appraisal of an IT event across time. Both paper draw on the measurement invariance of composite models (MICOM) procedure by Henseler et al. (2016) to establish measurement invariance. MICOM involves three steps: (1) configural invariance (i.e., equal parameterization and way of estimation), (2) compositional invariance (i.e., equal indicator weights), and (3) the equality of composite mean values and variances. If configural and compositional invariance are established (steps (1) and (2)), partial measurement invariance is confirmed, which allows a comparison of the relationships across the various groups. Also, if partial measurement invariance holds and the composite mean values and variances are equal across the groups, full measurement invariance is confirmed, which supports the pooled data analysis. In addition, **Paper X** performs a latent growth modeling (LGM) approach to investigate the change of user responses

while encountering a repeated IT event. To test for configural invariance, the paper follows the procedures outlined by Chan (1998) and used by Bala and Venkatesh (2013). In particular, to establish configural and metric invariance across time, two nested models are compared. Within the first model, the factors corresponded to the measurement occasions. In other words, T0 items loaded only on the T0 factors and the intercept is fixed to factor loadings, and error variances, factor means, and factor variances are freely estimated. An acceptable fit of Model 1 would indicate the unidimensional factor structure over time. Hence, configural invariance is established (Chan 1998). Model 2 is equal to Model 1 except that the factor loadings are equal across measurement occasions. Consequently, factor loading at T0 = factor loading T1 = factor loading T2. As Model 2 is nested within Model 1, the difference in chi-square is used to test whether there is any statistically significant change (i.e., reduction) in model fit from Model 1 to Model 2. If Model 2 did not differ significantly from Model 1, metric invariance has been established because a significant worsening in fit would indicate inequivalence of factor loadings over time.

4.3 Statistical Methods

To statistically analyze the measured data several statistical methods were used across the various papers of the dissertation. The statistical methods used were manifold, applying traditional statistical methods such as analyses of variance, as well as second generation methods such as structural equation modeling, up to hierarchical linear and multi group analyses. Each statistical method is explained subsequently.

4.3.1 Analyses of variance

An analysis of variance (ANOVA) compares the means values of a specific dependent variables across groups. A one-way ANOVA compares the means between exact two different groups, whereas a factorial ANOVA compares the means of the dependent variables across a more complex structure of groups. The underlying question answered with an ANOVA is where the values of the dependent variables between the various groups differ statistically.

The ANOVA methods determine the calculation of the F-value, which is the ratio of between-group variation and the within-group variation. The between-group variation *"depends on the difference between the group [(e.g., experimental treatment)] means"* (Rutherford 2012, p. 21) and the within groups *variation "depends on the variation of the individual scores around their group [(e.g., experimental treatment)] means"* (Rutherford 2012, p. 21). If the ratio of the between-group variation and the within-group variation is equal (also means that the F-value will be equal 1) then there are no differences between the groups (e.g., experimental treatment) means. The F-value is calculated to examine the differences between two or more groups statistically. To do so, the calculated F-value is compared with the sampling distribution of the F-statistic which in turn determines its statistical significance (Rutherford 2012).

In the dissertation **Paper IX** performances several ANOVAs to compare user responses across different treatment groups. Within the analyses, various post-hoc tests have been applied to compare more than two groups with each other.

4.3.2 Structural equation modeling

Second-generation techniques, such as structural equation modeling (SEM), allow researchers to integrate unobservable variables measured by latent variables. In other words, researchers are able to use latent variables in path-analytic modeling to test a set of hypotheses empirically (Chin and Newsted 1999, p. 130). SEM also supports the measurement of error variance in observed variables (Chin 1998b). *"There are unique advantages to SEM over linear regression in that SEM allows the creation and estimation of models with multiple dependent variables and their interconnections at the same time"* (Gefen et al. 2011, p. iv).

Two approaches of SEM exist: covariance-based SEM (CB-SEM) and partial least squares SEM (PLS-SEM) (Hair et al. 2017). Covariance-based SEM is based on the covariances and is parameter oriented. It is therefore used in confirmatory research. For example, this approach is mainly used to verify theories, i.e., whether they can be confirmed or must be rejected. CB-SEM tests the relationship between multiple variables

empirically. The validation is conducted by how well the theoretical model or theory can be estimated. The PLS-SEM is based on the variance of the dependent variables. Its objectives are to predict, as it is primary used in exploratory research. For example, it is used in exploratory research to develop theories by focusing on explaining the variance in the dependent variables when investigating the model (Chin and Newsted 1999; Gefen et al. 2011; Hair et al. 2017). PLS-SEM is the more appropriate approach when the phenomenon of interest is relatively new (i.e., coping with IT events) and the theoretical models and measures are sparse in prior research (Chin and Newsted 1999; Gefen et al. 2011). Therefore, the dissertation concentrates on the PLS-SEM approach, which is explained in detail in the following, although a CB-SEM approach is used in the hierarchical linear modeling section.

As shown in Figure 15, a PLS-SEM path model consists of two elements: the structural model and the measurement models. The structural model represents the latent variable and the relationship between the latent variable (path). The measurement models reflect the relationship between the latent variable and the measurement items (Hair et al. 2017).

A latent variable cannot be measured directly (also referred to as construct) as it captures an unobservable abstract concept such as psychological exhaustion. To measure such unobservable concept a measurement instrument consisting of a set of indicators or items are used to measure them indirectly. Each item out of the considered set of items represents one single aspect of the latent variable. The items act as a proxy and together measures the unobservable latent variable indirectly (Hair et al. 2017, p. 6). One example out of the dissertation is psychological exhaustion used in several papers which measures the emotional state of the individual. This latent variable cannot be measured directly but can be represented by a measurement instrument consisting of multiple questionnaire items based for example on Ayyagari et al. (2011) and rated on a Likert seven-point scale from “strongly disagree” to “strongly agree”.

The approach of PLS-SEM differentiates two types of latent variables: reflective and formative measurement models (Bagozzi 2011; Bollen 2011).

In a reflective measurement model, the items are formulated in such a way that they reflect the latent variable (an example of a reflective construct is seen at Y4 in Figure 15). Reflective constructs can be understood as a representative collection of all the possible items available within the domain of the construct (Nummally and Bernstein 1994). Therefore, given that the reflective measure dictates that all the items are caused by the same latent variable, the items associated with a particular latent variable must be highly correlated with each other. Thereby, the items are interchangeable such that each item can be omitted without changing the meaning of the latent variable on the condition that the variable has enough reliability. As the causality goes from the variable to the items, a change in the evaluation will affect all items simultaneously (Hair et al. 2017; Petter et al. 2007). Reflective items have, in contrast to formative items, an error term.

In a formative measurement model, latent variables are built by the linear combination of the items (an example of a formative construct is seen at Y1 in Figure 15). The items of formative variable are not interchangeable. Each formative item captures an explicit characterization of the formative latent variable (Petter et al. 2007). Hence, only the whole set of items determines the latent variable and the omission of an item changes the nature of such latent variable (Hair et al. 2017). As the items determine the latent variable, the change of one item is supposed to change the latent variable accordingly (Petter et al. 2007). Consequently, the extensiveness of the coverage of the items is important to ensure the adequate measurement of the formative latent variables (Diamantopoulos and Winklhofer 2001). In addition, formative items are free from error (Diamantopoulos and Winklhofer 2001).

Besides the reflective or formative nature of a latent variable, variables can also be first-order variables or second-order variables. First-order variables consist of one latent variable and its corresponding items (for example, variable Y1 and Y4 in Figure 15). Second-order variables are more complex, as they comprise two or more latent variables. Second-order variables can be used when a phenomenon can be represented by several first-order variables that measure separate characteristics of the phenomenon (Chin 1998a; Hair et al.

2017; Polites et al. 2017). For example, Figure 15 demonstrates the second-order construct Z1 which comprises the two first-order variables Y2 and Y3, which in turn, determines their corresponding measurement items.

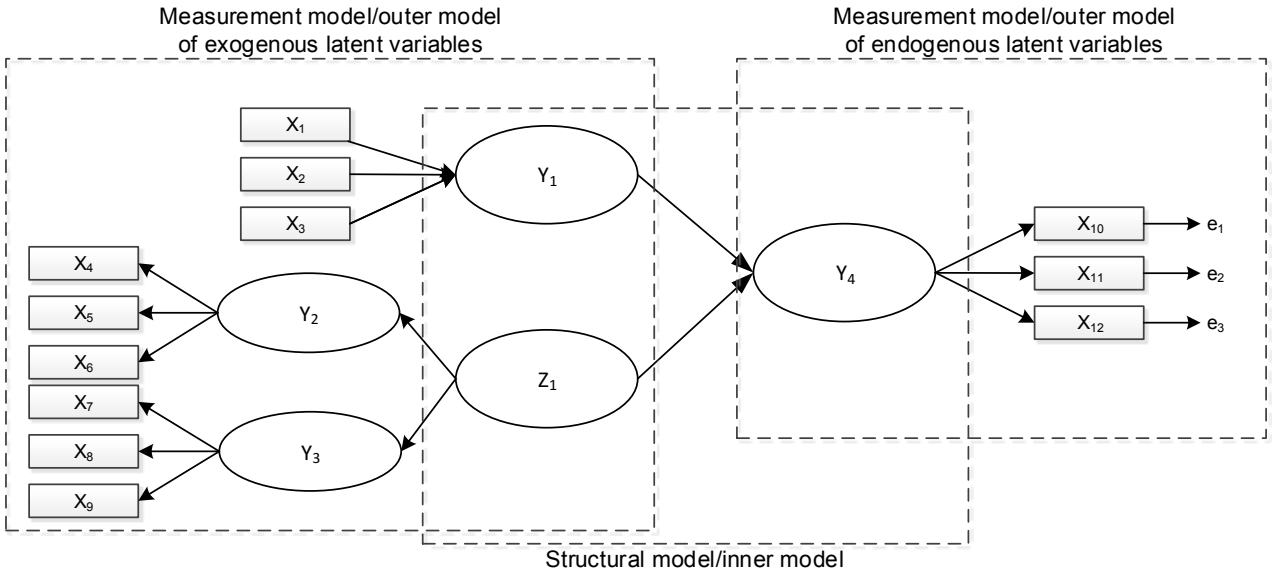


Figure 15: PLS path model (based on Hair et al. 2017)

4.3.3 Mediation and moderation analysis

The relationship between stimulus and response in PLS models suggests that exogenous variables directly influence endogenous variables without the systemic impact of other variables. In many situations, however, this is not the case, because a third variable can change the understanding of the relationship between stimulus and response. The two examples of such extensions are mediation and moderation (Hair et al. 2017).

Mediation occurs when a third variable (called a mediator variable), intervenes between two other related variables, shown in Figure 16 (middle (b)). In specific, a change in the exogenous variable leads to a change in the mediator variable, which in turn influences the endogenous variable (Hair et al. 2017). A variable functions as a mediator *"to the extent that it accounts for the relation between the predictor and the criterion"* (Baron and Kenny 1986, p. 1176). Figure 16 (left (a)) shows a simple stimulus (X) and response (Y) SEM-PLS path model, whereas Figure 16(b) demonstrates a mediation model, where the mediator (M) changes the relationship between the stimulus (X) and the response (Y). The pathway from the stimulus (X) to response (Y) through Mediator (M) is called the indirect effect (e.g., X→M→Y). According to Baron and Kenny (1986) the relationship between stimulus (X) and the response (Y) can be either fully or partially mediated by the mediator (M). In the case of full mediation, the relationship between the stimulus (X) and the response (Y) is insignificant when considering the mediator (M). The partial mediation reflects the situation where the response of the stimulus (X) on the response (Y) is only reduces but stays significant, although the moderator (M) influences the relationship.

To determine whether a full or a partial mediation exist, the Sobel test is the most frequent approach (Baron and Kenny 1986; Sobel 1982). In addition, Baron and Kenny (1986) suggest three criteria to identify mediation: First, the stimulus (X) must significantly predict the response (Y). Second, the stimulus (X) must significantly predict the mediator (M). Third, the mediator (M) significantly predicts the response (Y), while as well considering the stimulus (X). A more conservative method is provided by Preacher and Hayes (2004). They develop a nonparametric bootstrapping procedure. The procedure provides a confidence interval, p-value and standard error. If zero does not lie within the bias-corrected interval, the independent variable has an indirect response through the mediator on the depended variable (Hair et al. 2017). This procedure is also applicable in SEM-PLS approaches (e.g., SmartPLS 3.2.6; Ringle et al. 2015). **Paper I, IV, V, and VIII** use a mediation analysis, mostly conducted by using a SEM-PLS approach.

Moderation occurs when the response (strength or direction) of the relationship between two variables such as the stimulus (X) and the response (Y) depends on a third variable called the moderator (Hair et al. 2017; Henseler and Chin 2010). In other words, the relationship between two variables (e.g., stimulus and response) differs depending on the values of the moderator. Figure 16(c) shows a moderation model, where the relationship between the stimulus (X) and the response (Y) depends on the characteristic of the moderator. For example, the response of IT events on user responses differs between men a woman such that the response from X on Y is stronger for women than for men. **Paper VII** and **IX** use a moderation analysis.

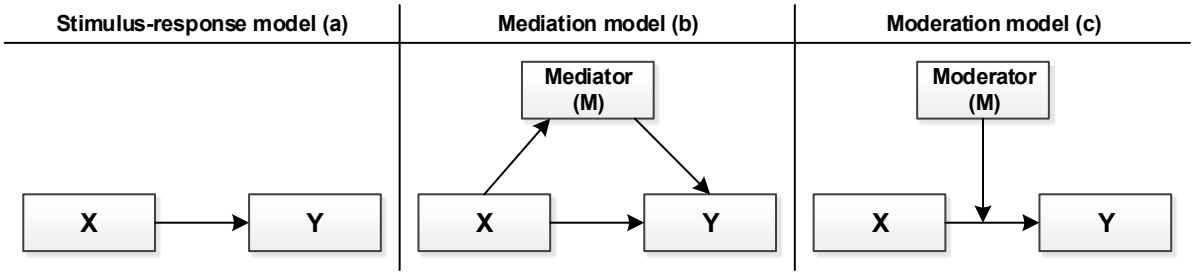


Figure 16: Mediation and moderation

4.3.4 Hierarchical linear modeling

Hierarchical linear modeling (HLM) enables researchers to examine cross-level effects (Raudenbush and Bryk 2002). HLM investigates cross-level relationships by considering at least two different levels. The first model, level-1, examines the relationship between the lowest analysis-level variables, often individuals or repeated measures that generate intercept and slope values linked to the result for each group (Bryk and Raudenbush 1992). The second model, level-2, tries to explain the variance of the intercept and slope values from the level-1 model (Bélanger et al. 2014; Short et al. 2005). For example, Figure 17 shows a cross-level relationship concerning repeated measures of individuals. Level-1 represents four repeated measures which are nested within different individuals (e.g., individual 1 to n) on level-2.

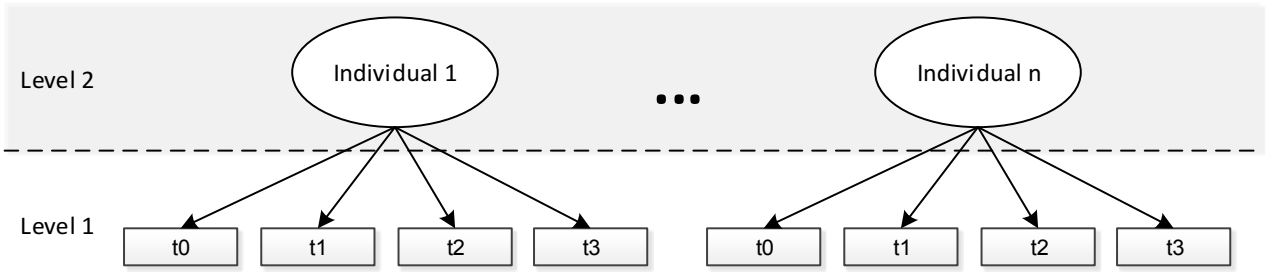


Figure 17: HLM structure[20]

The latent growth modeling (LGM) approach, which *"is a particular form of HLM founded on an event-level of analysis over time"* (Otondo et al. 2009, p. 609) has been applied in two papers of the dissertation. Several approaches exist which assess changes in a variable over time such as change scores, ANOVA, and multivariate ANOVA with repeated measures. However, these approaches are limited in power and in investigating intra-individual changes (Benlian 2015). LGM has recently been proposed as a powerful and integrative approach for assessing latent variable changes. LGM overcomes many of the limitations of the traditional approaches (Lance et al. 2002) and has been applied in recent IS examinations (Bala and Venkatesh 2013; Benlian 2015; Proudfoot et al. 2016; Zheng et al. 2014). Not only does LGM help measure the change in a latent variable over time, but it also validates causal models to predict changes and evaluate the impact of changes on outcome variables within a single structural model (Williamson et al. 2002). In particular, LGM integrates intercepts and slopes of latent variable to capture the initial status of each individual (intercept) and to develop a trajectory (slope) for each individual over time. Each individual has their own intercept and slope, and considerable intra-individual variation is expected in both the intercept

[20] Based on: https://slideplayer.com/slide/5928697/20/images/11/Longitudinal+Data+%28Vocabulary+Measured+Over+Time%29.jpg Accessed October 10, 2018.

and the slope (see for example Figure 18).

Paper X applies a LGM approach using a CB-SEM method (e.g., AMOS) to validate the research model hypothesizing that user responses as well as behaviors change in response to repeated encounters with an IT event. **Paper XI** uses LGM in terms of an mixed-model approach conducted in SPSS 24.0 (IBM Corp. Released 2016) to investigate reappraisal and the influences of four different coping strategies during a six-week implementation phase of an IS.

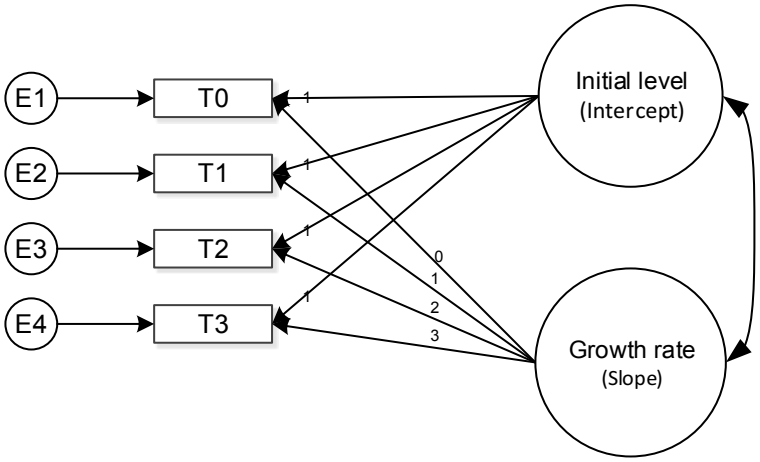


Figure 18: CB-SEM growth model

4.3.5 Multi-group analysis

Multi-group analysis uses observable characteristics within a sample to partition the observed data into groups and estimate separate models (Hair et al. 2017). The path coefficient generated of the different groups is almost always different, but the question that the multi-group analysis aims to answer is whether the differences are statistically significant. In other words, the multi-group analysis tests whether a path coefficient significantly differentiates between two groups (Hair et al. 2018; Henseler et al. 2009). Two different methods are used in the dissertation.

One, used in **Paper I**, used the PLS-MGA approach to analyze differences in the structural model between the identified contextual characteristics of the work and private role. PLS-MGA compares the structural model across different groups. This approach is similar to an ANOVA, but, instead of the comparison of the groups means, the approach compares the groups in terms of a system of relations between several latent variables (Henseler et al. 2009).

Two, used in **Paper IX**, follows a multisampling approach (Rigdon et al. 1998), because the group variables, as well as the independent variables, were discrete. Therefore, the group comparison approach developed by Chin (2000) and used by Keil et al. (2000) to analyze the group effect of the inter-individual characteristic of the participant on the relation between social support and user response was performed. According to the group comparison approach, the direct effects of the exogenous variable on the endogenous variables is estimated separately for each group of interest (Henseler and Fassott 2010). The group effect is then interpreted as the differences in the model parameters between the different data groups and calculated by the formula developed by Chin (2000).

5 MAIN RESEARCH RESULTS

The results of the eleven papers of the dissertation structured into four different parts address the overall research question of the dissertation and gives an answer to the more specific research questions developed in Section 2.4.

In terms of the chapters, the results of chapter 1 respond to the overall research question by investigating the source of the dark side of IT use in terms of IT events in more detail. Results give insight on the dark side of IT use, focusing on different contexts such as work–home conflict, social network sites, and enterprise resource planning systems and especially investigates characteristics such as work, households, networks, personality, and technologies affecting IT events. Chapter 2 responds to the overall research question by investigating the organizational related consequences of the dark side of IT use. The results demonstrate effects on performance and discontinuance intention as well as indicate two different systems (reflective and intuitive) to be relevant for IT usage behavior. Chapter 3 responds to the overall research question by showing how users cope with the dark side of IT use. Thus, it concentrates on the effect of coping strategies on IT events, user responses, and outcomes. In particular, the results show that different coping strategies reduced psychological and physiological response as well as outcomes. The results also introduce a structure of coping strategies and demonstrate how user respond in terms of proactive and reactive coping. Chapter 4 responds to the overall research question by showing the longitudinal effects of coping with the dark side of IT use. The results demonstrate that users reappraise IT events such as IT implementation and the findings uncover habituation and sensitization effects of user responses when encountering a repeated IT event.

Looking at the research questions developed in Section 2.4, Table 5 gives a brief overview of how each paper addresses one or more research questions. The results of each paper are summarized in the following sections. Thereby, each section describes how the paper addresses the corresponding research question.

Table 5: Results of each paper and how they answer the research questions

Chapters	Paper	RQ1: How do different characteristics influence IT events across various contexts?	RQ2: How are organizational-related outcomes influenced by IT events and user responses and how and what role do intuitive systems play in the context of the dark side of IT use?	RQ3: How do coping strategies influence IT events, user responses, and outcomes?	RQ4: How do users respond, appraise, and cope with the dark side over time?

Chapter 1	**Paper I**	▪ Work-home conflict context
		▪ IT events are affected by
		  ▪ Work characteristics
		  ▪ Household characteristics			

	Paper II	▪ Online social network context
		▪ IT events are affected by
		  ▪ Personality characteristics
		  ▪ Network characteristics
		  ▪ Communication characteristics
			▪ IT events decrease continuance usage intention
			▪ Responses such as satisfaction increase continuance usage intention		

	Paper III	▪ Enterprise resource planning context
		▪ IT events are affected by
		  ▪ Technology characteristics
		  ▪ Personality characteristics			

Chapter 2	**Paper IV**		▪ IT events leads to discontinuation of IS use ▪ User responses leads to discontinuation of IS use	▪ Reveals discontinuous usage as a coping strategy ▪ Identifies that switching diminishes discontinuous IS use	
	Paper V		▪ Reflective and intuitive system ▪ Effects from the intuitive on the reflective system		
Chapter 3	**Paper VI**	▪ Reveals different contexts such as IT adoption, technostress, IT security	▪ Reveals that organizationally relevant outcomes are neglected in specific contexts	▪ Reveals reducing and increase effects of coping strategies	▪ Reveals that the literature neglects longitudinal investigations of appraisal and coping
	Paper VII		▪ IT events influence end-user performance ▪ Psychological responses reduce end-user performance	▪ Coping strategies, characterized as being in four coping families, influence user responses and outcomes	
	Paper VIII			▪ Proactive coping influences IT events ▪ Reactive coping influences user responses	
	Paper IX	▪ The effect of coping strategies in terms of social support depends on personality characteristics	▪ IT events such as IT unreliability reduce end-user performance	▪ Instrumental support reduces psychological and physiological response and end-user performance ▪ Emotional support reduces psychological responses	
Chapter 4	**Paper X**		▪ User responses influences outcomes such as task-performance over time ▪ Non-associated learning in terms of habituation and sensitization as unconscious factor	▪ Reveals habituation as a non-associated coping strategy	▪ Repeated IT events over time ▪ Sensitizing of psychological exhaustion ▪ Habituation of physiological arousal
	Paper XI			▪ Indicates that coping strategies influence the reappraisal of IT events over time	▪ Reappraisal: appraisal of an IT event over time as less threatening

5.1 CHAPTER 1: DARK SIDE OF IT USE—CHARACTERISTICS, IT EVENTS, AND RESPONSES

Chapter 1 focuses on how different characteristics (e.g., related to technology, personality, work) influence IT events across various contexts. The papers in this chapter focus on these characteristics across three different contexts.

5.1.1 Paper I: Shedding light on the conflict between work and home: An investigation of the dimensions of the work–home conflict and how they influences work exhaustion[21]

In the context of the work–home conflict (WHC), **Paper I** examines how IT events in terms of different dimensions of WHC influence responses in terms of work exhaustion and how contextual characteristics of the work and private role influence the effects. For example, individuals act as a manager in their work role where they are exposed to work characteristics (e.g., teleworking) and act as a mother or father in their private role where they are exposed to private characteristics (e.g., children present). Concerning the characteristics studied, the paper concentrates on work characteristics such as profession, work time, and teleworking and on private characteristics from the household life cycle (Brown et al. 2006; Brown and Venkatesh 2005). A household life cycle is *"based on the assumption that human life is characterized by passing through a certain sequence of stages, and suggests that relations exist between life stage, demographic and behavioral characteristics of individuals"* (Bauer and Auer-Srnka 2012, p. 69). In particular, the household life cycle approach suggests that individuals develop through different stages during the path of their lives such that the life stages (e.g., marital status, age, the number of children) influence the effect of WHC.

Paper I develops a research model which distinguishes IT-based from work-based WHC dimensions (time, strain, behavior) and theorize their effect on work exhaustion. Moreover, **Paper I** also identifies and considers contextual characteristics of the work and private roles that might influence the effect of the WHC dimensions. To validate the model, a survey was conducted using an online questionnaire. The paper conducts a SEM-PLS approach (see Appendix B, Table 15 for a methodological summary of **Paper I**). The results showed that IT-based WHC is an antecedent of the work-based dimension of WHC and only indirectly influences work exhaustion. Moreover, a multi-group analysis based on the SEM-PLS approach was conducted that demonstrates that the effects of the WHC dimensions are influenced by contextual characteristics such as work times and the stages of the household live cycle (see Table 3 and Table 7).

In summary, **Paper I** gives empirical evidence about the effect of several dimensions of one IT event in terms of work–home conflict on user responses. In addition, it provided statistical insight about different work (e.g., teleworking, working time) and household (e.g., number of children, marital status) characteristics influencing this relationship. Thereby, **Paper I** responds to RQ1 by examining a specific context and revealing the effect of different work- and technology-characteristics.

Table 6: Multigroup comparison test results of work characteristics

	Work characteristics					
	IT-professionals (IT-professionals v. non-IT-professionals)		Work time (full-time v. paper-time)		Teleworking (non-teleworking v. teleworking)	
Relationship	|Δ|	P	|Δ|	p	|Δ|	p
Time-based WHC -> work exhaustion	.037	.599	.089	.165	.009	.541
Strain-based WHC -> work exhaustion	.060	.338	**.177**	**.957**	.066	.750
Behavior-based WHC -> work exhaustion	.153	.146	.068	.210	.017	.420
IT-based WHC -> work exhaustion	.172	.897	.076	.196	.083	.172
IT-based WHC -> time-based WHC	**.226**	**.023**	.029	.374	.065	.771
IT-based WHC -> strain-based WHC	.145	.096	**.141**	**.952**	.090	.855
IT-based WHC -> behavior-based WHC	.096	.213	.068	.769	.013	.446
IT-based WHC -> IT exhaustion	.025	.389	.034	.665	.057	.758
IT exhaustion -> work exhaustion	.080	.260	.015	.568	.033	.351

Note: |Δ| = Modulus of the delta between first and second group; p between .05 and .95 = insignificant, significant effects are bold, one-tailed bootstrapping;

[21] Manuscript under review: Weinert, C., Laumer, S., Maier, C., and Weitzel, T. "Shedding light on the conflict between work and home: An investigation of the dimensions of the work-home conflict and how they influence work exhaustion". Previous versions of the paper have been published: (Weinert et al. 2016a)

Table 7: Multigroup comparison test results of household characteristics

	Comparison of the household life cycle stages																											
	1 vs. 2		1 vs. 3		1 vs. 4		1 vs. 5		1 vs. 6		2 vs. 3		2 vs. 4		2 vs. 5		2 vs. 6		3 vs. 4		3 vs. 5		3 vs. 6		4 vs. 5		4 vs. 6		5 vs. 6	
Relationship	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p
Time-based WHC -> work exhaustion	.160	.822	.133	.810	.289	.924	.038	.630	X	X	.027	.444	.128	.707	.123	.241	.016	.532	.155	.763	X	X	.042	.591	.251	.103	.113	.306	.138	.820
Strain-based WHC -> work exhaustion	.285	.066	**.304**	**.020**	**.366**	**.029**	.211	.051	X	X	.019	.458	.081	.365	.074	.642	.017	.528	.062	.379	.093	.753	.036	.597	.155	.793	.098	.687	.057	.354
Behavior-based WHC -> work exhaustion	.083	.710	.134	.847	.098	.735	.023	.591	X	X	X	X	.014	.536	X	X	.181	.835	.036	.423	.111	.192	.131	.790	.075	.307	.167	.820	.242	.946
IT-based WHC -> work exhaustion	X	X	.137	.835	.087	.277	.052	.687	X	X	.114	.740	.110	.270	X	X	.057	.618	.224	.089	.085	.268	.057	.369	.139	.837	.167	.827	.028	.575
IT-based WHC -> time-based WHC	X	X	.212	.057	.129	.833	.097	.826	.117	.783	.178	.165	.162	.817	X	X	.150	.780	**.341**	**.988**	X	X	**.329**	**.972**	.113	.818	.012	.483	.020	.580
IT-based WHC -> strain-based WHC	X	X	.196	.065	.091	.249	.022	.581	.297	.052	.024	.434	.081	.652	X	X	.125	.292	.105	.759	**.217**	**.969**	.101	.309	.032	.378	.206	.153	**.318**	**.031**
IT-based WHC -> behavior-based WHC	X	X	.121	.841	.149	.842	.019	.562	.027	.579	X	X	.114	.717	X	X	.122	.712	.028	.602	.102	.176	.095	.274	.130	.168	.123	.241	.008	.538
IT-based WHC -> IT exhaustion	X	X	.030	.392	.034	.408	.128	.095	.114	.202	**.377**	**.992**	X	X	.279	.969	.293	.947	.004	.496	.098	.194	.084	.289	.094	.239	.080	.310	.014	.552
IT exhaustion -> work exhaustion	.010	.476	.065	.311	.014	.464	.074	.245	X	X	.055	.359	X	X	.064	.318	.112	.251	.051	.622	.009	.466	.056	.351	.060	.343	.107	.268	.047	.359

Note: |Δ| = Modulus of the delta between first and second group; p between .05 and .95 = insignificant, significant effects are bold and shaded, one-tailed bootstrapping; X = No multigroup analysis possible because of invariance; 1: Single person living alone, Under or equal 45, None children; 2: Single person living alone, Older 45, None children; 3: Single person living alone, Any age, One or more children; 4: Two adults living together, Under or equal 45, One or more children; 5: Two adults living together Older 45, One or more children; 6: Childless couple & older couple, Two adults living together, Any age, None children

5.1.2 Paper II: The negative side of ICT-enabled communication: The case of social interaction overload in social network sites[22]

IT events in terms of social interaction overload has been identified as a negative perception in psychology research (Ljungberg and Sørensen 1998, 2000). Applying this to the context of social networks sites (SNS), **Paper II** investigated the effects of social interaction overload as IT event on responses such as satisfaction and outcomes such as continuous usage intention. Moreover, **Paper II** aimed to investigating how SNS-specific network and personality characteristics manifest the perception of social interaction overload.

Paper II assumes that this negative perception while using SNS is caused by several factors based on either personality characteristics (demographic factors), network characteristics (extent of usage, number of friends), or SNS-specific communication characteristics (e.g. content, media richness). In addition, **Paper II** theorizes that too high numbers of social interactions, which nowadays not only take place in the real world but also in SNS, cause negative psychological responses and behavioral outcomes, so that users develop low levels of satisfaction and rethink their usage behavior by reducing their SNS usage intensity or even deregister from SNS.

The paper is based on an online survey and based on the answers of 246 individuals. A SEM-PLS approach has been used to validate the research model (see Appendix B, Table 15 for a methodological summary of **Paper II**). Figure 19 demonstrates the structural model, which demonstrates that personality characteristics (e.g., demographic factors), network characteristics (e.g., extent of usage, number of friends), and SNS-specific communication characteristics (e.g. content, media richness) influence social interaction overload. In particular, age, number of friends, and context explain the perception of social interaction overload, which in turn, decrease satisfaction and continuance usage intention.

Taking together, **Paper II** focuses on the 'characteristic–IT event–response–outcomes' relationships in the context of SNS. It responds to RQ1, as it provides empirical evidence of the effect of different personality and network characteristics on the IT event social interaction overload in the context of SNS. The paper demonstrates that age, number of friends, and the content increase, in this context, the perception of IT events such as social interaction overload. In addition, the paper responds to RQ2 by demonstrating that IT events such as social interaction overload decrease psychological response such as satisfaction and increase organizational relevant outcomes in terms of continuance usage intention.

[22] Previously published as: Laumer, S., Maier, C., and Weinert, C. (2013) "The negative side of ICT-enabled communication: the case of social interaction overload in online social networks", Proceedings of the 21th European Conference on Information Systems (ECIS), Utrecht, The Netherlands

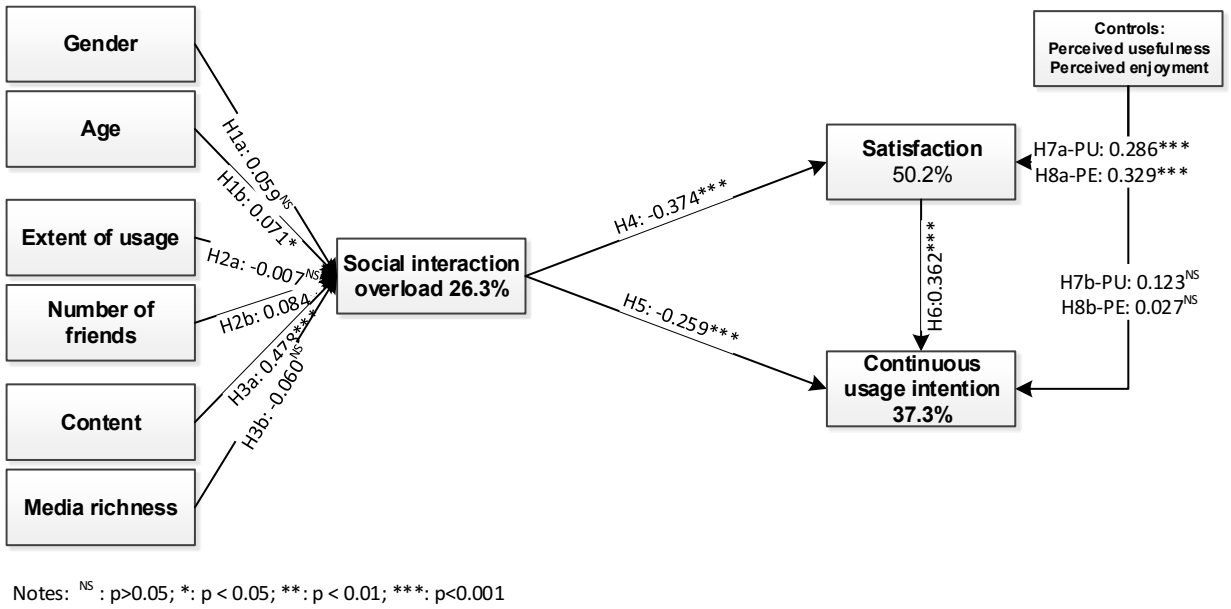


Figure 19: Research results of Paper II

5.1.3 Paper III: Enterprise resource planning systems induced stress: A comparative empirical analysis with young and elderly sap users[23]

Enterprise resource planning (ERP) systems have been one of the greatest technological advances in organizations in the last decades (Morris and Venkatesh 2010). **Paper III** examines in the context of ERP systems whether the technology characteristics of ERP systems influence IT events in terms of stressors. Moreover, even though IT provides specific user groups, such as elderly users, significant benefits from using IT (e.g., electronic health; Cho and Mathiassen 2017; Klein 2017), an age-related digital divide exists (Hsieh et al. 2008). Therefore, **Paper III** aims to investigate how personality characteristics such as age influence whether users are stressed when using an ERP system.

Paper III theorizes that ERP-system characteristics (e.g., usefulness, complexity, reliability, pace of change) influence IT events such as techno-stressors, which in turn influences user responses such as exhaustion. Age is assumed to influence these relationships.

Paper III uses a survey to question 227 individuals from two different organizations (see Appendix B, Table 15 for a methodological summary of **Paper III**). Results are based on the SEM-PLS approach, and are demonstrated in Table 8 divided into young users and elderly users. The findings show that usefulness and pace of change have no influence for the young users, whereas it shows a significant effect on work overload in the case of the elderly users.

In summary, **Paper III** concentrates on technology characteristics in the context of ERP system. In addition, it also considered personality characteristic by differentiating between young and elderly users. Moreover, in the context of ERP systems the paper shows that technology characteristics such as usefulness, complexity, and reliability influence IT events in terms of work overload. By providing empirical insight into the effect of technological characteristics on IT events and the moderation effect of age, the paper responds to RQ1.

[23] Previously published as: Maier, C., Laumer, S., and Weinert, C. (2015) "Enterprise resource planning systems induced stress: A comparative empirical analysis with young and elderly SAP users", Proceedings of the 12th International Conference on Wirtschaftsinformatik, Osnabrück

Table 8: Research results of Paper III

Hypotheses	Young users (N=100)	Elderly users (N=127)
H1a: Work-home conflict -> exhaustion	0.200*	0.188*
H1b: Work overload -> exhaustion	0.494*	0.209**
H1c: Role ambiguity -> exhaustion	0.291**	0.271***
H2: Usefulness -> work overload	-0.139^{NS}	-0.207**
H3: Complexity -> work overload	0.396***	0.144*
H4: Reliability -> work overload	-0.160^{NS}	-0.008^{NS}
H5a: Pace of change -> work overload	0.012^{NS}	0.159*
H5b: Pace of change -> role ambiguity	0.104^{NS}	0.053^{NS}
Notes: younger users: R^2: work-home conflict = 1.0%; work overload = 17.0%, role ambiguity = 2.9%, exhaustion = 46.7% *elderly users*: R^2: work-home conflict = 4.0%; work overload = 38.0%, role ambiguity = 3.0%, exhaustion = 78.4% NS p> 0.05, * p< 0.05, ** p<0.01, *** p<0.001		

5.2 CHAPTER 2: DARK SIDE OF IT USE—OUTCOMES

Chapter 2 considers on the effect of IT events on organizational outcomes, paying close attention to the differences between reflective and intuitive systems.

5.2.1 Paper IV: The effects of technostress and switching-stress on discontinued use of social networking services: A study of Facebook use[24]

Although numerous studies have focused on adoption and usage of IS, fewer studies have looked at the termination phase from a user's perspective by researching intentions to discontinue usage (Turel 2014), which reflects an organizationally relevant outcome. **Paper IV** aims in the context of social network sites (SNS) to examine whether discontinuous usage intention is a behavioral response of users who experience IT events such as SNS-stress creators when they use an SNS and whether discontinuous usage intentions are diminished by IT events such as switching-stress creators, which result out of switching away from an SNS.

Paper IV theorizes on the one hand that IT events such as SNS-stress creators increase psychological responses (SNS-exhaustion) and outcomes (discontinuous usage behavior). On the other, the paper theorizes that changing one's behavior causes switching stress because it takes effort and has costs (Polites and Karahanna 2012). It is theorized that switching-stress creators increase psychological responses (switching-exhaustion) and reduce outcomes (discontinuous usage intention).

Paper IV performs a field experiment by manipulating the switching of an SNS by blocking the accounts of the participants. It uses a multi-snapshot approach by conducting four different waves of data collection captured by different surveys. Moreover, **Paper IV** uses a qualitative research approach in terms of interviews to obtain further insight into the different types of IT events in terms of SNS-stress creators (see Appendix B, Table 15 for a methodological summary of **Paper IV**). The data analysis was based on a SEM-PLS approach demonstrated in Figure 20, and the results show that IT events such as SNS-stress creators and SNS exhaustion increase discontinuance usage intention, whereas switching-stress creators and switching exhaustion reduces it.

In conclusion, **Paper IV** focuses on the 'IT event—response—outcome' relationship. Thereby, it especially focusses on the outcome's variables in terms of discontinuous usage intention and discontinuous usage behavior. In addition, the paper shows empirical evidence showing how IT events such as SNS stress creators and user responses such as SNS exhaustion affect organizational outcome variables. Hence, the paper responds to RQ2 by giving insights into the specific organizationally relevant outcome variable. In addition, by discussing discontinuance IT usage as coping strategy and switching away as coping strategy, the paper also responds to RQ3.

[24] Previously published as: Maier, C., Laumer, S., Weinert, C., and Weitzel, T. (2015) "The effects of technostress and switching-stress on discontinued use of social networking services: A study of Facebook use", Information Systems Journal (ISJ) (25:3), pp. 275–308

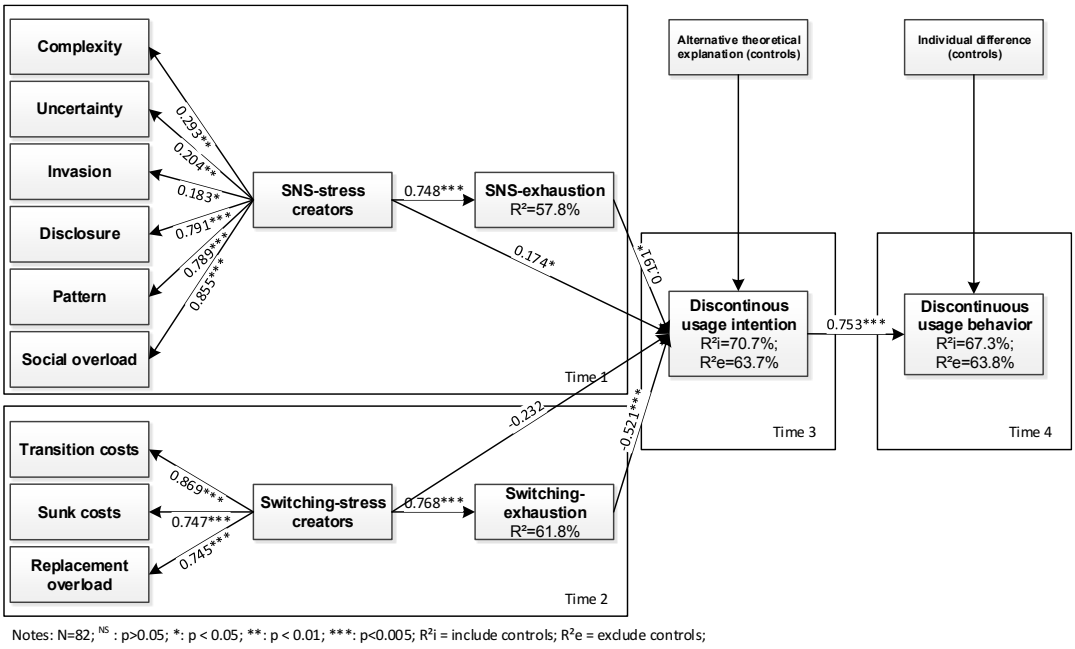


Figure 20: Results of paper IV

5.2.2 Paper V: How does intuition influence information systems usage behavior? An investigation into the relation between implicit attitudes, explicit attitudes, intentions, and behaviors[25]

Past coping literature (e.g., Beaudry and Pinsonneault 2005, 2010) indicates that users perform coping strategies against IT events to increase their IT usage behavior. However, psychology research shows that an individual's behavior is grounded in the individual's reflective and intuitive systems. The reflective system is characterized as rational and conscious, whereas the intuitive system is associative and unconscious (Gawronski and Creighton 2013; Kahneman 2003; Stanovich and West 2000). Hence, **Paper IV** aims to study the intuitive and the reflective systems regarding IS usage in the context of the dark side of IT use.

Paper IV theorizes that IS usage is not only determined by the traditional explicit factors but also goes beyond the reflective system. The paper describes a multiple snapshot study comprising two waves of data collection. The first wave used a laboratory study for data collection, and the second wave consisted of a follow-up questionnaire to participants. In the first wave, the paper captured the implicit attitudes were captured by asking the subjects to participate in a SC-IAT (Karpinski and Steinman 2006). After the SC-IAT, participants filled out a questionnaire captured their explicit attitudes and intentions towards the IS. For the second wave of data collection, all subjects were sent a second questionnaire two weeks after the laboratory study to measure actual IS usage and IS habits (see Appendix B, Table 15 for a methodological summary of **Paper IV**). Figure 21 shows the results of the laboratory study of 106 participants. The finding based on an SEM-PLS approach indicates that intuitive factors such as implicit attitudes have a noteworthy impact on IS usage, as positive and negative implicit attitudes influence intention of use in the reflective system. Positive implicit attitudes act as antecedents of IS habits, which reflects an intuitive dimension of IS usage.

In conclusion, **Paper IV** differentiates between the reflective system, considering conscious factors and the intuitive system, considering unconscious factors. The paper responds to RQ2, as it provides empirical evidence that outcomes such as IT usage are not only on the reflective system but also on the intuitive system. In addition, the findings indicate that negative intuitive associations also influence intention to use, which might users have to cope with on an intuitive system.

[25] Manuscript under review: Weinert, C., Maier, C., Laumer, S., and Weitzel, T. (2017) "How does intuition influence is usage behavior? An investigation into the relation between implicit attitudes and explicit attitudes, intentions, and behaviors". Previous versions of the paper have been published: (Weinert et al. 2015a) and (Weinert et al. 2016b)

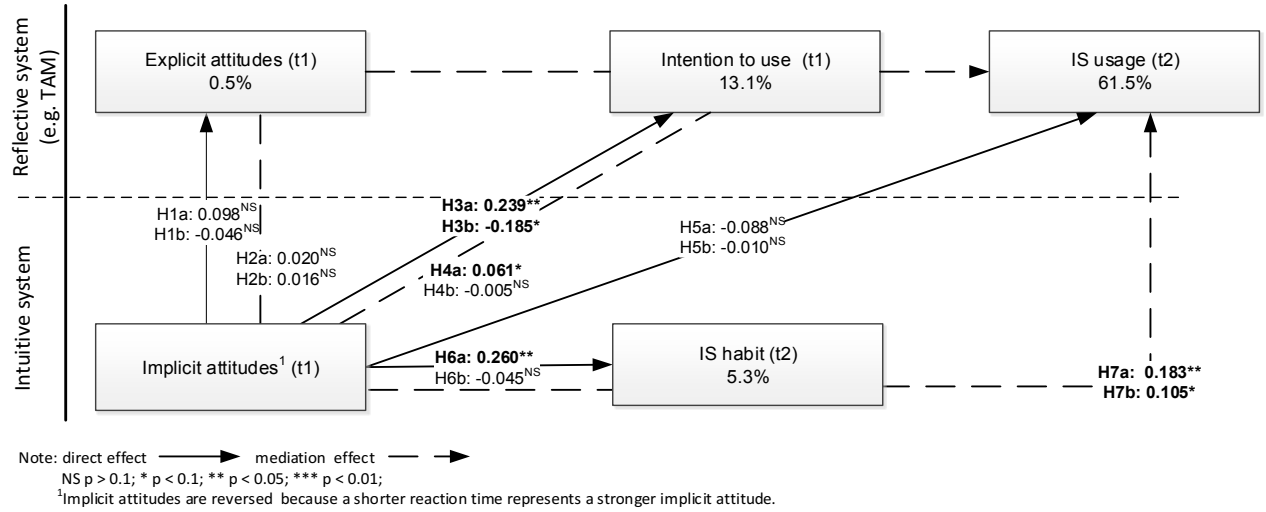


Figure 21: Research results of Paper IV

5.3 CHAPTER 3: COPING WITH THE DARK SIDE OF IT USE

Chapter 3 focuses on the effect of different coping strategies on the dark side of IT use in terms of responses and outcomes.

5.3.1 Paper VI: Coping with discrepant information technology events—A literature review[26]

IT users often perceive IT events, which are unexpected, negative events that occur due to problems and difficulties with IT (Ortiz de Guinea and Webster, 2013). However, the spectrum of coping literature in IS research has used a wide range of technologies, contexts, units of analysis, theories, and research methods. Therefore, **Paper IV** aims to answer the question how coping has been investigated in IS literature to explain and predict the behavior of users facing IT events.

Paper IV conducts a literature analysis based on the methods of vom Brocke et al. (2009). The main IS journals (e.g., the 'Basket of Eight') and conferences (e.g., AMCIS, ECIS, ICIS) regarding coping literature were analyzed (see Appendix B, Table 15 for a methodological summary of **Paper IV**). The Paper identifies three main research streams of coping literature: coping and technostress, IT adoption and usage, and IT security. Based on the analyses and synthesis, **Paper IV** reveals several general shortcomings of IS coping literature as well as proposes research questions for each research stream. For the context of technostress, the paper suggests investigating how IT events occur because of IT changes and because IT threats lead to strain, how cognitive appraisals determents the coping strategies in the context of technostress, and how coping influences the user response. In the context of adoption and usage the paper suggests studying how IT events influences job and IT outcomes and how coping strategies can reduce these effects and how emotion-focused coping strategies lead to protection against IT events. In the context of IT security, the paper suggests examining how EFC strategies reduce IT events such as malicious IT and how what role strain responses play in this research stream.

In conclusion, **Paper IV** analyses the literature on IS coping, addressing all of the research questions. The paper responds to RQ1 by revealing different contexts (coping and technostress, IT adoption, IT security). It responds to RQ2 by revealing shortcoming by the outcome variables across the different context. RQ3 is addressed by revealing interdependences between coping strategies and paradoxical effects of coping strategies. The paper also responds to RQ4 by highlighting the need of longitudinal effects of coping strategies.

[26] Previously published as: Weinert, C. 2018. "Coping with discrepant information technology events: A literature review," Proceedings of the 26st European Conference of Information Systems–ECIS 2018, Portsmouth, UK

5.3.2 Paper VII: How do users cope with technostress? Context-specific theorizing of coping in technostress research[27]

Past IS coping literature shows substantial heterogeneity in the examination of coping strategies and does not provide a theory that explains the differences between the various coping strategies. These coping strategies differ according to their methods, as some rely on behavioral efforts others on cognitive ones. Context-specific research argues that theories and empirical results might be different depending on the context (Johns 2006, 2017). In addition, research suggests aiming for a balance between the context-specific results and their generality (Sarker 2016). Therefore, the **Paper VII** aims to answer the research question on how coping can be contextualized into the domain of technostress.

Paper VII theorizes that coping can be structured into different coping families, which classify different coping strategies by their method (cognition vs. behavior) and approach (approach vs. avoidance). Based on this assumption, the paper assumes that coping strategies in different coping families have different effects on the relation between IT events in terms of techno-stressors, user responses in terms of techno-exhaustion, and on outcomes such as end-user performance.

Paper VII uses a survey to question 110 individuals (see Appendix B, Table 15 for a methodological summary of **Paper VII**). The data analysis is based on the SEM-PLS approach, and the results shown in Figure 22. They show decreasing and increasing effects of coping strategies out of four different coping families on user responses in terms of techno-exhaustion and outcomes in terms of end-user performance.

In sum, **Paper VII** responds to RQ3 by contextualizing coping into the technostress context, which is one part of the dark side of IT use. The paper demonstrates that four different coping families exist and classifies existing strategies into the different families. The empirical results also address the RQ3 by revealing decreasing and increasing effects of coping strategies in the different coping families. The paper also responds to RQ2 by showing that IT events such as techno-stressors and user responses such as techno-exhaustion influence outcomes in terms of end-user performance.

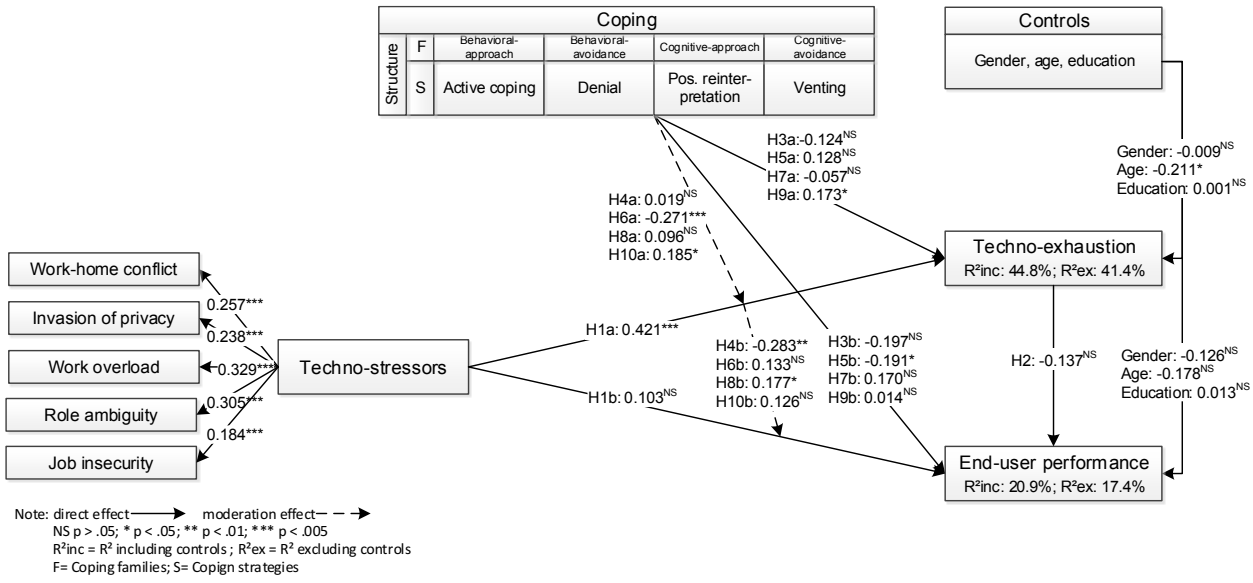


Figure 22: Research results of Paper VII

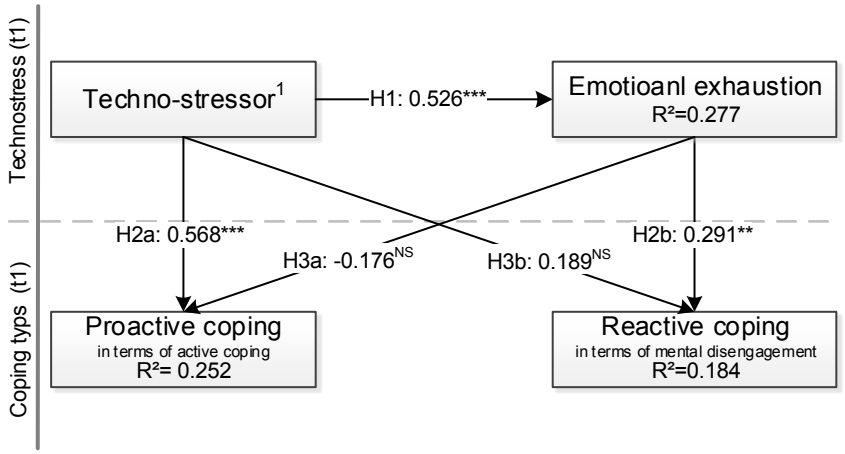
[27] Manuscript in preparation for submission: Weinert, C., Maier, C., Laumer, S., and Weitzel, T. "How do users cope with technostress? Context-specific theorizing of coping in technostress research"

5.3.3 Paper VIII: How do users respond to technostress? An empirical analysis of proactive and reactive coping[28]

The literature has neglected how users respond towards IT events such as techno-stressors and user responses such as emotional exhaustion. For instance, in medicine, doctors evaluate the causes and the consequences of illness and decide to treat the causes or the consequences depending on the type of the illness (e.g., bacterial or virus infection) and hence prescribe different medications to manage the illness, because causes and consequences need different treatments. **Paper VIII** investigates how IT events in terms of techno-stressors and user responses in terms of techno-exhaustion influence proactive and reactive coping.

Paper VIII theorizes that users respond differently to techno-stressors and emotional exhaustion. A survey was crafted and disseminated and received 110 responses (see Appendix B, Table 15 for a methodological summary of **Paper VIII**). Results based on a SEM-PLS approach show that users respond to IT events in terms of techno-stressors in a proactive way, whereas users reactively respond to emotional exhaustion. In addition, proactive coping is stronger affected by IT event in terms of techno-stressors, and reactive coping is stronger affected by emotional exhaustion, as shown in Figure 23.

In conclusion, **Paper VIII** indicates how users respond to IT events in terms of techno-stressor and responses in terms of emotional exhaustion by proactive and reactive coping. The paper responses to RQ3 by showing that users respond to IT events in terms of techno-stressors in a proactive way, by performing active coping and to user responses in terms of emotional exhaustion in reactive way and hence shed light on the question how users respond to the dark side of IT use.



Note: NS p > 0.05; * p < 0.05; ** p < 0.01; *** p < 0.005; [1]Technos-stressor is a second-order construct comprsing work-home conflict (0.257***), invation of privacy (0.238***), work overload (0.329***), role ambibuity (0.305***), job insecurity (0.184***).

Figure 23: Research results of Paper VIII

5.3.4 Paper IX: Technostress inhibition: An experimental study of how social support mitigates strain responses to techno-stressors[29]

Technostress is one manifestation of the dark side of IT use (Tarafdar et al. 2015a). However, most of the coping literature considers IT events due to IT usage, such as work overload (e.g., Ragu-Nathan et al. 2008) rather than focusing on IT events due to IT change (e.g., Riedl et al. 2013), such as computer freezes. Moreover, the past literature has examined coping strategies in terms of technostress inhibitors on a highly aggregated level rather than concentrating on a single technostress inhibitor (e.g., Ragu-Nathan et al. 2008; Tarafdar et al. 2011, 2014). To date, technostress inhibitor research has not investigated the effects of different types of social support (e.g., emotional and instrumental support), which have been well-established

[28] Previously published as: Weinert, C., Maier, C., Laumer, S., and Weitzel, T. 2019. "How do users respond to technostress? An empirical analysis of proactive and reactive coping," Proceedings of the 52nd Hawaii International Conference on System Sciences, Maui, USA

[29] Manuscript under review: Weinert, C., Maier, C., Laumer, S., and Weitzel, T. "Technostress inhibition: An experimental study of how social support mitigate strain responses to techno-stressors". A previous version of the paper has been published as: (Weinert et al. 2013c).

in psychological research (Cohen and Wills 1985; Taylor 2011). **Paper IX** aims to answer the question of how social support influences the user responses and outcomes resulting from the perception of IT event in terms of techno-stressors.

Paper IX contains a research model that hypothesized how coping strategies in terms of social support influences the user responses and end-user performance induced by IT events in terms of techno-stressors. Thereby, the paper distinguishes between two types of social support: instrumental support and emotional support. In particular, the paper examines how responses to IT events such as techno-stressors differ when users receive sympathy and understanding or help and instructions. Moreover, the effects of inter-individual differences are considered.

Paper IX describes a laboratory experiment that followed a 2x3 factorial between-subject design (see Appendix B, Table 15 for a methodological summary of **Paper IX**). Three separate ANOVAs were conducted to statistically analyze the influence of instrumental and emotional support on techno-exhaustion, physiological arousal, and end-user performance. The results are demonstrated in Table 9 and show that instrumental support reduces responses such as techno-exhaustion and physiological arousal as well as increases organizational relevant outcomes such as end-user performance. Emotional support in turn only influences responses in terms of techno-exhaustion. In addition, to examine the influence of inter-individual differences, a multi-group analysis based on Chin (2000) has been conducted. Findings are presented in Table 10 and demonstrate that the performance of the correct social support depends on inter-individual differences and the wrong coping strategy can increase the psychological or physiological responses instead of reduces them.

In conclusion, **Paper IX** demonstrates that different coping strategies such as instrumental and emotional support reduce user responses in terms of techno-exhaustion and physiological arousal and increase outcomes in terms of end-user performance. Thereby, the paper responds to RQ3 by empirically showing user coping responses and outcomes. In addition, by revealing different inter-individual differences on the effect of coping strategies on user responses and end-user performance, the paper responds to RQ1 and to RQ2 by considering end-user performance as an organizationally relevant outcome variable.

Table 9: ANOVAs and post-hoc analysis

		Dependent variables								
		End-user performance			Techno-exhaustion			Physiological arousal		
ANOVA results		F(3, 69) = 3.687, p = .016**; n2 = .138			F(3, 69) = 2.701, p = .052*; n2 = .105			F(3, 69) = 2.520, p = .065*; n2 = .099		
Pairwise comparisons		End-user performance			Techno-exhaustion			Physiological arousal		
Group (i)	Group (j)	MD	SD	P	MD	SD	P	MD	SD	p
Non-stressor (A)	No support (B)	-72.51	24.55	.004**	-.26	.13	.044**	-.11	.05	.044**
	Instrumental support (C)	-16.93	24.93	.499^{NS}	.04	.13	.737^{NS}	.03	.05	.618^{NS}
	Emotional support (D)	-55.85	24.55	.004**	.07	.19	.591^{NS}	-.06	.05	.247^{NS}
No support (B)	Instrumental support (C)	55.58	25.56	.033**	.30	.13	.024**	.13	.05	.016**
	Emotional support (D)	16.67	25.19	.510^{NS}	.33	.13	.014**	.04	.05	.390^{NS}
Instrumental support (C)	Emotional support (D)	-38.92	25.56	.132^{NS}	.03	.13	.851^{NS}	-.09	.05	.112^{NS}

Note: Social support is the independent variable; p<0.01***; p<0.05**; p<0.1*; p>0.1^{NS}; MD= mean difference; SD=standard deviation

Table 10: Interaction effects of inter-individual differences

			End-user performance			Techno-exhaustion			Physiological arousal		
			Independent variables (pairwise comparisons)			Independent variables (pairwise comparisons)			Independent variables (pairwise comparisons)		
			Instrumental support (C)		Emotional support (D)	Instrumental support (C)		Emotional support (D)	Instrumental support (C)		Emotional support (D)
			No support (B)	Emotional support (D)	No support (B)	No support (B)	Emotional support (D)	No support (B)	No support (B)	Emotional support (D)	No support (B)
Gender	MD (i-j)	Male	43.344	62.694	-19.350	.331	.024	.306	.126	.166	-.040
		Female	71.000	19.575	51.425	.281	-.0687	.350	.143	.025	.118
		T	.001^{NS}	.010^{NS}	.008^{NS}	.001^{NS}	.599^{NS}	.009^{NS}	0.500^{NS}	**2.460*** **	**5.465*** **
Age	MD (i-j)	Young	38.748	31.500	7.248	.235	-.018	.252	.100	.055	.045
		Old	137.667	85.333	52.333	.667	-.000	.667	.299	.289	.009
		T	.007^{NS}	.004^{NS}	.004^{NS}	1.407^{NS}	.715^{NS}	1.387^{NS}	**2.640*** **	**3.574*** **	.905^{NS}
IT-experience	MD (i-j)	High	4.750	68.975	-64.225	.201	.187	.218	.061	.078	.078
		Low	97.233	32.948	64.284	.217	-.179	.396	.213	.124	.089
		T	.009^{NS}	.009^{NS}	.017^{NS}	.775^{NS}	**2.399*** **	1.221^{NS}	**4.096*** **	.576^{NS}	**3.619*** **
IT-efficacy	MD (i-j)	Male	25.689	41.477	-27.364	.248	-.070	.318	.050	.092	-.013
		Female	132.114	46.257	47.138	.182	.064	.357	.242	.100	.141
		T	.009^{NS}	.009^{NS}	.014^{NS}	.960^{NS}	.822^{NS}	.248^{NS}	**2.413*** **	.051^{NS}	**4.852*** **

Note: end-user performance in seconds (high value = bad performance – low value = good performance); Techno-exhaustion measured on 5-point Likert scale (1 = not exhausted – 5 = exhausted); Physiological arousal measured in microsiemens µS (high value = high arousal – low value = low arousal); p<0.01***; p<0.05**; p<0.1*; p>=0.1^{NS};

5.4 CHAPTER 4: LONGITUDINAL APPROACH OF COPING WITH THE DARK SIDE OF IT USE

Chapter 4 focuses on a longitudinal approach of coping with the dark side of IT use over time. The chapter considered the encounter of repeated IT events and investigate reappraisal.

5.4.1 Paper X: How does performance change when users encounter repeated IT events? An investigation of habituation and sensitization of arousal, exhaustion, and task performance[30]

Previous IS literature concentrates only on the first encounter with an IT event (e.g., Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005; Bhattacherjee et al. 2017; Ortiz de Guinea and Webster 2013) and negelects the more realistic situation in which an IT event occurs not only once, but might arises several times in a row. Hence, **Paper X** aims to answer wherer users task performance is influenced by a repeated IT event in terms of a computer breakdown and the resultant user responses in terms of physiological arousal and psychological exhaustion over time.

Paper X builds upon the dual process theory (Groves and Thompson 1970) and argues that the repeated encounter with an IT event results in decreased physiological arousal, because users habituate to the repeated IT event, whereas the paper suggests an increase in psychological exhaustion because users sensitize to the repeated IT event. Most importantly, the paper theorizes that task performance improves as user habituate towards the repeated IT event, and as such, the habituation and sensitization of user responses predict such changes in task performance.

In Paper X a laboratory experiment was conducted with 100 subjects and follows a two-factorial subject-within design, encompassing the factors IT event (IT event, non-IT event) and encounter (none encounter to encounter 6). The paper also follows a longitudinal data collection timing by concentrating on six encounters with a repeated IT event (see Appendix B, Table 15 for a methodological summary of **Paper X**). In the **Paper X**, an LGM approach was used to address the longitudinal nature of the paper. The results are shown in Figure 24 and demonstrate that that users habituate to a repeated IT event in terms of physiological responses and sensitize in terms of psychological responses. The results indicate a habituation effect regarding task performance and demonstrate effects from physiological and psychological user responses on task performance over time.

In summary, **Paper X** took a longitudinal approach and demonstrates the trajectory of user responses and outcomes as well as their interdependences. Thereby, the paper responds to RQ4, as it concentrates not only on one IT event but rather on the repetition of an IT event over time, revealing reduced trajectories of physiological arousal and increasing trajectories of exhaustion. Responses affected task performance by showing that physiological arousal influences the initial status of task performance and psychological exhaustion reduces task performance trajectories. Also, the habituation effect of physiological user responses is also discussed as unconscious coping strategies, and hence the paper responds to RQ3. Habituation and sensitization depict a non-associated learning, reflecting an unconscious behavior and hence responding to RQ2.

[30] Manuscript in preparation for submission: Weinert, C., Maier, C., Laumer, S., and Weitzel, T. "How does performance change when users encounter repeated IT events? An investigation of habituation and sensitization of arousal, exhaustion, and task performance". A previous version of the paper has been published: (Weinert et al. 2016c).

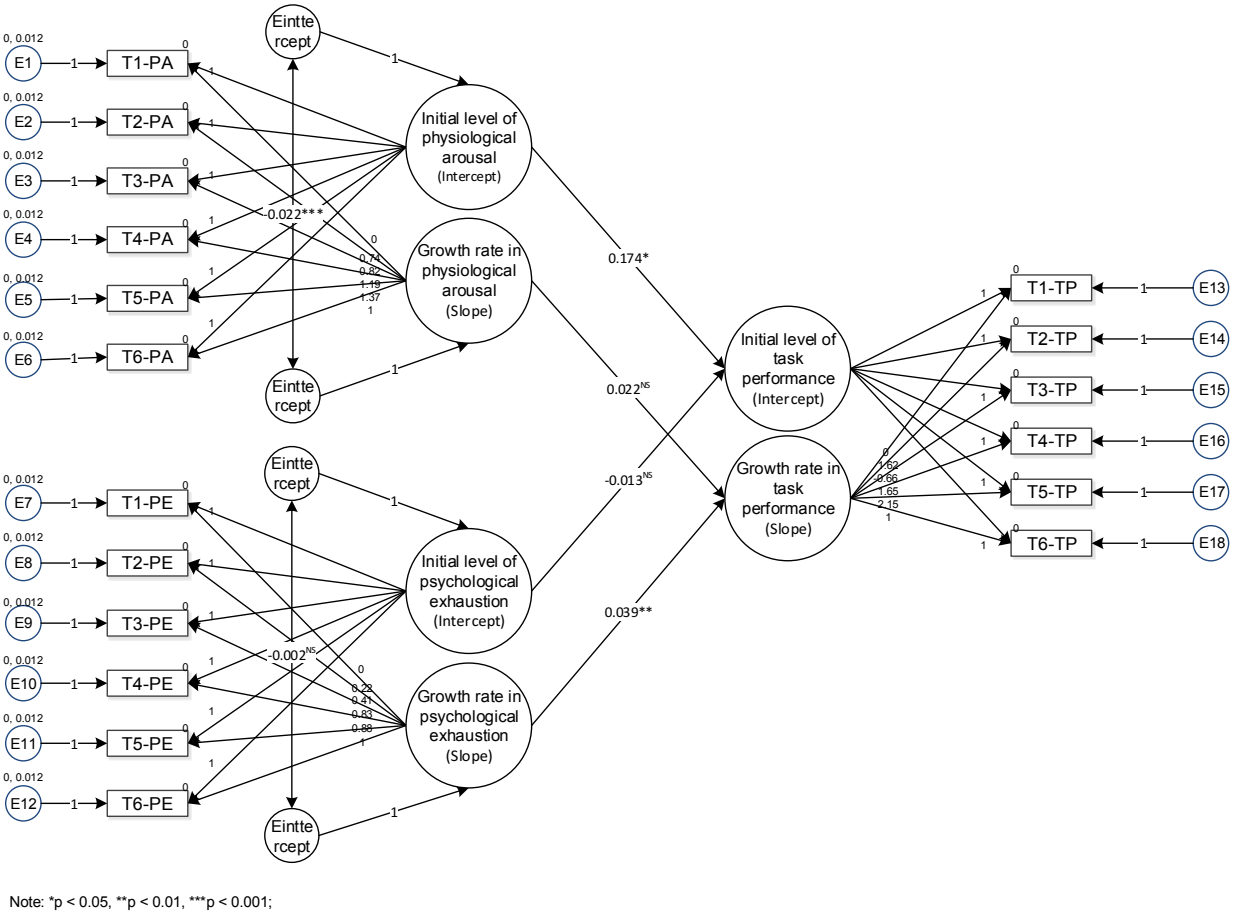


Figure 24: Research results of Paper X

5.4.2 Paper XI: IS reappraisal and technology adaptation a longitudinal study during an IS implementation[31]

Previous IS literature has treated appraisal and coping streategies, in terms of technology adaptation behaviors towards IS implementation, as a static process (Bala and Venkatesh 2015). The psychological literature, however, depicts instead a continuance process of 'appraisal–adaptation–reappraisal' unfolding over time (Folkman 1982; Lazarus and Folkman 1984). Past IS literature has investigated the appraisal–adaptation relationship (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005) but neglects reappraisal. Reappraisal takes the temporal development of the evaluation process into consideration. **Paper XI** examines how coping strategies in terms of technology adaptation behaviors influence reappraisal.

Paper XI theorizes that users reappraise an IT event such as new IS implementation over time, regarding its perceived opportunity, threat, and controllability. Additionally, the paper assumes that coping strategies in terms of technology adaptation behavior influences this reappraisal over time.

Paper XI conducts a longitudinal survey by using hierarchical linear modeling (HLM: see Appendix B, Table 15 for a methodological summary of **Paper XI**). The results, shown in Table 11, demonstrate that the perception of the IT event as a threat decreases over time. In addition, the paper theoretically and empirically shows that several technology adaptation behaviors influence technology appraisal over time.

In summary, paper **XI** focuses on reappraisal and the influence of coping strategies on such reappraisal. By considering reappraisal and encompassing time-dependent effects, the paper responds to RQ4. In addition, by revealing that coping strategies not only affect IT events, responses, or outcomes but also influences the appraisal process, the paper responds also to RQ3.

[31] Manuscript under review: Weinert, C., Maier, C., Laumer, S., and Weitzel, T. "IS reappraisal and technology adaptation a longitudinal study during an IS implementation"

Table 11: HLM results of Paper XI

Model	1	2	3	4	5	6	7	8	9
Perceived opportunity									
Intercept	4.427*** (0.181)	4.434*** (0.155)	4.432*** (0.152)	4.408*** (0.171)	4.409*** (0.169)	4.450*** (0.194)	4.450*** (0.194)	4.458*** (0.18)	4.458*** (0.166)
Time	-0.090^{NS} (0.181)	-0.051^{NS} (0.062)	-0.055^{NS} (0.058)	-0.075^{NS} (0.059)	-0.075^{NS} (0.059)	-0.081^{NS} (0.056)	-0.081^{NS} (0.057)	-0.092^{NS} (0.057)	-0.089^{NS} (0.063)
EXPLRI[a]	-	0.545*** (0.113)	0.468*** (0.127)	-	-	-	-	-	-
Time* EXPLRI[a]	-	-	0.090^{NS} (0.06)	-	-	-	-	-	-
EXPLT[a]	-	-	-	0.339*** (0.106)	0.357*** (0.122)	-	-	-	-
Time*EXPLT[a]	-	-	-	-	-0.020^{NS} (0.064)	-	-	-	-
EXPLRV[a]	-	-	-	-	-	0.161* (0.062)	0.128^{NS} (0.098)	-	-
Time*EXPLRV[a]	-	-	-	-	-	-	0.039^{NS} (0.067)	-	-
AVOID[a]	-	-	-	-	-	-	-	-0.162^{NS} (0.088)	-0.272* (0.106)
Time*AVOID[a]	-	-	-	-	-	-	-	-	0.083^{NS} (0.072)
Model fit									
-2LL	287.769	253.849	254.092	249.973	249.928	257.809	257.613	260.804	260.807
Δ X²		33.92***	-0.243^{NS}	37.796***	0.045^{NS}	29.96***	0.196^{NS}	26.965***	-0.003^{NS}
Perceived threat									
Intercept	2.397*** (0.212)	2.395*** (0.192)	2.394*** (0.189)	2.386*** (0.151)	2.382*** (0.131)	2.396*** (0.211)	2.396*** (0.214)	2.397*** (0.196)	2.396*** (0.195)
Time	-0.221*** (0.212)	-0.247*** (0.081)	-0.256*** (0.079)	-0.213* (0.090)	-0.228* (0.097)	-0.218** (0.077)	-0.215** (0.077)	-0.218* (0.081)	-0.220*** (0.079)
EXPLRI[a]	-	-0.439*** (0.138)	-0.531*** (0.16)	-	-	-	-	-	-
Time* EXPLRI[a]	-	-	0.096^{NS} (0.083)	-	-	-	-	-	-
EXPLT[a]	-	-	-	-0.678*** (0.118)	-0.874*** (0.122)	-	-	-	-
Time*EXPLT[a]	-	-	-	-	0.305*** (0.097)	-	-	-	-
EXPLRV[a]	-	-	-	-	-	0.121^{NS} (0.082)	0.193^{NS} (0.127)	-	-
Time*EXPLRV[a]	-	-	-	-	-	-	-0.076^{NS} (0.091)	-	-
AVOID[a]	-	-	-	-	-	-	-	0.418*** (0.108)	0.466*** (0.139)
Time*AVOID[a]	-	-	-	-	-	-	-	-	-0.069^{NS} (0.088)
Model fit									
-2LL	300.273	291.365	290.205	282.379	278.427	296.917	296.366	289.279	288.781
Δ X²		8.908***	1.16^{NS}	17.894***	3.952**	3.356*	0.551^{NS}	10.994***	0.498^{NS}
Controllability									
Intercept	4.680*** (0.186)	4.827*** (0.167)	4.823*** (0.164)	4.827*** (0.166)	4.834*** (0.147)	4.838*** (0.19)	4.840*** (0.19)	4.821*** (0.188)	4.825*** (0.184)
Time	0.246^{NS} (0.186)	0.119^{NS} (0.171)	0.106^{NS} (0.164)	0.162^{NS} (0.178)	0.143^{NS} (0.168)	0.096^{NS} (0.167)	0.101^{NS} (0.174)	0.104^{NS} (0.167)	0.114^{NS} (0.16)
EXPLRI[a]	-	0.437*** (0.143)	0.589*** (0.163)	-	-	-	-	-	-
Time*EXPLRI[a]	-	-	-0.303^{NS} (0.157)	-	-	-	-	-	-
EXPLT[a]	-	-	-	0.424*** (0.141)	0.632*** (0.146)	-	-	-	-
Time*EXPLT[a]	-	-	-	-	-0.450*** (0.163)	-	-	-	-
EXPLRV[a]	-	-	-	-	-	0.147^{NS} (0.151)	0.087^{NS} (0.191)	-	-
Time*EXPLRV[a]	-	-	-	-	-	-	0.129^{NS} (0.172)	-	-
AVOID[a]	-	-	-	-	-	-	-	-0.080^{NS} (0.154)	-0.280^{NS} (0.178)
Time*AVOID[a]	-	-	-	-	-	-	-	-	0.369* (0.168)
Model fit									
-2LL	371.269	251.876	248.275	243.063	238.9	252.481	252.122	255.806	251.29
Δ X²		119.393***	3.601*	128.206***	4.163**	118.788***	0.359^{NS}	115.463***	4.516**

Note: *** p < 0.005; ** p < 0.01; * p < 0.05; NS p > 0.05; EXPLRI: exploration-to-innovate; EXPLT: exploitation; EXPLRV: exploration-to-revert; AVOID: avoidance; [a]= group centered; values in parentheses = standard error

6 CONTRIBUTION AND IMPLICATIONS

The results of the eleven papers composing this dissertation encompass theoretical, practical, as well as measurement contributions. The contributions and implications are outlined in the following sections, starting with the contributions to theory, following with the practical contributions, and concluding with the measurement implications.

6.1 THEORETICAL CONTRIBUTIONS

The dissertation is structured into four chapters, each of which aim to answer a research question. Chapter 1 focuses on the relationship between characteristics, IT events, and responses within different contexts. This chapter aims to answer how different characteristics influences IT events across various contexts. Chapter 2 concentrates on organizational relevant outcomes such discontinuance of IT use and has the objective of differentiating between reflective and intuitive factors. Chapter 3 investigates how coping reduces the dark side of IT use by answering how and which users cope with IT events, user responses, and outcomes. Lastly, chapter 4 investigates the longitudinal effects of appraisal and coping strategies. Each individual chapter contains different contributions which are presented next.

6.1.1 Chapter 1: Dark side of IT use – Characteristics, IT event, and responses

Chapter 1 focuses on the question of how different characteristics influence IT events across various contexts. This chapter theoretically and empirically demonstrates that various characteristics in different contexts are responsible for the perception of IT events or their effects on user response. The contributions of the chapter are summarized in Figure 12 and explained in the following.

Chapter 1 theoretically and empirically demonstrates in the context of WHC that work characteristics such as profession and work times as well as household characteristics reflected in the household life cycle influence the effect of IT events such as WHC. The contextual influences from work and private situations enable researchers to better understand the different WHC effects and clarify the boundaries of conditions. Understanding the contextual influences of the work and private situations will provide greater insight into how to mitigate the perception of IT event in terms of WHC (**Paper I**).

In the context of social network sites (SNS) the dissertation provides evidence that personality, network, and communication characteristics influence one specific IT event - social interaction overload. Based on these findings, **Paper II** extends the current research focusing on negative perceptions (e.g., Ragu-Nathan et al. 2008; Tarafdar et al. 2010) by determining that characteristics such as age, number of friends, and communication increase social interaction overload. In the context of ERP systems, the dissertation contributes to the literature (e.g., Ayyagari et al. 2011) by theoretically and empirically demonstrating that the technology characteristics of complexity, usefulness, and pace of change result in the perception of IT events. In contrast, personality characteristic determines differences in the effect of IT events on user responses (**Paper III**). Taken together, the dissertation offers an evidence-based contribution to the discussion of how different characteristics and contexts are responsible for the perception of IT events and its effects. The contextual investigation of these characteristics helps demonstrate that the perception of an IT event and its effects depend on context specific characteristics, which helps future research to advance the theoretical foundations to understand how to cope with the source of the dark side of IT use.

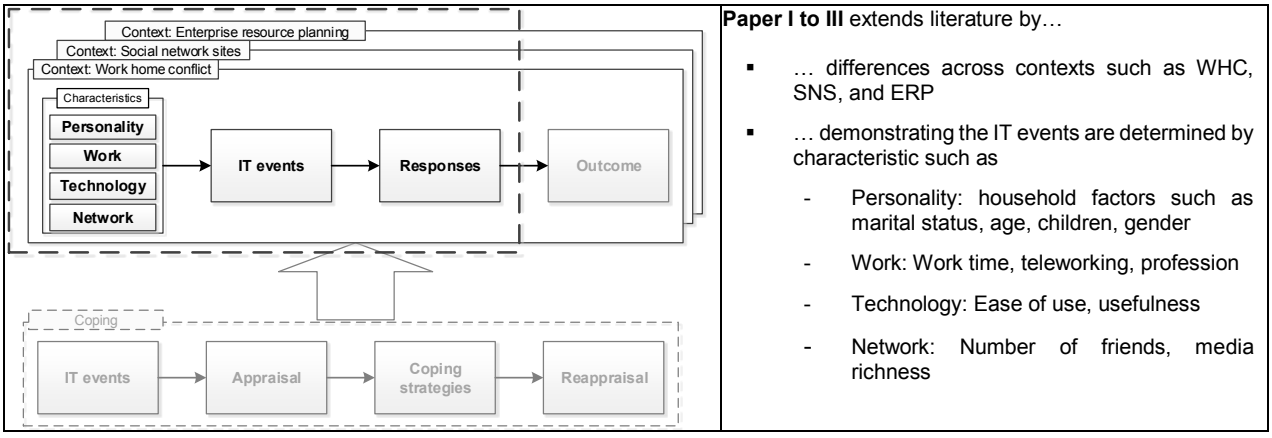


Figure 25: Research question 1 – Research contribution of chapter 1

6.1.2 Chapter 2: Dark side of IT use – Outcomes

Chapter 2 concentrates on the question how organizational outcomes are influenced by IT events and user responses and pays especial attention to the differentiation between reflective and intuitive systems. This chapter theoretically and empirically demonstrates that IT events and response lead to discontinuance usage and demonstrate that outcomes such as IT use has a reflective and intuitive manifestation. The contributions of chapter 2 are summarized in Figure 26 and explained in the following.

First, the chapter concentrates on organizational relevant outcomes. **Paper IV** contributes to literature (Ayyagari et al. 2011; Maier et al. 2014a) which has neglected organization-relevant outcome variables such as discontinuous IT use, by theoretically and empirically demonstrating that users stop using an IS when perceiving IT events in terms of SNS-stress creators and user responses in terms of SNS-exhaustion. In addition, the dissertation discusses discontinuous usage as a coping strategy and demonstrates that switching-

stress creators and switching exhaustion both diminish discontinuous usage intentions. These findings extend literature such as the CMUA (Beaudry and Pinsonneault 2005) as the paper theoretically and empirically demonstrates that discontinuous IT usage is reduced by events and responses resulting from switching to alternative solutions, not only by IT events and responses resulting out of IT usage or changes. Hence the paper provides an empirical foundation which can help future researchers to extend the appraisal process determining coping strategies in the way that these processes might also consider the consequences of the coping strategies. For example, the decision to perform a coping strategy might be influenced by the consequences of such coping strategy.

Second, the present paper also offers an evidence-based contribution to the discussion between the reflective and the intuitive system. **Paper V** extends the IS usage literature (e.g., Davis 1989; Venkatesh et al. 2012; Venkatesh et al. 2016) by following the dual process theory (Kahneman 2011) and separating the reflective and the intuitive system. It extends it by demonstrating an influence between the reflective and the intuitive systems. Thereby the paper demonstrates that outcomes such as IT use, which have been considered in previous coping literature (e.g., Beaudry and Pinsonneault 2005) have a reflective and an intuitive manifestation and both have different antecedents. These insights can help future research to advance the theoretical foundations of the dark side of IT use as negative attitudes might be intuitive rather reflective and hence depicts a condition to examine intuitive coping strategies in the future (see also Paper X).

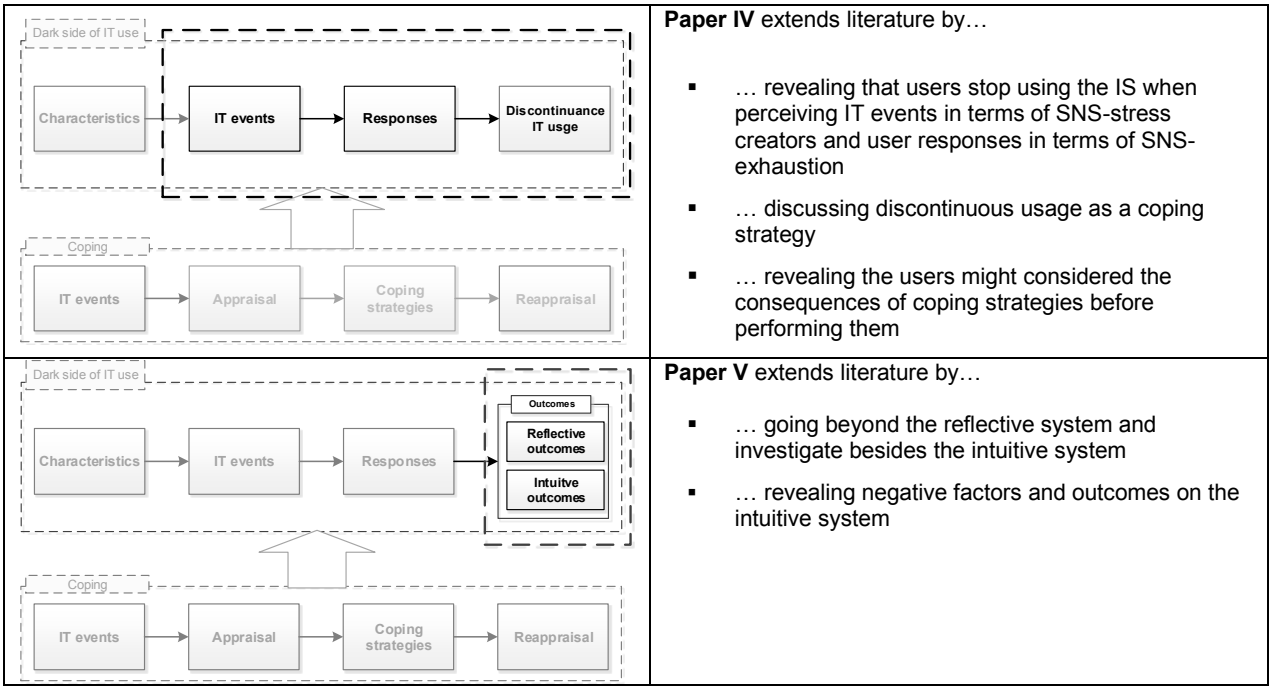


Figure 26: Research question 2 – Research contribution of chapter 2

6.1.3 Chapter 3: Coping with the dark side of IT use

Chapter 3 focuses on the question of how coping strategies influence IT events, user responses, and outcomes. Thus, the chapter provides theoretical evidence as it reveals a shortcoming within the literature and provides a structure of coping as well as shows evidence-based contributions how users respond to IT events and psychological responses as well as how coping strategies influences the dark side. The contributions of chapter 3 are summarized in Figure 27 and are explained in the following.

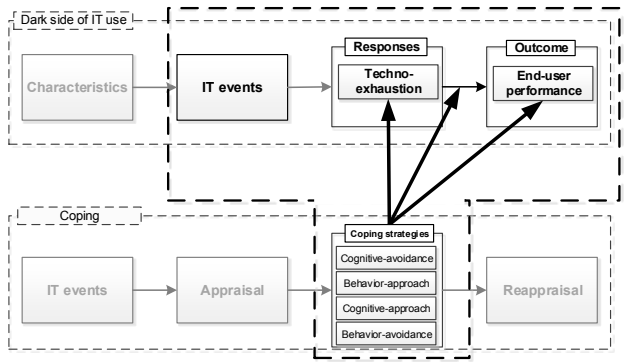
The dissertation provides a literature review in **Paper VI** that demonstrates that IS coping literature can be subdivided into three different contexts (Johns 2006) and reveals that each context concentrates on different objectives. By analyzing and synthesizing the literature, **Paper VI** contributes to coping literature (e.g., Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005) by revealing several shortcomings within the existing literature. The paper reveals that coping strategies are heterogeneous, as different coping strategies have been investigated. Also, it reveals that coping strategies not only reduce the IT events or

increase outcomes such as job performance but also influence each other. Hence, the revelation of these shortcoming helps researchers obtain an advanced theoretical understanding of coping by, for example, investigating beside the direct effects of the coping strategies also its dependencies when more than one coping strategy is considered.

Additionally, the chapter decomposes coping into its structure and into four distinct families of coping based on prior literature (Holahan et al. 1996; Skinner et al. 2003). Thereby, **Paper VII** extends the past literature as the decomposition approach helps to improve existing theoretical models (e.g., Beaudry and Pinsonneault 2005; Pirkkalainen et al. 2017) by zooming into the coping construct and differentiating between four different kinds of coping strategies distinguished by its method and approach. Also, the literature is extended by demonstrating not only a decreased effect of coping strategies but also increasing effects. Moreover, these approaches contribute to coping literature as it not only answers the question of how coping reduces IT events and its responses but also answers the question about what kind of coping strategies mitigate IT events and what responses. Consequently the decomposition helps researchers to improve their theoretical understanding whether a user performs a behavioral- or cognition-based strategy and whether they follow an approach or an avoiding strategy against the dark side of IT use.

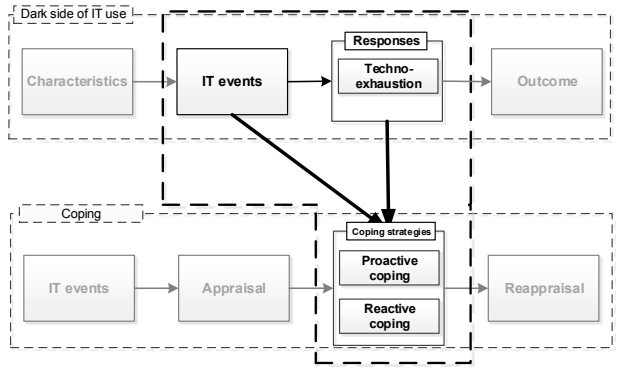
Chapter 3 further offers an evidence-based contribution to the discussion how users respond to IT events and responses. **Paper VIII** extends the coping literature (e.g., Beaudry and Pinsonneault 2005; Lamontagne et al. 2007; Salo et al. 2017) by empirically demonstrating that users immediately respond to IT events and the resultant responses with proactive and reactive coping. Users respond to IT events in a proactive way and to responses in a reactive way. This examination enriches the theoretical foundations of coping, as coping strategies are influenced by IT events and responses in a short-term situation rather than the other way around as supposed. For future researchers these insights demonstrate that the mitigating effect of coping can only be disclosed by longitudinal investigations as the short-term responses might mitigate the IT events thus resulting responses only over time.

Further, chapter 3 empirically deomonstrates differences by the impact of emotinal-focused and problem-focused coping strategies on user responses and outcomes. **Paper IX** extends the literature, considering coping strategies in terms of social support (Beaudry and Pinsonneault 2010; Fuglseth and Sørebø 2014; Tarafdar et al. 2011) by providing theoretical and empirical evidence that instrumental support has a direct effect on psychological and physiological responses and performance, whereas emotional support reduces only psychological responses. In addition, the paper empirically demonstrates that the effect of social support on psychological and physiological responses is moderated by inter-individual differences such that, for example, emotional support leads to higher instead of lower user responses. This examination supports future research by revealing that the effect of coping strategies such as social support depends on inter-individual differences. Future consideration of coping strategies should control for such differences to reveal the true effect of coping.



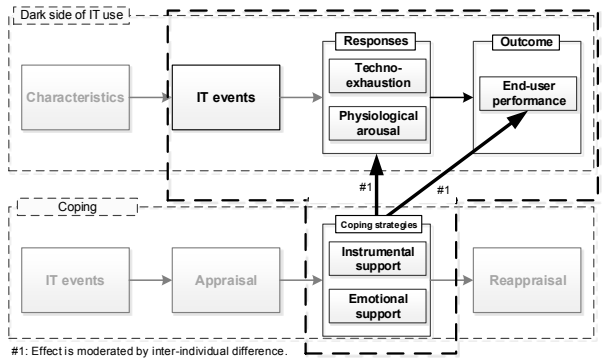
Paper VII extends literature by…

- … decomposing IS coping into its structure and into four distinct families of coping
- … proposing the coping families enable research to answer the question what kind of coping strategies mitigates IT events
- **…** revealing that coping strategies have a decreasing as well as an increasing effect on responses and outcomes



Paper VIII extends literature by…

- … demonstrating that users immediately respond to IT events and responses with proactive and reactive coping
- … revealing that coping strategies are influenced by IT events and responses in a short-term situation rather conversely as supposed
- … indicating that the true mitigating effect might disclose only over time



Paper IX extends literature by…

- … revealing that instrumental support effects responses and outcomes differently than emotional support
- … indicating that the effect of instrumental and emotional support depends on inter-individual differences

Figure 27: Research question 3 – Research contribution of chapter 3

6.1.4 Chapter 4: Longitudinal approach of coping with the dark side of IT use

Chapter 4 focuses on the question how users appraise, respond to, and cope with the dark side of IT use over time. This part provides theoretical and empirical evidence of a longitudinal effect by investigating reappraisal and the effect of repeated IT events. The contributions of chapter 4 are summarized in Figure 28 and explained in the following.

Chapter 4 first concentrates on longitudinal effects by looking at a repeated IT event. **Paper X** extends prior research by showing how users habituate in terms of physiological arousal (Ortiz de Guinea and Webster 2013) and sensitize in terms of psychological exhaustion (e.g., Ayyagari et al. 2011; Boucsein and Thum 1995, 1997). Additionally, the paper contributes to previous literature by showing that the first encounter of IT events leads either directly or indirectly to a deterioration of task performance (Addas and Pinsonneault 2018; Ortiz de Guinea and Webster 2013), by revealing that task performance improves by the repeated encounter of IT events over time. Moreover, **Paper X** demonstrates that the time-dependent effect of physiological arousal and psychological exhaustion predicts the changes of task performance. These can help future research to advance the theoretical understanding on how repeated IT events affect task performance and how users should cope with user response over time to increase task performance.

Second, chapter 4 focuses on the reappraisal of IT events over time. **Paper XI** extends the CMUA

(Beaudry and Pinsonneault 2005) by empirically evaluating the effect of reappraisal in the context of IT adaptation. In addition, it contributes to the literature by extending the technology adaptation model (Bala and Venkatesh 2015), by providing empirical evidence that users reappraise IT events such as IS implementation. Moreover, the paper demonstrates that reappraisal is predicted by specific coping, providing empirical evidence that coping strategies do not only influence organizational outcomes such as performance but influence reappraisal over time and might indirectly influences organizational outcomes by reappraising the IT event more favorably. These findings may help future researchers advance the theoretical foundations of how coping strategies influences the dark side of IT use over time, as they might already influence the appraisal process.

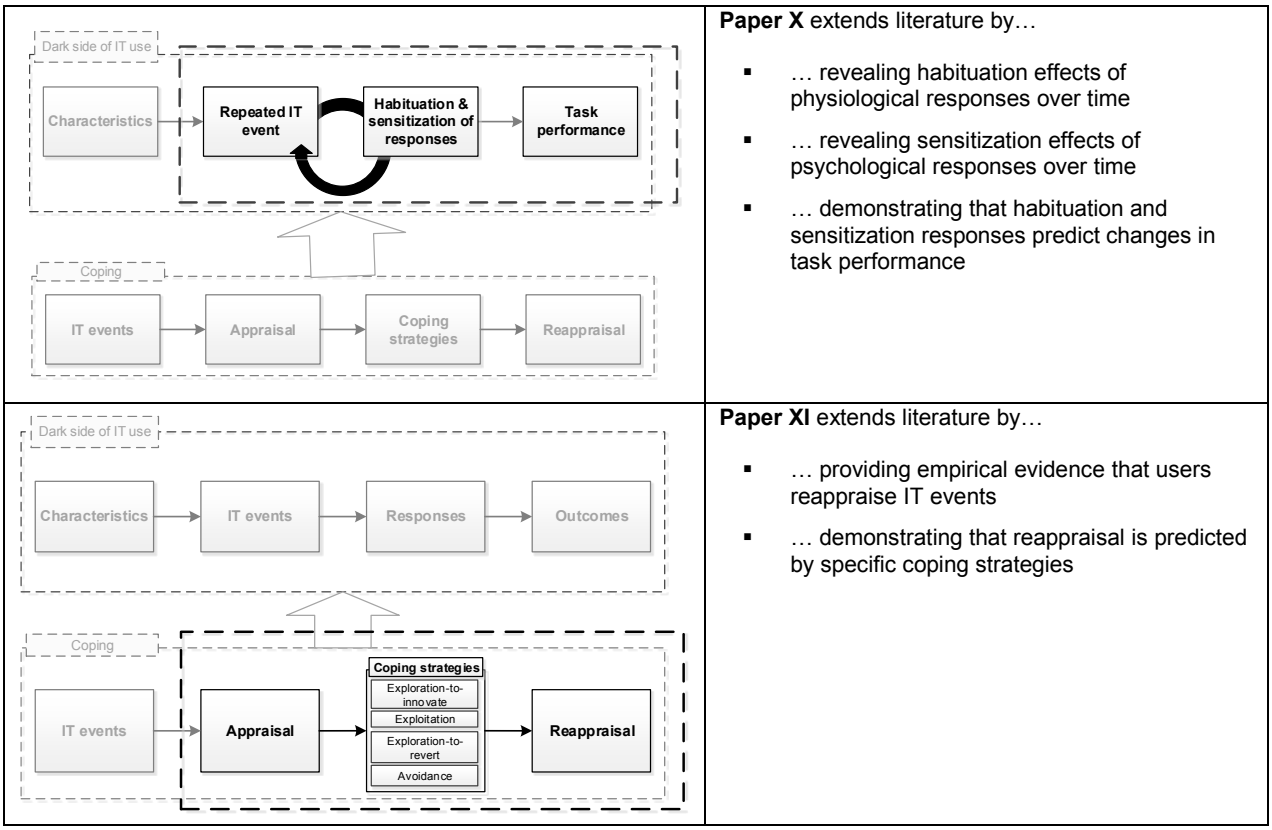


Figure 28: Research question 4 – Research contribution of chapter 4

6.2 PRACTICAL CONTRIBUTION

Chapter 1 demonstrates that IT events result out of different characteristics such as technological-, work-, or personality-related characteristics. Organizations should be aware of the sources of IT events and hence user responses to support their employees in an appropriate manner. Both levels, the technological and the work level, should be considered by organizations. For example, in the context of WHC, the dissertation indicates that it is not always right to blame the IT for the dark side of IT (**Paper I**). Organizations should not only focus on IT but also concentrate on additional factors such as network, personality, household etc. that are responsible for the perception of IT events (**Paper I–III**).

Chapter 2 concentrates on organizationally relevant outcomes and differentiates between reflective and intuitive factors. In the context of SNS, this dissertation demonstrates that organizational outcomes such as discontinuous usage is a strategic issue for SNS providers, who have a vested interest in reducing such intentions on the part of their users (Xu et al., 2014). When users stop using their SNS, providers lose their key asset and their financial profitability is endangered (Chiu & Huang, 2014). The results provide the initial indications of how SNS providers might discourage discontinuous usage intentions by reducing complexity, insecurity, the danger of invasion, and social overload (**Paper IV**). Concentrating on the intuitive system, the dissertation investigates intuitive factors along with the reflective factors. Firms face challenges as part of their regular change management efforts when, for example, they replace an old and outdated IS and have

to disrupt automatic usage habits among staff to develop new intentions to use the new IS. Change managers can develop more effective IS habit disruption and coping strategies if they consider the effects of implicit factors such as implicit attitudes. Managers might also consider coping strategies addressing intuitive negative factors (**Paper V**).

Chapter 3 concentrates on the effect of coping strategies on IT events, responses, and outcomes. Improving organizational outcomes such as performance and reducing user responses through coping is highly relevant in practice. This dark side of IT use costs companies a significant amount of money, so examining coping strategies, which might reduce these costs, is highly relevant to practitioners. The dissertation provides a classification of coping strategies that can guide managers to support appropriate coping strategies in an organizational setting. Managers can foster the denial strategy to lower the psychological response among their users and support the strategy of active coping to increase outcomes such as end-user performance. Furthermore, a structure and classification of coping is introduced that can be adopted by companies to enhance training programs focusing on the reduction the dark side of IT use (**Paper VII)**. In addition, organizations should support users perceiving high IT events in terms of techno-stressors by proactive coping and users with high emotional exhaustion by reactive coping (**Paper VIII)**. In particular, managers should establish standardized processes, such as contacting technical support when an IT problem is experienced rather than asking for understanding and emotional support from colleagues. Turning to colleagues for emotional support not only prevents the colleagues from focusing on their own task, but the emotional support received is less effective in improving performance levels than solution-oriented support in resolving the problem. Also, organizations should be careful when providing instrumental or emotional support, because the effect of providing social support highly depends on individual differences (**Paper IX)**.

Chapter 4 focuses on coping effects over time. The dissertation demonstrates that managers should focus on psychological responses of users rather than on physiological ones as findings demonstrate that users habituate to repeated IT events regarding their physiological responses, whereas they sensitize regarding their psychological responses. To increase short-term task performance managers might try to help their users reduce their physiological responses immediately and over time might try to reduce psychological exhaustion (**Paper X)**. In regard to IT events in terms of an IS implementation, managers are guided in developing effective change management strategies. The research indicates that coping strategies have not only an effect on organizational outcomes such as job performance or satisfaction but also on reappraisal. Hence, managers should be aware that the appraisal of the IT event changes over time. Regarding the coping strategies, the dissertation indicates positive as well as negative perception loops. Positive perception loops represent positive appraisal, which leads to coping and in turn leads to higher positive reappraisal. In contrast, negative perception loops represent negative appraisal, which leads to coping which in turn leads to higher negative reappraisal. Managers need strategies to disrupt these negative loops which might develop over time and increase positive ones (**Paper XI**).

6.3 Measurement Contributions

The present dissertation contains, besides the theoretical and practical contributions, also some measurement contributions. Several papers use the data collection technique of direct body measurement. By doing so, these papers contribute to the literature streams of NeuroIS and extend the diversity of methodology used in IS literature, which is described in the following.

Several papers use skin conductance (SC) measures to obtain the bodily responses when users encounter IT events. SC has been used in the past IS literature (Riedl et al. 2013; Teubner et al. 2015). **Paper IX** measures physiological user responses with SC, which captures data directly after the stimulus onset, contrary to the measurement of cortisol or alpha-amylase used in past research (Galluch et al. 2015; Riedl et al. 2012). **Paper X** used SCR to measuring habituation of physiological responses which reflects an unconscious mental process that is not obtainable by self-report, as it occurs in the intuitive brain system. Hence, these papers contribute to NeuroIS research (Dimoka et al. 2012; Riedl et al. 2014) by measuring

unconscious responses over time. Also, the papers underline the suggestion that NeuroIS can help IS research obtain a more complete or holistic understanding of the effects of IS phenomena and the resultant outcomes (Tams et al. 2014).

Response time is used in the cumulative dissertation to measure intuitive effect and task performance. As the dissertation identifies and measures implicit effects, the **Paper V** extends the findings of Dimoka and Davis (2008) and address their call to "*uncover other hidden components of IS constructs that cannot be easily inferred by self-reported measurement scales."* (p. 13) The SC-IAT (Karpinski and Steinman 2006) commonly used in psychological research, which originates from the IAT developed by Greenwald et al. (1998) to measure individuals' implicit associations has been introduced to the IS context. Furthermore, the semantical analysis of IS usage literature by Williams et al. (2009) reveals that over 70% of the investigations in this research stream use surveys and case studies. Hence, by introducing the SC-IAT into IS research as a means of measuring unconscious associations stored in implicit long-term memory, the paper contributes to a greater diversity of methods in IS research (e.g., Williams et al. 2009) and proposes a suitable approach to measuring implicit effects.

Paper IX and **X** measures performance by using a response time data collection method. Task performance has been measured several times within past research of the dark side of IT use (Moody and Galletta 2015; Ragu-Nathan et al. 2008; Tarafdar et al. 2010). However, most of these investigations use a self-reporting measurement technique to capture performance (Ragu-Nathan et al. 2008; Tarafdar et al. 2010). As hands-on tests are more appropriate to capture task performance (Marcolin et al. 2000), the paper extends prior technostress literature by emulating a real-life business scenario to capture the processing time of the tasks (Addas and Pinsonneault 2018; Chilton et al. 2005; Ragu-Nathan et al. 2008; Tarafdar et al. 2010). In addition, **Paper X** takes also the outcome of the task into consideration, which in turn extends previous literature.

7 LIMITATIONS

As every research study, this dissertation is also limited in various aspects.

The dissertation is limited by the stimulus–response perspective taken on the dark side of IT use encompassing characteristics, IT events, responses, and outcome. This perspective concentrates intensely on the source of the dark side of IT use in terms of IT events, but on the other hand neglects with this conceptualization key negative effect of the dark side of IT use such as addiction or misuse (Tarafdar et al. 2015a). Hence, the dissertation concentrates only on the effect of coping with a specific part of the dark side of IT use. The consideration of other phenomena of the dark side of IT use such as addiction or misuse might also require different coping strategies or different coping approaches.

Generally, the dissertation is limited by only focusing on three different contexts—WHC, ERP, SNS—and neglects additional context where other characteristics might be important. Also, the characteristics of IT events are limited to work, technology, network, and personality characteristics and only considers specific job profiles and technologies (**Paper I–III**). In particular, the dissertation is limited regarding the household life cycle, as it does not capture modern life situations where individuals, for example, are caregivers who care for people other than their own children, the presence of troubled or disabled children, situations where children are only present on weekends, or the consideration of the presence of parents or relatives in need of care (**Paper I**).

Although numerous strategies exist (Skinner et al. 2003), the dissertation is limited by the investigated coping strategies, because the papers of the cumulative dissertation only examine specific selected coping strategies, such that a selection of other or additional coping strategies might lead to different results (**Paper IV, VI–XI**). The same applies for the IT events investigated. The papers focus on specific IT events, which can limit the generalizability and transferability of the results (**all Papers**). Certainly, different kinds of IT events exist such as expected IT events or discovery IT events (Ortiz de Guinea and Webster 2013).

The body of literature of the dissertation is limited to the IS discipline (mostly the basket of eight and IS conferences; see Section 3.3.4). The inclusion of literature from related discipline for example from the field of computer human interaction or psychology would extend the body of literature (**all Papers**). This applies especially to the literature analyses, which indeed follows a rigorous approach (vom Brocke et al. 2009; Webster and Watson 2002), but the results are limited due to the used search terms and selected journals (e.g., basket of eight; see **Paper VI**).

The dissertation is also limited regarding the body measures used in several papers. These papers use only one body measure, whereas the literature suggests using more bodily measures at the same time to reduce mono-operationalization biases (Dimoka et al. 2012; **Paper V, IX and X**). Concerning the intuitive system, the dissertation is limited by its measurements. The IAT has on the one hand been used and published in high ranked journals (e.g., Baccus et al. 2004; Greenwald et al. 1998; Greenwald et al. 2003), but on the other hand, the current literature indicates some issues concerning the method (Carlsson and Agerström 2016; Gawronski et al. 2017). Nevertheless, *"the IAT as a tool to learn about automatic associations can be a good way to start a rich discussion about attitudes […] [and that] […] the IAT can still be a useful tool for researchers […]*" (Carlsson and Agerström 2016, p. 286; see **Paper V**). Also, the dissertation uses only body measures able to capture physiological user response or reaction time but neglects neurological measures such as functional magnetic imaging (fMRI) or electroencephalography (EEG), which might enable researchers to obtain deeper insight on physiological or intuitive responses.

Lastly, the dissertation contains several longitudinal analyses but is limited by the time period of these investigations, as the papers concentrate only on a maximum period of six weeks (**Paper X and XI**). In context of repeated IT events, the chapter is limited as it only investigates the encounter of six repeated IT events within a 30 minutes laboratory experiment. Current research (Vance et al. 2018) notes that especially habituation is related to the frequency of stimuli received, such that users might show different patterns of habituation within a 30-minute laboratory experiment than they would show over a time period of one day by a constant number of repetitions (**Paper X**). Regarding reappraisal, the chapter considers the growth trajectories of reappraisal over time but treats coping strategies as time-dependent predictors and does not consider their growth trajectories. The consideration of intra-individual differences within coping strategies might modify the effect on reappraisal (**Paper XI**).

8 FUTURE RESEARCH

The results and implication of the dissertation builds a base for future research to reveal further insights how user can cope with the dark side of IT use.

Future research should investigate coping within mandated IT use within organizational environment. The papers of the cumulative dissertation mostly concentrate on voluntary IT use and neglects mandated IT use (all Papers). However, Bhattacherjee et al. (2017) suggest in a mandatory usage situation, different responses and coping strategies may exist or be more desirable, such that the results within a mandatory context might be different. For example, avoiding strategies such as discontinuing IT use are not possible within this context. Hence, future research might concentrate on investigation of coping strategies within mandatory IT use context in organizational environments.

The present dissertation focuses on the differentiation between the reflective and intuitive system (**Paper V**). However, most of the literature on the dark side of IT use and IS coping only considers the reflective system and neglects the intuitive. Besides the present dissertation, Ortiz de Guinea (2014) also concentrates on implicit characteristics of IT events. Consequently, as the present dissertation demonstrates that also intuitive factors exist, future research should concentrate on implicit coping strategies that are performed unconsciously, as well as further implicit outcome variables. Regarding the measurement of implicit factors, future research might also combine other data collection techniques such as EEG with the SC-IAT to analyze what happens in the brain when users unconsciously associate the usage of an IS as positive and negative.

Additional coping strategies and IT events should be investigated within future research. Several papers of the dissertation are limited by focusing on only some specific coping strategies and IT events, whereas numerous coping strategies (Schmitz et al. 2016; Skinner et al. 2003) and IT events exist (Ortiz de Guinea and Webster 2013; **Paper VII, VIII, IX, XI**), which might be considered in future research. The coping families provided in **Paper VII** might help to classify all the coping strategies that support researchers in the future to select relevant coping strategies. Regarding the IT events, Ortiz de Guinea et al. (2013) introduce three types: expected IT events, discrepant IT events, and discovery IT events. As the present dissertation solely concentrates on discrepant IT events, future research should take others into consideration, because coping strategies might differ against these other kind of IT events.

Past literature on coping mostly investigates the effect of one or more coping strategies on responses or outcomes (e.g., Beaudry and Pinsonneault 2010; Pirkkalainen et al. 2017). However, the dissertation structures coping into four different coping families and shows that user respond in proactive way, focusing on the IT event, and in a reactive way, addressing the responses (**Paper VII and VIII**). Additionally, results demonstrate that coping strategies influence each other (**Paper VI**). Based on these results and in line with Stein et al. (2015), who demonstrate that users perform combined coping strategies, future research should analyze different coping patterns, which might comprise the coping families and their interactions with each other. In particular, the investigation of patterns might be a fruitful research direction, such that future research might identify different situations or IT events in which different patterns should be performed to cope with the dark side of IT use. For example, one pattern might contain two coping strategies out of two different coping families performed sequentially to proactively cope with IT events in an organizational context.

Future research should also investigate the longitudinal effect of coping strategies on the dark side of IT use. This dissertation investigates the effect of coping mostly with a cross-sectional data collection timing approach (**Paper I–IX**). The longitudinal data collection timing approach conducted within the dissertation concentrates on repeated IT events and reappraisal and neglects the effect of coping strategies on the dark side of IT use (**Paper X and XI**). In general current IS coping literature is limited to the cross-sectional analyses of coping (e.g., Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005), whereas current psychological literature demonstrate that coping is flexible over time (Cheng 2001; Cheng et al. 2012; Kato 2012). The literature suggests that the ability to discontinue an ineffective coping strategy and perform an alternative coping strategy is highly relevant in the coping context (Kato 2012). Users perform not only one coping strategy rather hold a repository of coping strategies that can be performed over time. Hence, deeper investigation of the longitudinal effects of coping strategies on the dark side of IT use is one avenue of future research, as the investigation of coping flexibility provides more insight how users cope with the dark side of IT use.

9 CONCLUSION

The main objective of this dissertation is to provide theoretical foundations and empirical evidence of how users cope with the dark side of IT use. Thus, the dissertation takes a stimulus–response perspective on the dark side of IT use and investigates how the transactional process of coping influences this ‘dark side’. The findings demonstrate that the sources of the dark side of IT use in terms of IT events are influenced by different characteristics across contexts. Additionally, they provide insights on organizational outcomes on the intuitive and reflective system. Moreover, the dissertation demonstrates that users perform coping strategies to manage the dark side of IT use, yet, the mitigating effect depends on inter-individual differences. Coping strategies are not all equal; instead they can be structured depending on their method (e.g., behavior or cognition) and focus (e.g., avoidance or approach). Also, users respond to IT events and the resultant responses differently by performing proactive and reactive coping. In addition, the dissertation gives insight into the longitudinal effects of coping with the dark side of IT use by focusing on the more realistic situation where IT events are encountered repeatedly and reappraised.

The dark side of IT use represents an issue for users and organizations. Even though IT solves many

problems, IT use often has unintended consequences and creates IT events. Yet, coping is one key to overcome this for staying heathy and be productive. In the future the world will become an increasingly virtual place such that the ubiquity of IT will increase. IT will accompany users more often, more intensively, and for longer times, such that the need to understand how to cope with the emerging IT events is even greater. This dissertation offers scholars and practitioners a first empirical foundation on how users cope with the dark side of IT use.

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11 APPENDIX

11.1 Appendix A

Table 12: Overview of the annually candidate study

Pre-studies	Participants	Reported in …
Bewerbungspraxis 2013	6,137	(von Stetten et al. 2013)
Bewerbungspraxis 2014	10,050	(Maier et al. 2014b)
Bewerbungspraxis 2015	7,040	(Maier et al. 2015)
Bewerbungspraxis 2016	4,800	(Weitzel et al. 2016a, 2016b, 2016c, 2016d)
Bewerbungspraxis 2017	3,400	(Weitzel et al. 2017a, 2017b, 2017c, 2017d, 2017e)
Bewerbungspraxis 2018	2,800	(Weitzel et al. 2018a, 2018b, 2018c, 2018d)

Table 13: Overview of the annually organizational study

Pre-studies	Response rate from 1000 organisations	Reported in …
Recruiting Trends 2013	13,7 %	(von Stetten et al. 2013)
Recruiting Trends 2014	12,8 %	(von Stetten et al. 2014)
Recruiting Trends 2015	12,5 %	(Weinert et al. 2015d)
Recruiting Trends 2016	11,4 %	(Weitzel et al. 2016a, 2016b, 2016c, 2016d)
Recruiting Trends 2017	12,6 %	(Weitzel et al. 2017a, 2017b, 2017c, 2017d, 2017e)
Recruiting Trends 2018	11,7 %	(Weitzel et al. 2018a, 2018b, 2018c, 2018d)

Table 14: Overview of case studies

Pre-studies	Practices partner	Reported in …
Case study I	A1 Telekom Austria	(Weinert et al. 2013a)
Case study II	Krones AG	(von Stetten et al. 2014)
Case study III	Otto GmbH & Cop KG	(von Stetten et al. 2014)
Case study IV	VOITH GmbH Heidenheim	(Weinert et al. 2014)
Case study V	Österreichische Post AG	(Weinert et al. 2014)
Case study VI	Deutsche Bahn AG	(Weinert et al. 2015d)
Case study VII	LG Electronics Deutschland GmbH:	(Weinert et al. 2015d)
Case study VIII	WITT-GRUPPE	(Weitzel et al. 2016a)
Case study IX	NETPIONEER GMBH	(Weitzel et al. 2016a)
Case study X	COMATCH GMBH	(Weitzel et al. 2016a)

11.2 APPENDIX B

Table 15: Methodology summary of papers (continued)

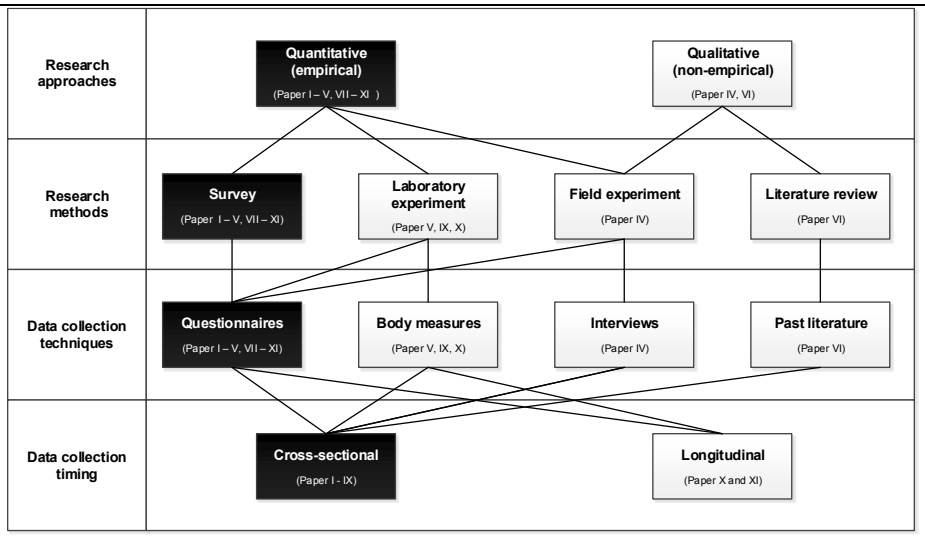
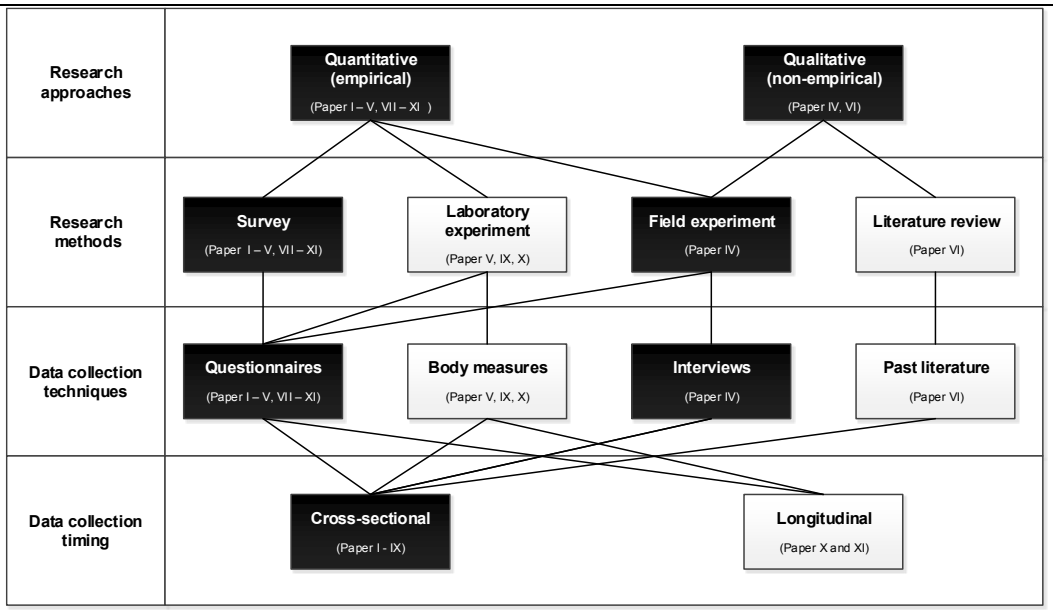
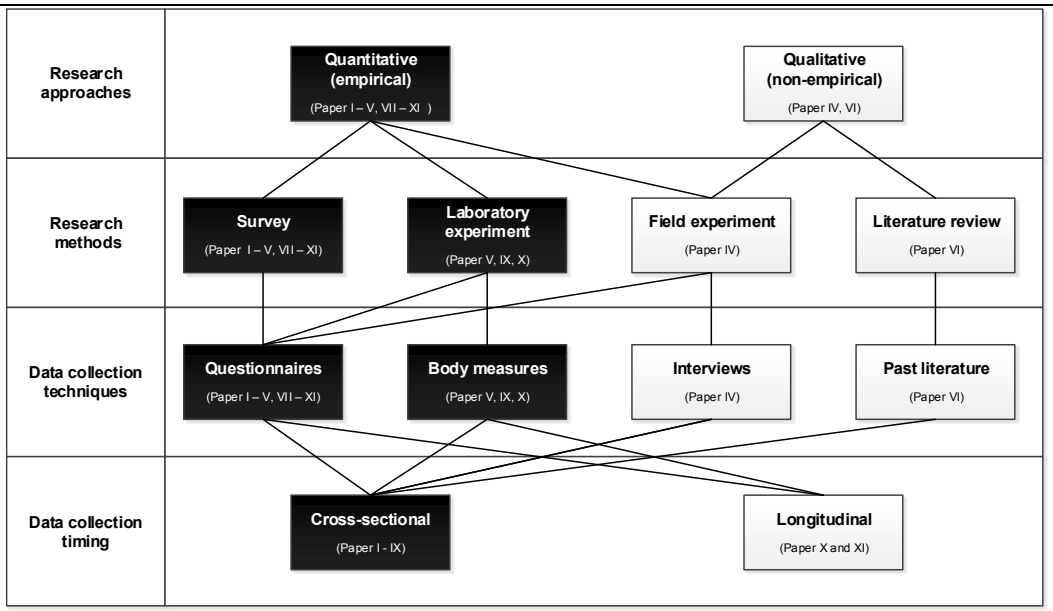
Papers I-III and VII-VIII	

Table 15: Methodology summary of papers (continued)

Paper IV



Paper V



Paper VI

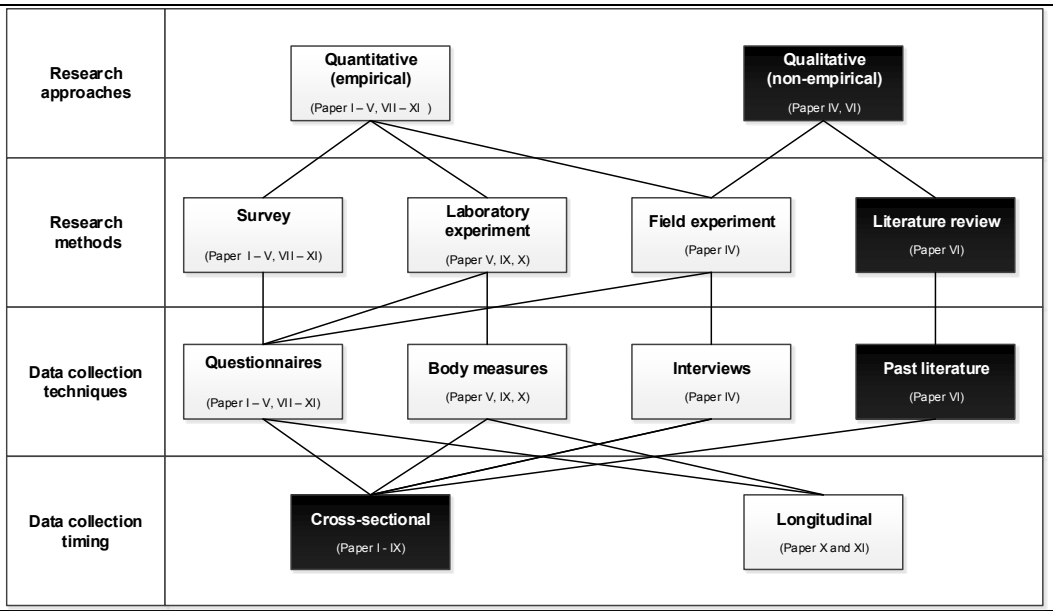
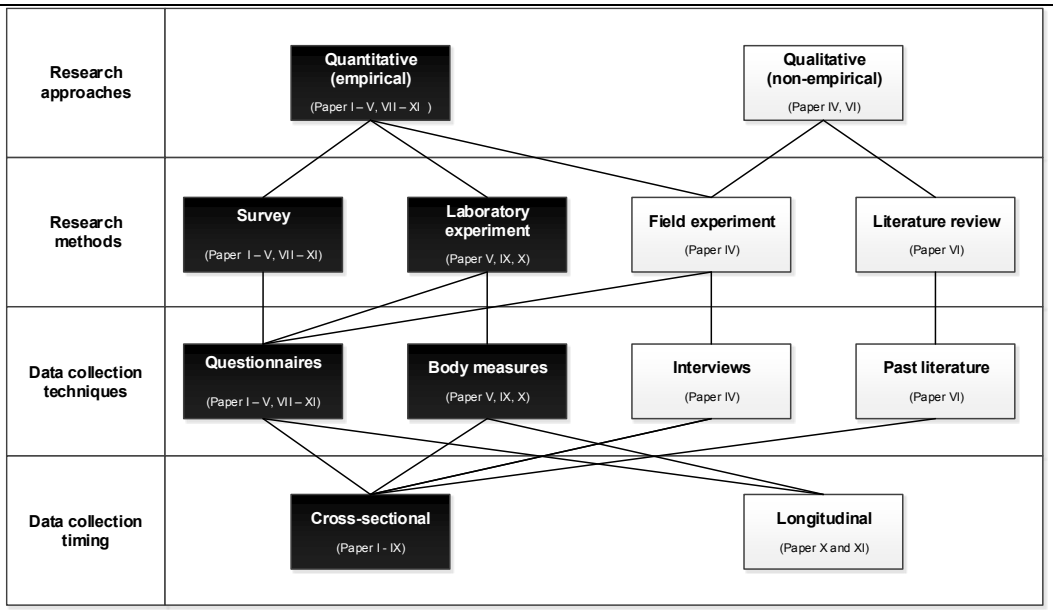
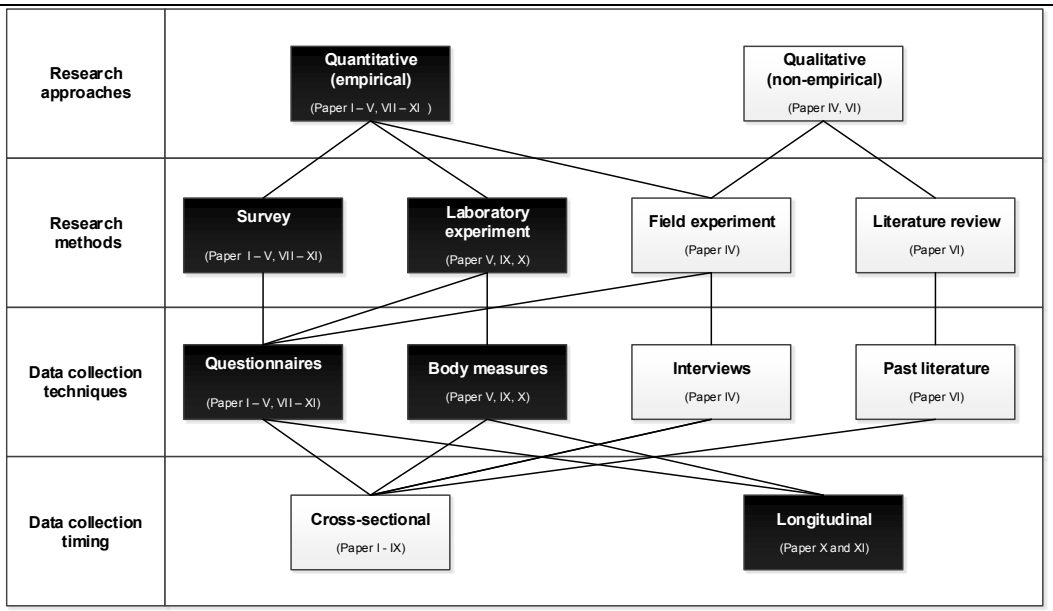


Table 15: Methodology summary of papers (continued)

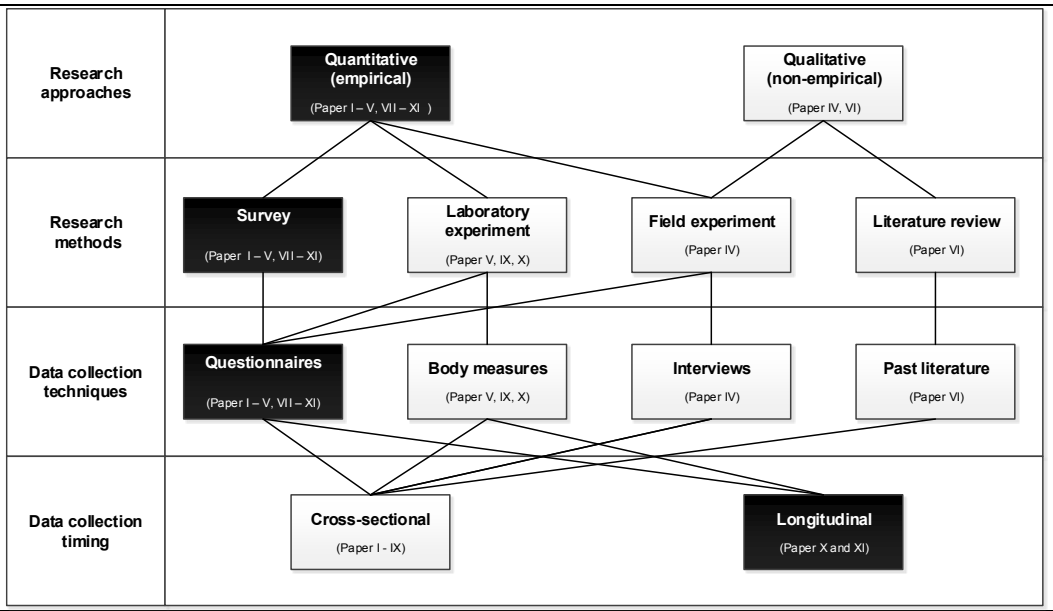
Paper IX



Paper X



Paper XI



1. Chapter
The dark side of IT use: Characteristics, IT events, responses

Paper I

SHEDDING LIGHT ON THE CONFLICT BETWEEN WORK AND HOME

AN INVESTIGATION OF THE DIMENSIONS OF THE WORK-HOME CONFLICT AND HOW THEY INFLUENCE WORK EXHAUSTION

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SHEDDING LIGHT ON THE CONFLICT BETWEEN WORK AND HOME

AN INVESTIGATION OF THE DIMENSIONS OF THE WORK-HOME CONFLICT AND HOW THEY INFLUENCE WORK EXHAUSTION

Abstract

Most previous literature treats the work-home conflict (WHC) as aggregated or unidimensional without considering its dimensions. As a result, organizations and governments often treat IT usage as the source and symbol of WHC and have implemented laws and policies to restrict access to IT at home to reduce WHC. However, WHC literature based on such an aggregated view of WHC does not provide a sufficiently differentiated picture of WHC and therefore does not allow effective interventions to be derived. This study develops and empirically validates a research model which distinguishes IT-based from work-based WHC dimensions (time, strain, behavior) and theorize their effect on work exhaustion. We also identify and consider contextual characteristics of the work and private role which might influence the effect of the WHC dimensions. To validate our model, we surveyed 542 employees. Our study reveals that IT-based WHC is an antecedent of the work-based dimension of WHC and only indirectly influences work exhaustion. Moreover, we demonstrate that the effects of the WHC dimensions are influenced by contextual characteristics of the work and private role. We discuss implications and opportunities for future research into WHC to counteract the WHC dimensions and reduce work exhaustion.

Keywords: work-home conflict, work exhaustion, role conflict theory, blurring of boundaries, household life cycle

1 INTRODUCTION

Using information technology (IT) to perform work-related tasks at home can blur the boundaries between work and private life, which reflects a conflict between an employee's work and private role (Ayyagari et al. 2011; Köffer et al. 2014; Turel et al. 2011a). This conflict is common when employees are forced to use or think that they have to use IT to stay connected with their work to meet deadlines and demands. At the same time, employees also use IT to fulfill private duties in their private role. Thus, IT-based work-home conflict (WHC) is a role conflict resulting when individuals are less capable of fulfilling their private demands such as dining with the family because they are or feel compelled to use a pervasive, work-related IT, for example to check work-related emails (Ayyagari et al. 2011; Turel et al. 2011a).

To address this conflict, many organizations have implemented policies restricting IT usage designed to reduce IT-based WHC, such as by only enabling employees to receive emails during their working hours and 30 minutes before and after their shift (de Castella 2014). For example, Volkswagen turns off Blackberry email access after work hours (bbc.com 2012), and France passes a law which bans employees from checking work emails after 6:00 p.m. (The Economist 2014) to reduce the blurring of work and private life. Circumstantial evidence indicates that most laws and organizational policies focus on IT to reduce WHC and that IT usage is considered a primary source and symbol of WHC.

In this study, we draw on psychological research to theorize that the conflict between work and private life has causes beyond IT usage. In addition to IT-based WHC, this paper identifies and differentiates between time-, strain- and behavior-based WHCs. *Time-based WHC* results when different roles, such as the work and private role, compete for an employee's time. When job demands exceed an employee's resources and prevent them from investing as much energy into their private life as they would like, *strain-based WHC* occurs. Finally, when the work role requires different behavioral patterns than the private role, *behavior-*

based WHC arises (Carlson et al. 2000; Greenhaus and Beutell 1985). For example, an authoritarian interaction style might be effective in a work role, but ineffective in the private role. WHC is thus rooted not only in IT usage but also in additional characteristics of the work and private roles.

Most extent literature investigates WHC as an aggregate construct and neglects these four different dimensions of WHC (e.g., Armstrong et al. 2015; Sarker et al. 2012). Most previous literate does not specify whether the conflict is time-, strain-, behavior-, or IT-related. A few studies focus only on IT-based WHC (Ayyagari et al. 2011; Köffer et al. 2015; Turel et al. 2011a), but the majority consider WHC an aggregate construct and do not specify different dimensions (Ahuja et al. 2007; Armstrong et al. 2015; Sarker et al. 2010; Sarker et al. 2012; for an overview see Appendix Table 9). Consequently, organizations see IT as source and symbol of WHC and may take IT-related measure to reduce it, such as turning off email servers after work hours. In this study, we argue that the aggregated, isolated and scattered results in the literature on WHC do not provide a sufficiently holistic and complex picture of WHC, which prevents beneficial interventions from being derived. Theory and practice need a comprehensive understanding of employees' work–home conflicts because these issues constitute one of the most important predictors of work exhaustion (Ahuja et al. 2007). Work exhaustion includes emotional exhaustion at the job and is, in addition to depersonalization and diminished personal accomplishment, a central component of job burnout (Maslach 1993; Maslach et al. 2001; Maslach and Jackson 1981). It results from the sense of tension and frustration because employees fear that they will not be able to perform as well as previously (Swider and Zimmerman 2010). To address this gap in the literature, the present research focuses on WHC by identifying and its various IT- and work-based dimensions and comparing the degree to which they influence work exhaustion to assess the effect of actions taken by organizations and governments. Thus, our first research question is:

How do the dimensions of the work-home conflict influence work exhaustion?

Past literature indicates that considering an individual's environment or context is significant to in understanding the person's interactions in a situation (Johns 2006; Sarker 2016). According to the role conflict theory (Ashforth 2001; Madsen and Hammond 2005), individuals perform different roles which compete against each other. WHC has various dimensions because of incompatible role expectations in the work and private role. The expectations of the work and private role are driven by work and private contextual characteristics such as marital status, the number of children, degree of responsibility at home and at work, or hours of work (Greenhaus and Beutell 1985). However, the contextual characteristic of the working and the private living situation changes over time (Bauer and Auer-Srnka 2012), which influences the effects of the different WHC dimensions. For example, a single young employee with no children is likely to have fewer conflicts between his work and private role because he has less pressing work and private duties, whereas a senior employee who is married and has three children may have more time conflicts between work and private roles, which may result in higher work exhaustion. It is essential to consider the environmental context in terms of the characteristics of the work and private living situations because these characteristics determine the effects of the WHC dimensions. Hence, our second research question is:

How do contextual characteristics of the work and private role influence the effects of the different work-home conflict dimensions?

To answer the research questions, we develop and validate a research model which investigates WHC on a techno level (Köffer et al. 2014; Sarker et al. 2012; Turel et al. 2011a) and on a work-level (Ahuja et al. 2007; Greenhaus and Beutell 1985; Sarker et al. 2010). We thus take a closer look at the WHC construct by considering its various dimensions and analyze the influence of effects of work and private contextual characteristics. Our results contribute to the literature by illustrating that the IT-based dimension of WHC alone does not significantly influence work exhaustion, whereas time-based WHC and strain-based WHC are significant factors contributing to work exhaustion. The present study reveals that IT-based WHC is an antecedent of the work-based dimension of WHC and only indirectly influences work exhaustion. Moreover, we demonstrate that the effects of the WHC dimensions are influenced by contextual characteristics from the work and private roles.

The remainder of this paper is organized as follows. First, we provide the theoretical background of our study by explaining the role conflict theory, demonstrating its multidimensionality, outlining past literature on WHC, and describing the contextual influences from the work and private role. Subsequently, we develop our research model and explain our methodology before presenting the results. Lastly, we discuss the findings and draw implications of the present research for theory and practice.

2 THEORETICAL BACKGROUND

In this section, we outline the role conflict theory, discuss the state of WHC literature, illustrate that WHC is multidimensional, and introduce the work and private contextual characteristics.

2.1 ROLE CONFLICT THEORY

A role is a unique set of behaviors, requirements, responsibilities, and even identities (Ashforth 2001; Madsen and Hammond 2005). Individuals adopt many roles in life: for example, they may act as managers, line workers, experts, creative thinkers, or laborers at work, as mothers, fathers, sons, daughters, sisters or brothers in the family, as volunteers in social projects, as political activists, as members of a spiritual community, or as a partner or friend in romantic and platonic relationships. Each role has its own objectives, beliefs, values, norms, interaction styles, and time horizon (Ashforth 2001, 2001; Sundaramurthy and Kreiner 2008). Individuals take on an entire assortment of roles rather play only in one role at a given time (Madsen and Hammond 2005).

As individuals regularly occupy more than one role, the different roles intersect with each other, and sometimes one role impedes an individual's ability to accomplish the duties required by another role. The conflict between the different roles occurs because (1) the expectations and duties within one role are incompatible, or (2) the duties of one role are incompatible with the duties of another role (Koch et al. 2012). In some cases, different roles may cause personal conflicts which make it more difficult to perform each role successfully due to conflicting demands on time, lack of energy, or incompatible behaviors among roles (Grandey and Cropanzano 1999). Role conflict theory claims that when employees struggle within or between different roles, this results in an undesirable state (Grandey and Cropanzano 1999). Such role conflict can reduce job satisfaction, the employees' sense of commitment to the organization, and her productivity (Igbaria and Guimaraes 1993; Tarafdar et al. 2007) and can foster work exhaustion and even burnout (Moore 2000).

In summary, employees perform several roles each containing a unique set of behaviors, requirements, responsibilities, and even identities. Performing multiple roles simultaneously can result in an interruption of the different roles. If the expectations and duties within or between roles are not compatible, a conflict between various roles may arise, which may lead to negative consequences for the individual. In the case of WHC, this may take the form of work exhaustion.

2.2 WORK-HOME CONFLICT

The role conflict theory suggests that employees perform several roles which lead to conflicts between these roles (Ashforth 2001; Madsen and Hammond 2005). Concentrating on the work and private role, role expectations in the work and in private life are not always compatible, which can result in conflicts between the work and private role (Netemeyer et al. 1996). We argue that WHC is multidimensional as it encompasses several work-based dimensions as well as an IT-based dimension (Ayyagari et al. 2011; Greenhaus and Beutell 1985). In the following sections, we explain each dimension of WHC precisely and provide an overview of IS research into WHC.

2.2.1 The multidimensionality of work-home conflict

Past psychological literature (Carlson et al. 2000; Greenhaus and Beutell 1985) outlines various work-based dimensions of WHC: time-based WHC, strain-based WHC, and behavior-based WHC. In addition, IS research proposes an IT-based dimension of WHC. Consequently, we argue that WHC contains four different

dimensions which are described in the following.

Time-based WHC occurs when the time spent in the work role makes it difficult to participate in the private role (Carlson et al. 2000). This dimension of WHC considers the conflict of employee's time within different roles. For example, the time spent on work-based activities within the work role cannot be devoted to activities within the private role. Time-based WHC contains the time pressures within the work role, which makes it physically difficult to fulfill the duties arising from the private role. The pressure might lead to a preoccupation within the work role even though an employee is physically trying to meet the demands of another role. This dimension of WHC is based on working hours, the frequency of overtime, and the presence and irregularity of shift work (Greenhaus and Beutell 1985; Netemeyer et al. 1996).

Strain-based WHC occurs when the burden of the work role affects activities in the private role (Carlson et al. 2000). This conflict occurs when strain symptoms such as tension, anxiety, or fatigue in the work role influence the performance of an employee in the private role. The professional and private role are incompatible because the demands of the work role make it difficult to meet the duties of the private role (Greenhaus and Beutell 1985; Netemeyer et al. 1996).

Behavior-based WHC arises when the behavior in the work role affects the behavior in the private role (Carlson et al. 2000). Specific behavior within the work role might be inconsistent with expectations regarding behavior in the private role. For example, an employee should be independent, emotionally stable, aggressive, and objective in his job role, whereas in the private role he should be warm, nurturing emotionally available, and vulnerable. If an employee is unable to adjust his or her behavior to meet the behavioral expectations of the work and private role, behavioral-based WHC might occur (Greenhaus and Beutell 1985).

IT-based WHC is the discord between the professional and private role related to IT use (Ayyagari et al. 2011; Köffer et al. 2015), such as when constant connectivity via IT for professional purposes blurs work-private boundaries (Mann and Holdsworth 2003). IT devices such as laptops and smartphones in combination with broadband connections are blurring the boundaries between work and private by providing increased access to work from private spaces (Ayyagari et al. 2011; Sarker et al. 2012). In addition, the usage of consumer IT such as private smartphones at work increases the blurring of work and private roles (Köffer et al. 2014; 2015). IT-based WHC occurs when the duties required by the private role cannot be fulfilled because of the usage of a specific work-based pervasive technology. For example, when an employee is not able to dine with the family because of the pressure to read and compose mobile work emails at home (Turel et al. 2011a).

2.2.2 Related IS research on work-home conflict

The conflict between work and private life has been investigated in several contexts within the IS discipline (for a detailed review see Köffer et al. 2014). Various examinations focus on WHC among IS professionals (Ahuja et al. 2007; Armstrong et al. 2015; Sarker et al. 2010; Weinert et al. 2014a). An early examination by Ahuja et al. (2007) theorizes that WHC is a crucial factor by considering work exhaustion and turnover intention. They assume that WHC influences work exhaustion and organizational commitment and indirectly turnover intention. Their findings indicate that WHC influences organizational commitment and work exhaustion and indirectly influences the turnover intention of IT personnel as the major contributor to work exhaustion. The following investigation based on the research model by Ahuja et al. (2007) focuses on IS career experience and considers WHC as an antecedent of work exhaustion. In this context, the results demonstrate that WHC has no effect of work exhaustion related to IS career experiences (Armstrong et al. 2015). An additional study investigates the antecedent of WHC among IT-professionals in globally distributed system development teams. The examination assumes that time difference, the frequency of communication, and the number of distributed locations influence WHC. The findings indicate that all three antecedents have a significant effect on WHC in this context (Sarker et al. 2010).

Several investigations in the context of WHC concentrate on IT use in general. An early investigation examines the differences of WHC between after-hours telecommuters and core working-hours

telecommuters (Duxbury et al. 1992). Their findings indicate that gender and after-hour telecommuting significantly influences WHC. They also compare different work arrangements (dual-career vs. traditional-career) and gender (men vs. women) and find intra-group and inter-group differences (Duxbury et al. 1992). Other studies have considered the role of technology characteristics in WHC and have investigated WHC as an antecedent of IT-based exhaustion. For example, Ayyagari et al. (2011) focused on technology characteristics which influence IT-based WHC, which in turn influences IT-based exhaustion. Their results show that presentism positively influences IT-based WHC and that IT-based WHC influences among others IT-based exhaustion. They find that IT-based WHC can also result when employees use the same technology for work and private life. The increasingly common practice of employees using their privately-owned IT instead of the enterprise IT also blurs the boundaries between work and private (Köffer et al. 2014; 2015). A practitioner-oriented examination demonstrated that using mobile devices can influence WHC. The scholars develop a framework of different perceptions on WHC and propose a set of managing strategies, identifying three different WHC perceptions: one which separates work and private life, one which views work as overlapping with private life, and a last which perceives this domain as integrated (Sarker et al. 2012). Turel et al. (2011a) indicate that technology addiction is one cause of IT-based WHC, which in turn influences WHC.

In summary, several investigations have focused on WHC in various contexts. The antecedents and consequences of WHC have been investigated at the techno and work level. The findings of past studies indicate that WHC, either on a techno level or on a work level, results in negative consequences such as reduced satisfaction or work exhaustion. However, almost all investigations within IS research treat WHC as unidimensional and focus only on the IT-based domain of WHC and neglect its multidimensionality by disregarding the work-based dimensions or consider WHC as aggregated construct by completely neglecting the different dimension. Besides the different WHC dimensions, the environment of the work and the private role might be significant influencing factors on the effect of WHC such that we next focus on the contextual influences of the different roles.

2.3 Contextual Characteristics of the Work and Private Role

Context is important as research has to understand the environment of an individual to understand person-situation interactions (Johns 2006) and to provide clear boundary conditions (Sarker 2016). As employees perform several roles which lead to role conflicts (Ashforth 2001; Madsen and Hammond 2005), the context of each role is important for these incompatibility of roles. As WHC occur because of incompatibility between the work and private roles (Netemeyer et al. 1996) it is obvious that the context of each role in which an employee work and lives is highly important for the effect of the WHC. For example, the effects of WHC might be different for employees with children working full-time compared to those who are childless and only work part-time. Therefore, in line with Greenhouse et al. (1985), we consider the contextual characteristics of the work role and the private which are described in the following.

2.3.1 Contextual characteristics of the work role

Based on the role conflict theory (Ashforth 2001; Madsen and Hammond 2005) we assume that individuals act within different roles such as the work and the private role. However, the work role of each employee is not equal, but rather specified by several characteristics of the work role. For example, the work role is specified based on the discipline such that the role of employees out of technical disciplines such as IT-professionals are different than others (Joseph et al. 2007; Joseph et al. 2015). These professionals are a crucial group of employees in the current knowledge-driven economy (Niederman et al. 2007). To grow and remain competitive, firms depend on IT and in turn on the technical and business knowledge of IT-professionals (Ahuja et al. 2007; Moore 2000). In the context of WHC, past literature focused especially on this unique group of employees (Ahuja et al. 2007; Armstrong et al. 2015; Sarker et al. 2010). In addition, the work role is also specified by the extent of work time (Greenhaus and Beutell 1985). For example, the hours spent at work specify the work role. Past literature demonstrates that the *work time* is an important characteristic of the work role in the context of WHC (Greenhaus and Beutell 1985; Macmillan and Copher

2005). Moreover, the work role is also specified by its location and autonomy. For example, if employees work at home in the afternoon when their children are present, this working situation is significantly different compared to employees working in a silent office. These characteristics such as location and autonomy play a significant role in the WHC context (Sarker et al. 2010). To specify these factors to the work situation, past literature (Gambles et al. 2006; Greenhill and Wilson 2006) focus on whether or not employees *telework.*

2.3.2 Contextual characteristics of the private role

Employees' private roles can also vary considerably, such as but not limited to regarding age or marital status. For example, some employees have partners and children, whereas others are single and live alone. These changes within the private role are reflected in the household life cycle (Bauer and Auer-Srnka 2012). Household life cycles have a long history and are multidisciplinary developed in sociology and applied in several disciplines such as marketing (Nance and White 2009; Neulinger and Simon 2011), economics (Hong and Kim 2000), and IS research (Brown et al. 2006; Brown and Venkatesh 2005; for review see Bauer and Auer-Srnka 2012). A household life cycle is *"based on the assumption that human life is characterized by passing through a certain sequence of stages, and suggests that relations exist between life stage, demographic and behavioral characteristics of individuals"* (Bauer and Auer-Srnka 2012, p. 69). In particular, the household life cycle approach suggests that individuals develop through different stages during the path of their lives. Several household life cycle models concentrate on characteristics such as marital status, age, and the number of children, among others, to assign households to the various stages (e.g., Schaninger and Danko 1993; Wells and Gubar 1966). For instance, the household life cycle models suggest that individuals go from the bachelor life which is characterised by young single persons without children, over the family life which is characterised by old married persons with children up to old single persons which are characterised by old single persons with children (cf. Bauer and Auer-Srnka 2012). Each stage represents another private situation and therefore might has a different effect on the conflict between work and private role.

3 RESEARCH MODEL

In this section, we develop our research model. As shown above, previous literature indicates that antecedents and consequences of WHC have been investigated on a techno and work level (Maier et al. 2015a). The techno level considers the effects regarding IT usage containing the IT-based dimension of WHC and considering IT-based consequences such as IT-based exhaustion (Ayyagari et al. 2011), whereas the work level encompasses the three work dimensions of WHC (Carlson et al. 2000) and considers consequences of WHC based in work processes such as work exhaustion (Ferguson et al. 2016; Moore 2000). IS literature suggests that the techno level also has an impact on the work level (Maier et al. 2015a). In addition, work and private living situations vary through life (Bauer and Auer-Srnka 2012) such that these effects are influenced by contextual characteristics from the work and private role.

Therefore, our model builds on past literature (Maier et al. 2015a) and distinguishes between a techno level and a work level. On the work level, we argue that the work-based WHC dimensions (time-based, strain-based, behavior-based WHC) have an influence on work exhaustion. On the techno level, we assume in line with Ayyagari et al. (2011) that IT-based WHC influences IT-based exhaustion. Afterward, the impact of the techno level on the work level is theorized, and the influences of the contextual characteristics of the work and private role are hypothesized.

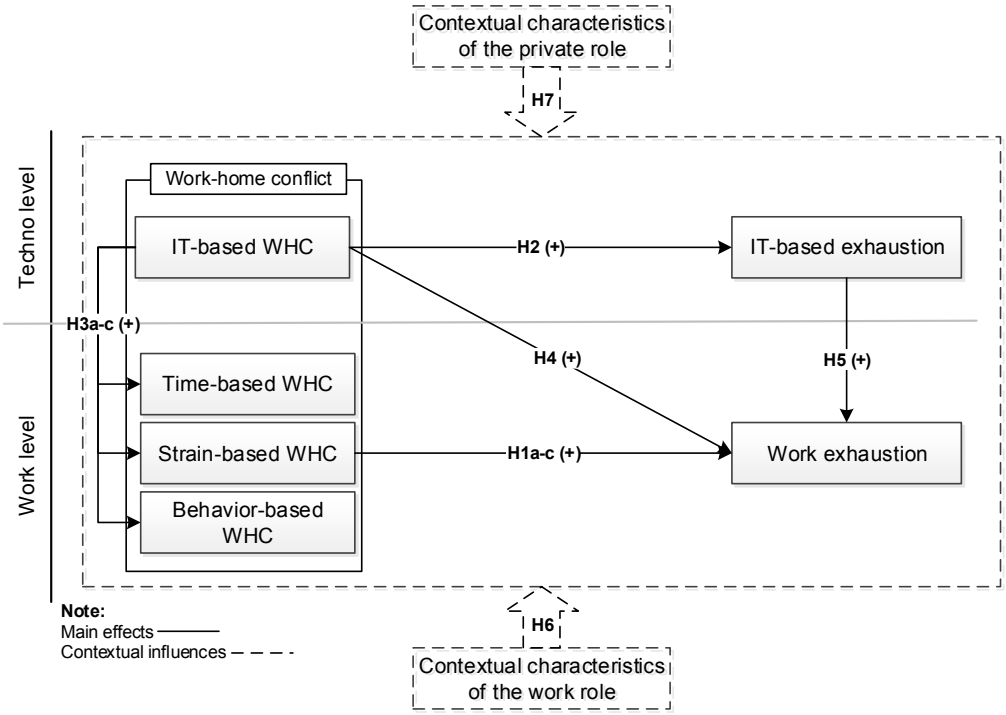

Figure 1: Research model

3.1 The Work Level: The Influence of the Work Dimensions of WHC on Work Exhaustion

In the following, we focus on the work level by hypothesizing the influence of the work dimensions of WHC on work exhaustion. As the literature indicates that WHC consists out of three different dimensions: time-based WHC, strain-based WHC, and behavior-based WHC (Carlson et al. 2000; Greenhaus and Beutell 1985) we also focus on these unique effects.

Time-based WHC considers the conflict of employee's time within different roles. This conflict results because the time pressure within the work role makes it impossible to perform some duties from the private role such that employees are exhausted and drained. This dimension of WHC is based on working hours, the frequency of overtime, and the presence and irregularity of shift work (Greenhaus and Beutell 1985; Netemeyer et al. 1996). Employees, who spend more time in the work role have less time to fulfill their duties in the private role and have less time to recover from work which results in work exhaustion (Ferguson et al. 2016). The competition between the work and private role for the employee's time costs mental resources and reduces recovery time which increases employees' work exhaustion. Hence, we assume that:

H1a: The higher the time-based WHC, the higher the work exhaustion.

Strain-based WHC occurs when tension, anxiety, or fatigue in the work role influences the performance of an employee in the private role (Greenhaus and Beutell 1985; Netemeyer et al. 1996). Negative events (e.g., the conflict between work and private) are attributed to external sources (e.g., work) instead of internal (e.g., private) to maintain positive self-view (Greenwald 1980). Employees more frequently blame WHC on the work role rather than the private role (Poposki 2011). Hence, the work is blamed for the conflicts which occur when employees bring work-based tensions into the private role and are therefore not able to fulfill their responsibilities in this role. As strain perceived in the work role is responsible for this conflict, employees condemn their work for this situation. These increases work exhaustion because they struggle with the work-based tensions as well as the strain-based conflict between the work and their families. Therefore, we presume that:

H1b: The higher the strain-based WHC, the higher the work exhaustion.

Behavior-based WHC occurs when the behavior in the work role affects the behavior in the private role (Carlson et al. 2000). Specific behavior within the work role might be inconsistent with expectations regarding behavior in the private role (Greenhaus and Beutell 1985). As mentioned above, the conflict between work and private life is mostly attributed to the work role in order to maintain a positive self-image (Greenwald 1980; Poposki 2011), which in turn increases the overall work exhaustion. The conflict may occur when employees behave in the private role as if they were in the work role. It increases the overall work exhaustion because the culprit is seen within in the work role. Returning to the example above, employees blame the work role for the struggle which occurs when an employee behaves independently, emotionally stable, aggressively, and objectively in the private role instead of behaving with warmth, emotions, and vulnerability. Hence, when an employee is unable to adjust his behavior to meet the duties in the private role, overall work exhaustion increases because work is blamed for this incompatibility between work and private life. Therefore, we assume that:

H1c: The higher the behavior-based WHC, the higher the work exhaustion.

3.2 The Techno Level: The Effect of IT-based WHC on IT-based Exhaustion

On a techno level, previous research identifies IT-based WHC as an antecedent of IT-based exhaustion, which is understood as the depletion of mental resources due to IT usage (Ayyagari et al. 2011). As the usage of mobile devices and broadband connections make employees potentially reachable twenty-four seven, the boundaries between work and private are blurred (Ayyagari et al. 2011; Sarker et al. 2012). In addition, employees use an increasing number of privately-owned IT rather than enterprise IT at and for work, which blurs the boundary between work and private life (Köffer et al. 2014; 2015) and increases IT-based exhaustion (Ortbach et al. 2013). As employees perceive a conflict between work and private life due to IT usage, the metal resources decrease. Hence, we assume that:

H2: The higher the IT-based WHC, the higher the IT-based exhaustion.

3.3 The Impact of the Techno Level on the Work Level

3.3.1 The effect of it-based on time-, strain- and behavior-based work-home conflict

Prior literature implies a relationship between the techno level and the work level (Maier et al. 2015a). Regarding WHC, research indicates that IT-based WHC has an effect on work-based WHC (Maier et al. 2015a; Turel et al. 2011a). Past literature indicates that IT usage for work purposes in the household increases time-based WHC (Ferguson et al. 2016). Employee roles are no longer restricted by spatial or temporal conditions. Their technical ability to connect to work-related resources at nearly any time and any place using mobile devices blurs the boundaries between work and private (Sarker et al. 2012). As employees can work from almost everywhere using IT, they are able to spend time in the work role even they are at home or on vacation, which decreases the time they can spend on their private life. Furthermore, since employees spend more time in the role in which they are potentially more satisfied (Edwards and Rothbard 2000), they may choose to or feel pressure to work at home, at the expense of spending time fulfilling their duties in the private role (Ferguson et al. 2016). Consequently, we assume that IT-based WHC influences time-based WHC if employees spend even more time in the work role and neglect their private life when boundaries between work and private are blurred due to IT usage. Therefore, we assume that:

H3a: The higher the IT-based WHC, the higher the time-based WHC.

Because the boundaries between work and private are blurred due to IT-based WHC (Ayyagari et al. 2011), the strain symptoms of the work role might have stronger effects on the performance of an employee in the private role. For example, the anxiety or fatigue of employees perceived at work influence the private role stronger because it is not clear when work is over and when private time begins. Employees sometimes use their private cell phone for work purposes, which makes it almost impossible to compartmentalize between work and private because the phone might also ring in the private role (Köffer et al. 2015). Research shows that the usage of IT at home or on vacation for work purposes costs emotional resources and brings

work-related depletion back into the private role (Ferguson et al. 2016). For example, when employees are at home, and their mobile phone rings or they are alerted that a work e-mail has arrived, work issues come up, which result in work anxiety or fatigue into the private role, and in turn, increase strain-based WHC. Hence, we believe that:

H3b: The higher the IT-based WHC, the higher the strain-based WHC.

Behavior-based WHC results when behavior within the work role is inconsistent with expectations regarding behavior in the private role (Carlson et al. 2000). Inappropriate behavior within the household role might occur because the boundaries between work and private are blurred because of IT usage. Because work and private role are blended, there is no longer a clear physical separation between these roles, which shortens or eliminates the phase in which employees switch their behavior. Thus, role- and location-specific behavior is no longer clearly differentiated due to the blending of work and private boundaries (Duxbury et al. 1992). Employees might not be aware whether they are in the job role or the private role and hence behave inappropriately. Prior findings show that work-based IT usage in the household or on vacation creates behavior-based WHC because work behavior is needed during the use of IT which is not helpful in the private role (Ferguson et al. 2016). For example, if employyes are at home and handling critical issues with their colleagues and directly afterward have to put their children to bed, they might unintentionally treat their children as colleagues or subordinates without warmth and emotions. Therefore, we assume that IT-based WHC influences behavior-based WHC.

H3c: The higher the IT-based WHC, the higher the behavior-based WHC.

3.3.2 The effect of it-based whc on work exhaustion

Past literature provides evidence that the conflict between roles significantly influences work factors such as job satisfaction or performance (Tarafdar et al. 2007). Many employees depend heavily on IT during their work, and it is very common to use computers and cell phones for work purposes. As IT is so intricately tied to work processes (Laumer et al. 2016), some employees are not able to accomplish their work goals without using IT. As IT and work are so tightly related, the blurred boundaries between work and private not only lead to IT-based exhaustion but may also directly influence work exhaustion, because the IT usage is such an integral part of their daily work, and they might not be able to differentiate between work and IT, such that we assume:

H4: The higher the IT-based WHC, the higher the work exhaustion.

3.3.3 The effect of it-based exhaustion on work exhaustion

Previous literature provides evidence that IT-based exhaustion increases work exhaustion (Maier et al. 2015a) and since IT usage is an important part of many modern jobs, employees who are exhausted due to IT usage (Ayyagari et al. 2011) may also be exhausted within the job. When employees are drained or exhausted because of IT usage, they are less energetic and are frustrated at work such that their work exhaustion increases. Hence, we assume that:

H5: The higher the IT-based exhaustion, the higher the work exhaustion.

3.4 Contextual Influence of the Work and Private Role

We assume that the work role is specified by contextual characteristics of the present work situation. Past literature indicates that the characteristics of the work role are known as influencing factors of the WHC dimensions (e.g., Greenhaus and Beutell 1985; Kreiner 2006). Therefore, we assume that the effects of the different WHC dimensions are influenced by work characteristics such as IT-professionals, working hours, and teleworking. WHC has especially investigated in the context of IT-professionals (Ahuja et al. 2007; Armstrong et al. 2015; Sarker et al. 2010). Research suggests that the balance between work and private is especially important by IT-professionals as the likelihood for organizations to losing them is high and predicts a crucial issue for firms (Sarker et al. 2010). The structure of work and the individual mindsets toward work are different for IT-professionals and therefore influences the WHC (Dinger et al. 2010) such

that the effects of the different WHC dimensions vary between IT-professionals and non-IT-professionals. In addition, past literature shows that WHC is positively related to the number of hours worked per week (Greenhaus and Beutell 1985). Results show that part-time employees are more likely to experience private role-related conflicts than full-time employees (Hall and Gordon 1973). For example, employees who work only part-time might perceive a lower time-based WHC because they have enough time left to fulfill their private duties such that the effect of different WHC dimensions vary between full-time and part-time employees. Literature suggests that telework influences WHC as it provides employees with higher job flexibility (e.g., Hill et al. 2001). Teleworking enables employees to work across time and place which lead to working overtime (Gambles et al. 2006) such that the time-based WHC is even stronger. Employees might not have more time for their family while working from home because the activities are mutually exclusive and hence lead to increased WHC (Greenhill and Wilson 2006). For example, when employees work from home and have to meet a deadline for a tender while cooking lunch for their children at home, the strain-based WHC might be stronger such that the effects of different WHC dimensions vary between teleworker and non-teleworker. Hence, we assume that:

H6: The contextual characteristics of the work role influence the effects of the four WHC dimensions.

We also assume that the private role is specified by contextual characteristics from the present private situation. We theorize that the effects of the different WHC dimensions at various stage of the household life cycle may not be the same because the characteristics of the different life cycle stages such as marital status, age, and children (Bauer and Auer-Srnka 2012) are known as influencing factors on the WHC dimensions (e.g., Greenhaus and Beutell 1985; Kreiner 2006). Marital status is thereby defined broadly to include two adults cohabitating. This includes same-sex couples such that we classified in line with Brown and Venkatesh (2005) individuals who are single, divorced, or widowed as a single person living alone and individuals who are a couple, engaged, married, or registered civil partnership as two adults living together. In line with Wells and Gubar (1966), we differentiate between young people (under and equal 45 years) and old people (46 years and older) and we consider whether the participants have one or more children or are childless. For example, the marital status influences the effect of the different WHC dimensions because the duties within the private role might be higher when living in a marriage or as a couple such that more time is needed and the strain is higher which results in higher work exhaustion. On the contrary, singles might face fewer duties from the private role such that employees in this life cycle stage are experiencing less work exhaustion. Furthermore, older employees show a stronger conflict between work and private than younger employees (Turel et al. 2011a), one explanation might be because older employees might not be able to balance the duties from work and private life such that the conflict is stronger and has greater effects. It might be obvious that the presences of children influence the effects between the WHC dimensions and their consequences. For example, the duties of parents are higher than for no-parents such that the time-based WHC is greater because parents should spend some time with their children which cannot be spent otherwise. Hence, we assume that:

H7: The different household life cycle stages influence the effects of the four WHC dimensions.

4 RESEARCH METHODOLOGY: DESIGN AND MEASUREMENT

In this section, we describe our research design and data collection process to validate our research model. To validate the research model, we collected data using an online survey. Our institute cooperates with a human resources (HR) organization that provides HR services to both organizations and employees. We randomly selected one thousand employees from the customer database of the project partner and sent them the hyperlink to our questionnaire. We received 834 responses, which reflects a response rate of 83,4 percent. We based our research on the responses from 542 employees who submitted complete surveys and who had the requisite level of work experience. The sample reflects a suitable data sample for our research as the majority currently have a job and are between 35 and 54 years old. The demographics of the participants are listed in Table 1.

On the IT level, we measured IT-based WHC and IT-based exhaustion by adopting the scales by Ayyagari et al. (2011) . On the work level, we measured the three work-dimensions of WHC using the scale proposed by Carson et al. (2000) and drawing on the work exhaustion scale proposed by Ahuja et al. (2007). All items were measured on a 7-point Likert scale ranging from 1 (strongly agree) to 7 (strongly disagree). Because negative perceptions such as work exhaustion might skew distributions (Turel et al. 2011b), and since partial lease square (PLS) does not require normally distributed data (compared to covariance-based structural equation modeling), we use structural equation modeling (SEM) in terms of SmartPLS 3.2.2 (Ringle et al. 2015). In addition, we used SPSS 23.0 to calculate the demographics and test for mediation effects.

Table 1. Study participant

General demographics (N=542)		Private characteristics			Work characteristics	
Gender (%)		Age (%)			Work time (%)	
Men	60.1	15-24	.2		Full-time	60.9
Women	39.9	25-34	17.0	45.8	Part-time	36.5
Educational status (%)		35-45	28.6		Currently no contract	2.6
Vocational training	31.5	46-54	34.5		Teleworking (%)	
University degree	51.7	55-65	18.4	54.2	Non-teleworking	48.7
PhD	5.4	Over 65	1.3		Teleworking	51.3
Other	11.4	Marital status (%)			IT-professionals (%)	
		Single living alone		32.1	Non-IT-professionals	88.5
		Married or couple living not alone		67.9	IT-professionals	11.5
		Children (%)				
		No children		45.0		
		One or more children		55.0		

5 RESEARCH RESULTS

Before presenting our results, we will demonstrate that our data are not subjected to common method bias (CMB) and that the research model is valid and reliable following generally accepted thresholds of validity and reliability.

5.1 COMMON METHOD BIAS

Perceived and subjective measures are used to capture employees' responses to a given situation. A potential issue with subjective measures is common method bias (Podsakoff et al. 2003). To evaluate the extent of CMB, we utilize Harman's single factor test (Harman 1976) and the procedure suggested by Williams et al. (2003). The results of the Harman's single factor test show that one factor explains 32.7% of the variance, which is not the majority, such that we conclude that CMB is of no great concern. Furthermore, we follow the procedure suggested by Williams et al. (2003), during which an additional factor is entered into the PLS model, which contains each indicator of the origin model. The remaining factors are transformed into single-item constructs, and the ratio of R^2 with the CMB factor is compared with the R^2 without the CMB factor. The CMB factor explains an average R^2 of 0.003 so that a ratio of 1:217 is received. By comparing this ratio with the ratio of prior research using this approach (Liang et al. 2007), we can state that no signs of CMB influence are observed despite several flaws in this method (Chin et al. 2012).

5.2 MEASUREMENT MODEL

To ensure that the measurement model we chose to test our hypotheses is valid and reliable and as we measured all constructs with reflective indicators, we validated the measurement model in terms of content validity, indicator reliability, construct reliability, and discriminant validity (Bagozzi 1979).

Table 2: Measurement model of overall sample

		Mean	SD	AVE	CR	Loadings	1	2	3	4	5	6	7	8	9	10	11	12
1	IT-based WHC	4.43	1.47	.763	.906	.733-.852	.879											
2	Strain-based WHC	3.47	1.54	.802	.941	.828-.924	.385	.896										
3	Time-based WHC	3.36	1.35	.719	.927	.754-.894	.363	.621	.849									
4	Behavior-based WHC	4.14	1.33	.590	.881	.736-.816	.337	.462	.333	.771								
5	Marital status	1.54	.50	NA	NA	NA	-.050	.029	.003	.008	NA							
6	Age	1.46	.50	NA	NA	NA	.017	.050	.065	.055	.188	NA						
7	Children	1.55	.50	NA	NA	NA	.059	.100	.029	.044	.465	.376	NA					
8	Teleworking	1.51	.50	NA	NA	NA	-.102	.042	-.025	.049	.123	.117	.125	NA				
9	Work time	1.37	.48	NA	NA	NA	.084	.127	.051	.129	.003	-.068	-.042	.089	NA			
10	IT-professionals	1.88	.32	NA	NA	NA	-.024	.006	.026	-.008	-.019	.043	-.035	-.102	-.082	NA		
11	IT-based exhaustion	5.29	1.54	.869	.964	.890-.950	.466	.420	.316	.358	.035	.056	.125	.012	.120	-.113	.932	
12	Work exhaustion	4.31	1.67	.817	.922	.879-.930	.345	.629	.482	.342	.048	.161	.174	.098	.142	-.010	.527	.905
Note: Square root of AVE is listed on the diagonal of bivariate correlations; NA = not applicable because of single item construct																		

Content validity: To ensure content validity, we used items that have been used in prior research articles (see Appendix Table 10) and discussed each item within our project team and with the managers of our cooperation partner. Regarding the contextual variables, all variables are measured by categorical variables. Marital status is coded with one for singles living alone and with two for two adults living together. In line with the household life cycle (Wells and Gubar 1966), age is coded with one for employees under or equal 45 years and with two for employees over 45 years. Children are codes with one for no children and with two for one or more children. Teleworking is coded with one for non-teleworker and with two for teleworker. Work time is coded with one for full-time employees and with two for part-time employees. IT-professionals is coded with one for IT-professionals and with two for non-IT-professionals.

Indicator reliability: This reflects the rate of the variance of an indicator that comes from the latent variables. To ensure that 50 percent or more of the variance is explained by the indicators, each value should be at least 0.707 (Carmines and Zeller 2008). All other items which have not been fulfilled this threshold were removed from the model. Table 2 shows that this condition is fulfilled, and moreover, each loading has a significance level of at least 0.001.

Construct reliability: To determine construct quality, we use composite reliability, which should be at least 0.7, and average variance extracted (AVE), which has to be at least 0.5 (Fornell and Larcker 1981). Both criteria are fulfilled (see Table 2). Also, the Cronbach's Alpha values of all constructs in the model are higher than 0.7 (see Appendix Table 10).

Discriminant validity: This reflects the extent to which items differ from other items (Campell and Fiske 1959). The square root of AVE should be greater than the corresponding construct correlations (Fornell and Larcker 1981; Hulland 1999). Table 2 shows that the square roots of the values are greater than the corresponding correlations between the constructs. As Henseler et al. (2015) state, the Fornell-Larcker criterion does not detect a lack of discriminant validity in each case. Hence, we also ensured that the most conservative 0.85 heterotrait-monotrait (HTMT) criterion is fulfilled. As the highest correlation between strain-based WHC and work exhaustion is 0.77 – and hence lower than 0.85 – and the bootstrapping approach shows that HTMT is in each sample significantly different from 1, we can state that discriminant validity using $HTMT_{0.85}$ is not an issue in the present research. We thus conclude that our measurement model is valid.

5.3 Structural Model

To validate the structural model displayed in Figure 2 we use the coefficient of determination (R^2) and the significance levels of the path coefficients (Chin 1998b). On the work-level, work exhaustion is positively influenced by time-based WHC and strain-based WHC, whereas the behavior-based WHC has an insignificant effect on work exhaustion. These results support H1a, H1b and do not support H1c. On the techno level, our results show that IT-based WHC significantly influences IT-based exhaustion, which

supports H2. By focusing on the effect of the techno level on the work-level, results show that IT-based WHC positively influences time-based WHC, strain-based WHC, behavior-based WHC, which support H3a, H3b, and H3c. Also, the influence of IT-based WHC on work exhaustion is insignificant, which does not support H4. Furthermore, the results show that IT-based exhaustion significantly increases work exhaustion, which supports H5.

Also, we controlled whether the contextual characteristics have a direct effect on work exhaustion. Findings show that none has a significant direct effect on work exhaustion,

Turning to the coefficient of determination (R^2), we can demonstrate that on a work-level, 51.2 percent of the variance of work exhaustion is explained. On a techno level, 23.1 percent of the variance of IT-based exhausted is explained. Also, results show that 13.7 percent of the variance of time-based WHC, 16.3 percent of strain-based WHC, and 10.4 percent of behavior-based WHC is explained by IT-based WHC.

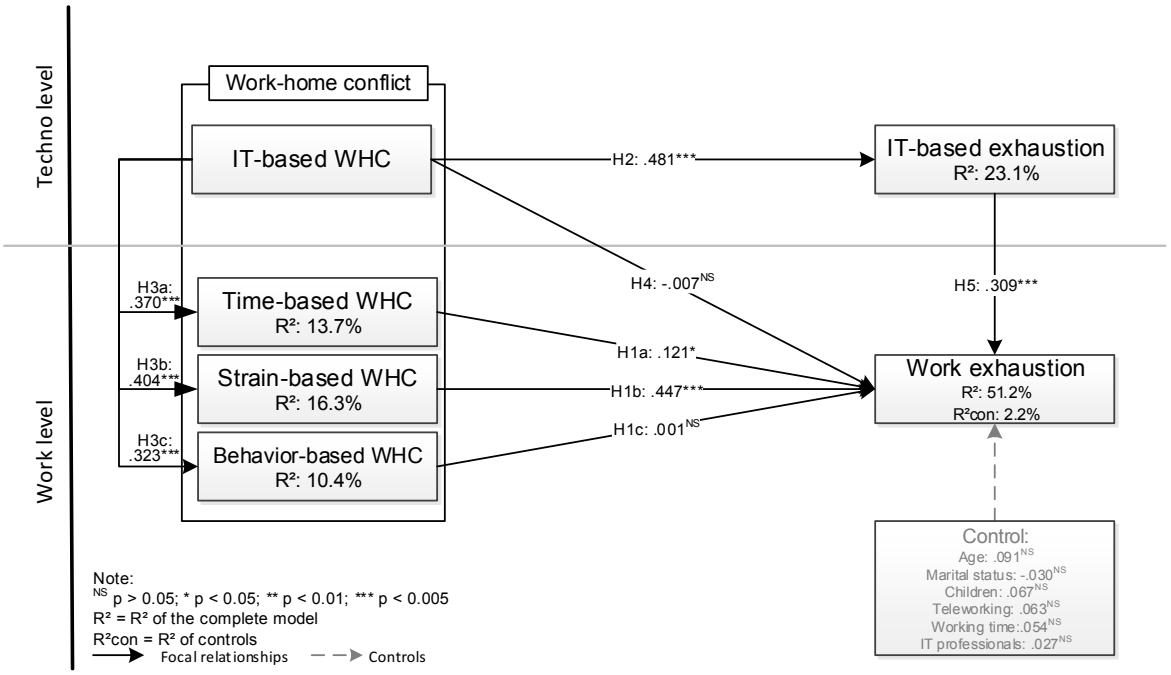

Figure 2: Structural model

5.4 MULTIGROUP ANALYSIS

To validate the contextual influences, we applied several multiple-group analysis SEM (MGA) to analyze differences in the structural models between the identified contextual characteristics of the work and private role, to validate H6 and H7. The MGA compares the structural model across different groups. This approach is similar to an ANOVA; but, instead of the comparison of the groups means, the approach compares the groups in terms of a system of relations between several latent variables (Henseler et al. 2009). Before performing the MGA, we first test the measurement model of invariance, which is a requirement for this type of analysis. Subsequently, we show the MGA results for the different contextual influences on the work and private role.

5.4.1 Testing measurement model invariance

To assess measurement invariance, we draw on the measurement invariance of composite models (MICOM) procedure by Henseler et al. (2016b). The MICOM involves three steps: (1) configural invariance (i.e., equal parameterization and way of estimation), (2) compositional invariance (i.e., equal indicator weights), and (3) the equality of composite mean values and variances. If configural and compositional invariance are established (step one and two), partial measurement invariance is confirmed, which allows us to compare the relationships across the various groups. Also, if partial measurement invariance holds and the

composites' mean values and variances are equal across the groups, full measurement invariance is confirmed, which supports the pooled data analysis. The detailed results of invariance test are presented in the Appendix. In line with past literature (Hair et al. 2018, p. 146), we excluded the variables from the multigroup analysis where configural and compositional invariances are not established such that we are able to compare the work and private characteristic across each other.

5.4.2 Results of the multigroup analysis of the contextual influences on the work role

Table 3 shows the differences in comparisons' path coefficient estimates for the three work characteristics and provides the results of comparisons based on the Henseler's (2009) approach for each characteristic. Results reveal a significant difference of path coefficients by IT-based WHC on time-based WHC between IT-professionals and non-IT-professionals such that the effect is stronger for IT-professionals. Between full-time and part-time employees, the results indicate two significant path coefficients such as strain-based WHC on work exhaustion and IT-based WHC on strain-based WHC. In particular, the influence of strain-based WHC on work exhaustion is stronger for part-time employees compared to full-time employees. The same applies for the influence of IT-based WHC on behavior-based WHC. Between the non-teleworker and the teleworker group, we found no significant differences. In sum, some effects of the WHC dimensions are influenced by contextual characteristics of the working situation which partially supports H6.

Table 3: Multigroup comparison test results work characteristics

	Work characteristics					
	IT-professionals (IT-professionals – non-IT-professionals)		**Work time (full-time – part-time)**		**Teleworking (non-teleworking - teleworking)**	
Relationship	|Δ|	p	|Δ|	p	|Δ|	p
Time-based WHC -> work exhaustion	.037	.599	.089	.165	.009	.541
Strain-based WHC -> work exhaustion	.060	.338	**.177**	**.957**	.066	.750
Behavior-based WHC -> work exhaustion	.153	.146	.068	.210	.017	.420
IT-based WHC -> work exhaustion	.172	.897	.076	.196	.083	.172
IT-based WHC -> time-based WHC	**.226**	**.023**	.029	.374	.065	.771
IT-based WHC -> strain-based WHC	.145	.096	**.141**	**.952**	.090	.855
IT-based WHC -> behavior-based WHC	.096	.213	.068	.769	.013	.446
IT-based WHC -> IT exhaustion	.025	.389	.034	.665	.057	.758
IT exhaustion -> work exhaustion	.080	.260	.015	.568	.033	.351
Note: |Δ| = Modulus of the delta between first and second group; p between .05 and .95 = insignificant, significant effects are bold and shaded, one-tailed bootstrapping;						

5.4.3 Results of the multigroup analysis of the contextual influences on the private role

To validate H7, we analyze whether the effects of the different WHC dimensions vary along the household life cycle stages. The sample has been broken down into the different life cycle stages based on the three key household life cycle stages variables such as marital status, age, and children. Consistent with past literature (see Brown et al. 2006; Brown and Venkatesh 2005; Schaninger and Danko 1993) we merged and simplified several stages as some stages would collapse because the given sample size would not be sufficiently large in all stages. The merging of the various stages has been theoretically justified as we considered similarities between the stages. Also, we ensured by the simplification of the stages that the characteristics of the stages are given. For example, although we only consider whether or not the individual has children and neglect the age of the children because of sample size issues the characteristics of the stage remain the same. Therefore, we consider in the following the six stages which are demonstrated in Table 4.

Table 4: Household life cycle stages

#	Household life cycle stage	Marital status[a]	Age[b]	Children[c]	N[d]
1	Bachelor I	Single person living alone	Under or equal 45	None	131
2	Bachelor II & III	Single person living alone	Older 45	None	62
3	Single parent	Single person living alone	Any age	One or more	97
4	Newlywed & full nest I & II	Two adults living together	Under or equal 45	One or more	57
5	Delayed full nest & full nest III	Two adults living together	Older 45	One or more	140
6	Childless couple & older couple	Two adults living together	Any age	None	59

Note:
Marital status is defined broadly to include two adults cohabitating. This includes same-sex couples such that we classified In line with Brown and Venkatesh (2005) individuals who are single, divorced, or widowed as a single person living alone and individuals who are a couple, engaged, married, or registered civil partnership as two adults living together.
In line with Wells and Gubar (1966), we conceptualize age as binary variables under and equal 45 years or older 45 years.
In line with Gilly and Enis (1982), we use a categorical variable to represent children, however, because of sample size issues we neglect the age of the children and differentiate only between no or one or more children.
According to the rule of ten (Hair et al. 2011), the sample sizes are sufficient.

To compare the different life cycle stages, we must compare more than one group. To do so, we perform the omnibus test of group differences (OTG) approach by Sarstedt et al. (2011).

First, we assess if the path coefficients are equal across the six groups demonstrated in Table 4. Therefore, we followed the four steps of the OTG approach. The analysis reveals that in respect of all structural model relations, the null hypothesis that the path coefficients are equal across the six groups can be rejected. In detail, the analysis yields F_R values (we used the code file for R (R-Development-Core-Team, 2011), which performs the approach. Available under https://www.pls-sem.net/downloads/advanced-issues-in-pls-sem-1) of 4.015584 (time-based WHC -> work exhaustion), 4758.223 (strain-based WHC -> work exhaustion), 3037.237 (behavior-based WHC -> work exhaustion), 2100.302 (IT-based WHC -> work exhaustion), 6565.252 (IT-based WHC -> time-based WHC), 4693.344 (IT-based WHC -> strain-based WHC), 1600.164 (IT-based WHC -> behavior-based WHC), 9867.404 (IT-based WHC -> IT exhaustion), 751.1894 (IT exhaustion -> work exhaustion), rendering all differences significant at $p<0.01$. These results show that in respect of all relationships, at least one path coefficient differs from the remaining five across the different life cycle stages.

Second, we conducted a pairwise comparison by comparing each path coefficient across the six groups to analyze the differences more precisely. For each comparison, we draw on the nonparametric PLS-MGA approach by Henseler et al. (2009). This approach compares each bootstrap estimate of one group with all other bootstrap estimates of the same parameter in the other groups. The results summarized in Table 5 show that there are several differences between the life cycle stages which partially supports H7. In particular, we revealed significant differences between the "bachelor I" stage (1) and the "single parent" stages (3) as well as "newlywed & full nest I & II" (4) regarding the influences from strain-based WHC on work exhaustion such that the influence is significantly stronger in the "bachelor I" stage (1). Differences between the "single parent" stage (3) and the stages "newlywed & full nest I & II" (4) and "childless couple & older couples" (6) regarding the influences of IT-based WHC on time-based WHC has been identified which show that this influence is stronger in stages four and six. Also, the influence of IT-based WHC on strain-based WHC significantly differs between the stages "single parent" (3) and "delayed & full nest & full nest III" (5) as well as between "delayed & full nest & full nest III" (5) and "childless couple & older couples" (6) which shows that in both cases the influence is stronger in stage five. In addition, regarding the effect of IT-based WHC on IT exhaustion, we revealed differences between the stages "bachelor II & III" (2) and "single parent" (3) which demonstrate that this influence is stronger for the "single parent" stage (3).

Table 5: Multigroup comparison test results of the household life cycle stages

	Comparison of the household life cycle stages																											
	1 vs. 2		1 vs. 3		1 vs. 4		1 vs. 5		1 vs. 6		2 vs. 3		2 vs. 4		2 vs. 5		2 vs. 6		3 vs. 4		3 vs. 5		3 vs. 6		4 vs. 5		4 vs. 6		5 vs. 6	
Relationship	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p	|Δ|	p
Time-based WHC -> work exhaustion	.160	.822	.133	.810	.289	.924	.038	.630	X	X	.027	.444	.128	.707	.123	.241	.016	.532	.155	.763	X	X	.042	.591	.251	.103	.113	.306	.138	.820
Strain-based WHC -> work exhaustion	.285	.066	**.304**	**.020**	**.366**	**.029**	.211	.051	X	X	.019	.458	.081	.365	.074	.642	.017	.528	.062	.379	.093	.753	.036	.597	.155	.793	.098	.687	.057	.354
Behavior-based WHC -> work exhaustion	.083	.710	.134	.847	.098	.735	.023	.591	X	X	X	X	.014	.536	X	X	.181	.835	.036	.423	.111	.192	.131	.790	.075	.307	.167	.820	.242	.946
IT-based WHC -> work exhaustion	X	X	.137	.835	.087	.277	.052	.687	X	X	.114	.740	.110	.270	X	X	.057	.618	.224	.089	.085	.268	.057	.369	.139	.837	.167	.827	.028	.575
IT-based WHC -> time-based WHC	X	X	.212	.057	.129	.833	.097	.826	.117	.783	.178	.165	.162	.817	X	X	.150	.780	**.341**	**.988**	X	X	**.329**	**.972**	.113	.818	.012	.483	.020	.580
IT-based WHC -> strain-based WHC	X	X	.196	.065	.091	.249	.022	.581	.297	.052	.024	.434	.081	.652	X	X	.125	.292	.105	.759	**.217**	**.969**	.101	.309	.032	.378	.206	.153	**.318**	**.031**
IT-based WHC -> behavior-based WHC	X	X	.121	.841	.149	.842	.019	.562	.027	.579	X	X	.114	.717	X	X	.122	.712	.028	.602	.102	.176	.095	.274	.130	.168	.123	.241	.008	.538
IT-based WHC -> IT exhaustion	X	X	.030	.392	.034	.408	.128	.095	.114	.202	**.377**	**.992**	X	X	.279	.969	.293	.947	.004	.496	.098	.194	.084	.289	.094	.239	.080	.310	.014	.552
IT exhaustion -> work exhaustion	.010	.476	.065	.311	.014	.464	.074	.245	X	X	.055	.359	X	X	.064	.318	.112	.251	.051	.622	.009	.466	.056	.351	.060	.343	.107	.268	.047	.359

Note: |Δ| = Modulus of the delta between first and second group; p between .05 and .95 = insignificant, significant effects are bold and shaded, one-tailed bootstrapping; X = No multigroup analysis possible because of invariance

5.5 Post-hoc Analysis: Mediation and Total Effects

Our findings demonstrate that IT-based WHC has no direct effect on the work exhaustion. As past literature shows an effect between the techno level and the work level (Maier et al. 2015a; Turel et al. 2011a), IT-based WHC might have an indirect effect on work exhaustion. To validate whether the influences of IT-based WHC on work exhaustion is mediated by time-based WHC, strain-based WHC, behavior-based WHC, or IT-based exhaustion, we use a bootstrapping method as suggested by Preacher and Hayes (Preacher and Hayes 2004). The method suggests calculating the 95 percent-bias-corrected confidence intervals (1,000 bootstrap resamples) of each independent variable. If zero does not lie within the bias-corrected interval, the independent variable has an indirect effect through the mediator on the depended variable. The results show that IT-based WHC indirectly affects work exhaustion through IT-based exhaustion, time-based WHC, strain-based WHC, and behavior-based WHC.

In addition, we provide the total effects of the four WHC dimensions on work exhaustion. Our findings indicate that strain-based WHC has the highest total effect on work exhaustion, whereas IT-based WHC shows the second highest effect followed by time-based WHC. These results are presented in Table 6.

Table 6: Indirect and total effects of IT-based WHC on work exhaustion

Independent variable (IV)	Mediator (M)	Dependent variable (DV)	Bootstrapping results overall sample		
			Lower	Upper	Indirect effect
IT-based WHC	IT-based exhaustion	Work exhaustion	.223	.377	Yes
IT-based WHC	Time-based WHC		.113	.231	Yes
IT-based WHC	Strain-based WHC		.204	.361	Yes
IT-based WHC	Behavior-based WHC		.064	.179	Yes
Total Effects					
IT-based WHC	->	Work exhaustion	.265		
Time-based WHC	->		.116		
Strain-based WHC	->		.453		
Behavior-based WHC	->		-.002		

6 Discussion and Implications

Most previous literature treats WHC in an aggregated or unidimensional fashion and fails to consider the dimensions of WHC. As a result, organizations and governments often treat IT usage as the main source and symbol of WHC and have implemented laws and policies to restrict access to work-related IT from home to reduce WHC. This study distinguishes IT- from work-based dimensions and theorizes their effect on work exhaustion, based on findings that WHC is a major predictor of work exhaustion. Specifically, we investigate the effect of the IT-based dimensions of WHC as well as the work-based dimensions of WHC: time-, strain-, and behavior-based WHC. Understanding the dimensions of WHC can help organizations and governments move beyond IS usage restrictions to identify and prevent the negative consequences of each dimension for employees, such as work exhaustion.

In general, the findings of the present study align well with previous research results (Ahuja et al. 2007; Ayyagari et al. 2011; Maier et al. 2015a). As in previous studies, we confirm a connection between employee exhaustion and IT usage and their work role (Ahuja et al. 2007; Ayyagari et al. 2011). We provide further evidence for the previous conclusion that employees who are exhausted by the usage of IT also perceive a higher work exhaustion (Maier et al. 2015a). Moreover, our results align with Ayyagari et al. (2011) who identified a significant relationship between IT-based WHC and IT-based exhaustion.

In addition, we provide new insights which go beyond the results of previous research. As discussed above, prior IS research related to WHC consider it only at a techno level, focusing only on to what degree WHC relates to IT usage (Köffer et al. 2015; Turel et al. 2011a) or, at the work level, identifying IT professionals' perception of work-based WHC (Ahuja et al. 2007; Sarker et al. 2010). Furthermore, most previous IS research only adopts a one-dimensional or aggregated focus on WHC and neglects its multidimensionality, as demonstrated above. The present study theorizes and empirically validates the influence of multiple dimensions of WHC on work exhaustion. The results also show that IT-based WHC has no direct effect on work exhaustion, but rather that time-based WHC and strain-based WHC are the major dimensions of WHC, which influences work exhaustion. In contrast, IT-based WHC only indirectly affects work exhaustion. Moreover, we demonstrate that the work and private contextual characteristics influence the effects of the WHC dimensions. These additional findings contain several theoretical and practical contributions, which are discussed below.

6.1 THEORETICAL IMPLICATIONS

The current research focuses on the WHC construct by considering the different dimensions of WHC (Ayyagari et al. 2011; Greenhaus and Beutell 1985), which are either based on IT usage or work in general. The theoretically developed and empirically evaluated research model is the first approach in WHC research to consider four dimensions of WHC, differentiate between a techno level and a work level, and consider the influence of the techno level on the work level. Moreover, we examine the contextual influences on the work and private role which specifies each role and hence determine the effects of the WHC dimensions. The paper's contributions to the literature are illustrated in Figure 3 and explained in the following.

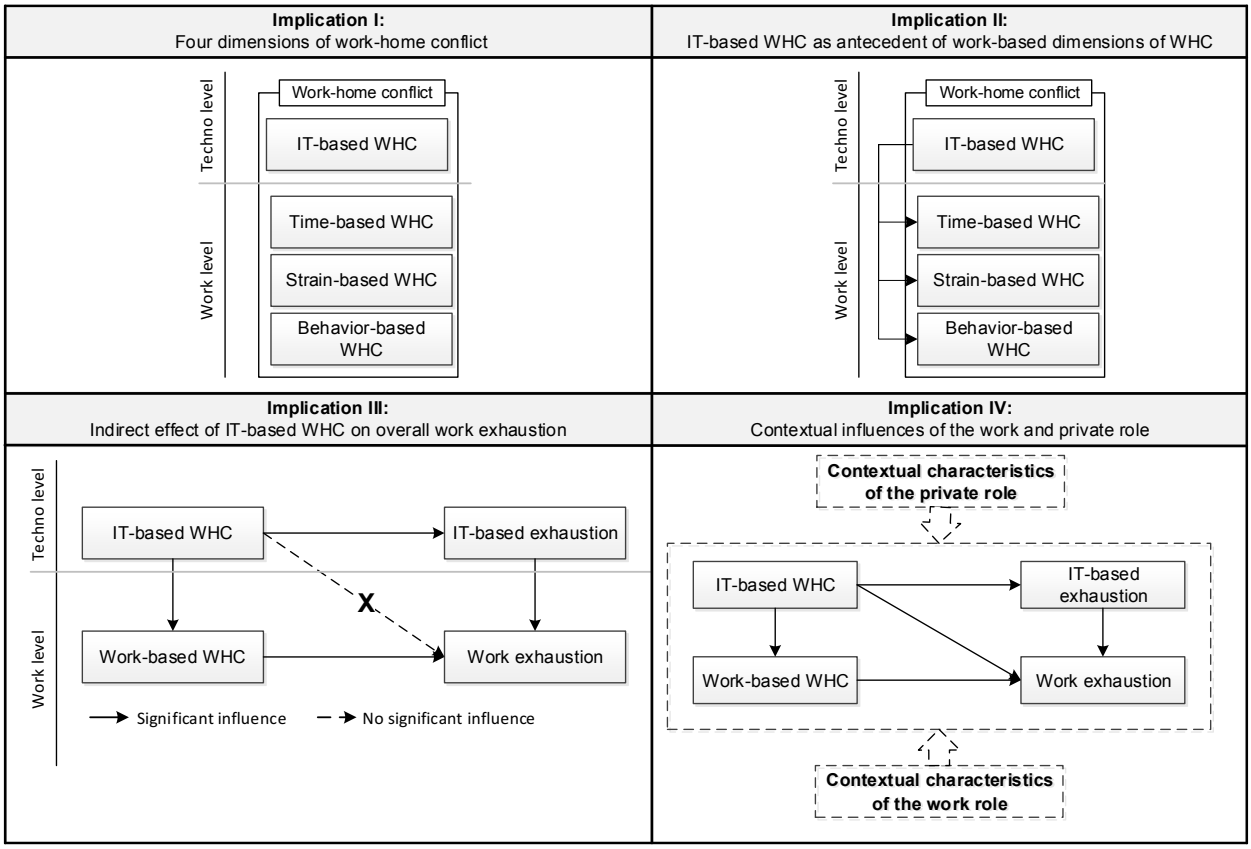

Figure 3: Theoretical implications of the present examination

6.1.1 Four dimensions of work-home conflict

Our study contributes by theorizing and empirical validating that WHC has four distinct dimensions (see Figure 3 implication I): strain-based, time-based, behavior-based, and IT-based WHC. We demonstrate that, in addition to the three work-based dimensions, WHC also has an IT-based dimension.

The present paper thus extends prior general WHC research, such as Greenhaus et al. (1985) and Carlson et al. (2000), who establish that WHC encompasses three work-based dimensions, by demonstrating that in addition to these work dimensions, WHC also has an IT-based dimension. IT devices such as laptops and smartphones in combination with broadband connections are blurring the boundaries between work and private life by providing increased access to work-related stimuli at home (Köffer et al. 2015; Turel et al. 2011a). Therefore, we contribute to the general psychological literature by indicating that in addition to resulting from time, strain, and behavior incompatibility, WHC also results from work-related IT usage at home.

By using this extended conceptualization of WHC, we also contribute to research into WHC in a general work context. Our focus on the WHC constructs provides results which go beyond results of prior single-dimensional studies. In particular, the results enhance prior work by Ahuja et al. (2007) who investigate WHC as antecedents of work exhaustion among so-called IT road warriors (IT-professionals who spend most of their working week away from home at a client site). By narrowing our focus on WHC and investigating the effect of four dimensions of WHC on work exhaustion, our results show that WHC is multidimensional and that two of the four dimensions, namely time-based WHC and strain-based WHC, significantly influence work exhaustion. In other words, the time incompatibilities between work and private life and the strain transferred from the work role to the private role are the major reason why WHC increases work exhaustion. IT-based and behavior-based incompatibilities between work and private life have no direct effect on work exhaustion. Also, we extend prior WHC work, such as Sarker et al.'s (2010), who investigated antecedents of a general work-based WHC, or Turel et al.'s (2011a) and Köffer et al.'s (2014), who investigated only IT-based WHC, by revealing that WHC is multidimensional and contains an IT-based dimension and three work dimensions.

In summary, we contribute to WHC literature by illustrating that WHC is multidimensional and contains work and IT dimensions. Future studies focusing on WHC should use this extended WHC conceptualizing to test the effect of these four dimensions in different contexts and more precisely identify the sources of WHC. In our study, we revealed only significant influences of time- and strain-based WHC on work exhaustion.

6.1.2 IT-based whc as an antecedent of work-based dimensions of whc

Prior literature shows that WHC has been investigated either on a techno level or a work level (Ahuja et al. 2007; Ayyagari et al. 2011). This study of the WHC construct reveals four WHC dimensions as well as a significant relationship between the IT-based and the work-based WHC dimension. We theorized based on previous literature indicating that IT factors influences work factors (Maier et al. 2015a) that general time-, strain-, and behavior-based WHC are influenced by an IT-based WHC (see Figure 3 implication II). We argue that the usage of IT enables employees to spend time in the private role on work duties and facilitates pressure on employees to access work-related content at all times. This theoretically derived influence is validated by our study.

Hence, our study contributes to research as we extend the results of Ayyagari et al. (2011) by indicating that IT-based WHC influences not only IT-based exhaustion but also directly influences work-based dimensions of WHC. In addition, our results extend research focused on the work dimensions of WHC (Ahuja et al. 2007; Sarker et al. 2010) by revealing IT-based WHC as a direct antecedent of WHC on the work level. Moreover, our findings extend prior literature such as Turel at al. (2011a), who demonstrate that IT-based WHC has an effect on work-based WHC, by providing evidence that IT-based WHC significantly affects time-based, strain-based, and behavior-based WHC. Furthermore, this result also extends general

WHC literature such as Greenhaus et al. (1985) and Carlson et al. (2000) by revealing that IT-based WHC is not only an additional dimension of WHC, but also a direct antecedent of time-based WHC, strain-based WHC, and behavior-based WHC.

In summary, we contribute to WHC literature and psychological WHC literature by theorizing and providing empirical evidence for IT-based WHC as a direct antecedent of time-based WHC, strain-based WHC, and behavior-based WHC. For future studies on WHC, this result implies not only that the four WHC dimensions need to be considered, but also the influence of each dimension on the others. In our study, we focused on the influence of IT-based WHC on the work-based dimensions, and future research can extend this result by measuring the interplay among the three work-based WHC dimensions.

6.1.3 Indirect effect of IT-based whc on work exhaustion

This study's close focus on the WHC construct also facilitates the analysis of the different effects of IT-based and general work-based WHC on employees' work exhaustion. Our examination reveals that IT-based WHC has no direct influence on work exhaustion, whereas strain-based and time-based WHC has a direct influence. Hence, employees are in general more exhausted by time-based and strain-based WHC than by IT-based WHC. However, our study also reveals an indirect influence of IT-based WHC on work exhaustion. Time-, strain-, and behavior-based WHC mediate the effect of IT-based WHC on work exhaustion, and IT-based exhaustion mediates the effect of IT-based WHC on work exhaustion. As IT-based WHC has no direct effect on work exhaustion but indicates the second highest total effect, we assume that IT-based WHC is one major reason why employees perceive time-, strain-, and behavior-based WHC (see Figure 3 implication III).

The present paper contributes to literature such as Ahuja et al. (Ahuja et al. 2007), who find that work-based WHC leads to work exhaustion, by showing that work-based WHC acts as a mediator between IT-based WHC and the work exhaustion. The blurring of boundaries between work and private life due to IT usage increases time-, strain-, and behavior-based WHC, which in turn result in work exhaustion. We also extend prior research examining the influence of IT-based WHC on IT-exhaustion (Ayyagari et al. 2011) by revealing new insights into the effect of the techno level on the work level by showing that IT-based WHC has no direct effect on work exhaustion. Instead, it leads to the time-, strain-, and behavioral-incompatibilities between the work role and the private role and thus indirectly influences work exhaustion. Moreover, we reveal IT-based exhaustion as a mediator for the influence of IT-based WHC on work exhaustion, such that we can conclude that IT-based exhaustion mediates the effect of IT-based WHC on work exhaustion. Furthermore, we extend WHC literature such as Ferguson et al. (2016), who investigate the effect of work-based IT usage in the private role on work dimensions of WHC and in turn on burnout, by demonstrating that the work dimensions of WHC mediate the effect of IT-based WHC on work exhaustion as a specific characteristic of burnout.

In summary, the present paper contributes to WHC literature and psychological WHC literature by revealing that IT-based WHC has no direct but rather an indirect effect on work exhaustion, whereby the three work-based WHC dimensions – time-based, strain-based, and behavior-based WHC – as well as IT-based exhaustion – act as mediators. Therefore, IT-based WHC is not the only source and symbol of work exhaustion, but rather reinforces the effect of other WHC dimensions and IT-based exhaustion. Scholars investigating WHC and work exhaustion should, therefore, consider all dimensions of WHC and also IT-based exhaustion.

6.1.4 Contextual influences of the work and private situation

Past literature demonstrates that context is important to understand organizational behavior (Johns 2006) and to provide clear boundary conditions (Sarker 2016). In the WHC context, the present study contributes to the literature (Johns 2006; Sarker 2016) by considering the contextual influences from work and private situations, enabling us to better understand the different WHC effects and clarify the boundaries of conditions (see Figure 3 implication IV).

This study focuses on different work role characteristics such as IT-professionals, work time, and telework which have been considered in past literature (e.g., Ahuja et al. 2007; Ferguson et al. 2016; Greenhaus and Beutell 1985). However, most of these previous examination considers these characteristics only as control variables. We demonstrate, however, that the effect of IT-based WHC on time-based WHC is significantly stronger for IT-professionals compared to non-IT-professionals. One explanation might be that IT-professionals have more contact with IT and their expertise is often in short-notice demand by organizations (Niederman et al. 2007). In addition, we reveal that the influence of strain-based WHC on work exhaustion and the influence of IT-based WHC on strain-based WHC are stronger for part-time employees that for full-time employees. One explanation might be that part-time employees often only work part of the day and are home for part of the day, whereas full-time employees are at work for most of the day and are only at home at a time when the work strain affects the privat role less, such that the strain conflict between the work and private role is lower for full-time employess. The same applies for the effect of IT-based WHC on strain-based WHC because part-time employees who split their day equally into two parts experience a stronger blurring of boundaries between the work and private role and greater strain.

With respect to the contextual characteristics from the private role in terms of the household life cycle stages, the present study is the first to analyze the effect of WHC across these stages. Variables such as age or marital status have been considered as control variables in numerous investigations (e.g., Greenhaus and Beutell 1985; Turel et al. 2011a) however the different household life stages and the comparison among them have been neglected.

In particular, we show that the influence from *strain-based WHC on work exhaustion* is significantly stronger for childless singles under 45 compared to singles with one or more children of any age and compared to couples under 45 with one or more children. One explanation for these effects is the emotional support typically provided by family members (Taylor 2011). Such support provided by children and other family members may lessen the effect of strain-based WHC on work exhaustion. Another explanation might be that young childless singles are in a more competitive stage at their career and are more open to uncertainty and more reliant on others.

In addition, we show that the influence from *IT-based WHC on time-based WHC* is significantly stronger for individuals under 45 who cohabitate with another adult and who have one or more children compared to individuals who do not live with another adult and who have one or more children. This relationship is also stronger for individuals of any age who live with another adult but do not have any children than for individuals of any age who have one or more children.

In addition, we show that the influence from *IT-based WHC on strain-based WHC* is significantly stronger for individuals over 45 who live with another adult and who have one or more children than for individuals of any age who live alone and have one or more children and for individuals of any age living with another adult who do not have children.

The relationship between *IT-based WHC and IT exhaustion* is stronger for individuals who live alone and have one or more children than for individuals over 45 who live alone and do not have any children. We know from technostress literature that older employees are less IT exhausted than young (Ragu-Nathan et al. 2008) and that having children enhances the WHC effect (Netemeyer et al. 1996), which might be one explanation.

In summary, we contribute to literature by considering the contextual influences of the work and private role on WHC (see Table 7). Regarding the work role, we demonstrate that some effects from the WHC dimensions differ significantly depending on the work situation. In the case of the private role, we reveal that the influence of several WHC dimensions significantly differs across the life cycle stages. The present study demonstrated that context in terms of the work and private situation has a significant influence on some WHC effect. Hence, we call for a precise investigation of contextual influences from work and private role in the research stream of WHC. Understanding the contextual influences of the work and private role will provide greater insight into how to mitigate the perception of WHC.

Table 7: Overview of the contextual influences of the work and private situation

Relationship	Roles	Contextual influences
Strain-based WHC -> work exhaustion	Private	This relationship is stronger for childless singles under or equal 45 years (1) compared to singles with one or more children any age (3).
	Private	This relationship is stronger for childless singles under or equal 45 years (1) compared to a couple under or equal 45 years with one or more children (4).
	Work	This relationship is stronger for part-time employees compared to full-time employees.
IT-based WHC -> time-based WHC	Private	This relationship is stronger for couples under or equal 45 with one or more children (4) compared to singles any age with one or more children (3).
	Private	This relationship is stronger for childless couples any age (6) compared to singles any age with one or more children (3).
	Work	This relationship is stronger for IT-professionals compared to non-IT-professionals.
IT-based WHC -> strain-based WHC	Private	This relationship is stronger for couples older 45 years with one or more children (5) compared to singles any age with one or more children (3).
	Private	This relationship is stronger for couples older 45 years with one or more children (5) compared childless couples any age (6).
	Work	This relationship is stronger for part-time employees compared to full-time employees.
IT-based WHC -> IT exhaustion	Private	This relationship is stronger for singles any age with one or more children (3) compared to childless singles older than 45 years (2).

6.2 Practical Implications

The actions taken, the policies implemented, and the laws passed to reduce employees' WHC by organizations and governments focus primarily on IT usage, for example, not delivering emails after working hours (de Castella 2014; The Economist 2014). However, our studies show that IT-based WHC has no direct effect on the work exhaustion of employees, but rather only indirectly affects work exhaustion. The major contributing factors contributing to work exhaustion are time-based WHC and strain-based WHC. Hence, although IT-based WHC is not the sole source of work exhaustion, it amplifies the work dimensions of WHC – time-based, strain-based, and behavior-based WHC – which in turn increase work exhaustion.

Consequently, the study suggests that policies limited to regulate IT usage such as email delivery should be accompanied by additional measures to counteract the time-, strain-, and behavior-based causes of WHC. Hence, to reduce WHC, policies should address not only IT usage, but also the general organization of work time, the general demands required by a job, and the general behaviors required by employees. Focusing solely on IT usage may indirectly effect employee's work exhaustion, whereas policies considering time-, strain-, and behavior-based dimensions will have a greater and more direct effect. Hence, based on the results of this study, organizations should treat IT-based WHC as only one factor that indirectly affects work exhaustion and adopts a holistic approach to reducing employee exhaustion at work including the other three work-based dimensions of WHC. Based on the four management strategies suggested by Sarker et al. (2012) – compensation, negotiation, integration, protection –Table 8 illustrates one proposal of how these management strategies might influence the four different WHC dimensions.

The *compensation strategy* might have some relevance for time-based and strain-based WHC because monetary rewards and time off might encourage employees to accept these issues for a short time. However, this strategy does not solve the incompatibility in the long run. In the case of behavior- and IT-based WHC, this strategy might have lower relevance as the compensation in terms of money or time off might not change the behavior or the IT usage. The *negotiation strategy* may be highly relevant for the time-based and strain-based WHC dimensions because the personal situation and the capabilities of everyone are considered, which could reduce the time and strain conflicts between work and private. For the behavior-based and IT-based dimension of WHC, this strategy might be only moderately relevant as the consideration of the personal situation might not change the behavior of the employees. The *integration strategy* might be largely irrelevant for all four dimensions, as this strategy aims to integrate work and private to a greater extent. Thus, the effect might be reversed, as this strategy might increase the effect of the WHC dimensions rather than reduce it. The *protection strategy* might prove highly relevant across all WHC dimensions, as the right policies might reduce the WHC dimensions. However, our study shows that policies should focus on time-based and strain-based WHC. In general, the protection strategy is highly relevant, but the policies taken by organizations and governance should target all WHC dimensions independently rather blame only IT for the WHC.

Table 8: Management strategies based on Sarker et al. (2012) and their impact on the different domains of WHC

Management strategies		Time-based WHC	Strain-based WHC	Behavior-based WHC	IT-based WHC
Compensation	Compensation is in the form of monetary rewards or time off. However, this strategy does not really address the work-life imbalance but merely provides incentives for employees to overlook the problem. (Sarker et al. 2012, p. 150)	M	M	L	L
Negotiation	Consideration the personal situations and capabilities of the individual, and harmonizing them with the demands of the work. (Sarker et al. 2012, p. 150)	H	H	M	M
Integration	Creating an inviting environment where employees experience life in the workplace, thereby allowing those who are sufficiently motivated or committed to immerse themselves in work without feeling they are missing out on life outside their organization.(Sarker et al. 2012, p. 150)	L	L	L	L
Protection	Organizations must attempt to ensure that the expectation of sustained connectivity does not affect the health and personal well-being of valuable individuals and must enact policies that protect subordinates and colleagues. (Sarker et al. 2012, p. 150)	H	H	H	H
Note: H = high relevance; M = medium relevance; L = low relevance					

7 LIMITATIONS AND FUTURE RESEARCH

As with all empirical research, the present examination is limited in several ways. For example, the present study does not consider technology characteristics that may moderate the effect of the WHC dimensions (Ayyagari et al. 2011). For example, some employees receive a cell phone or use their private devices for work purposes. These technology characteristics might affect the perception of WHC and should be considered by future research. By differentiating between the techno and work level, we follow prior literature (Maier et al. 2015a) but neglect that these levels might also overlap because IT is so intricately related to work processes. Future research might also concentrate on coping strategies which can reduce the perception of WHC and its consequences. In line with Sarker et al. (2012), future literature should focus on management strategies which reduce all dimensions of WHC and not only IT-based WHC, which we propose in Table 8.

In addition, the present paper concentrates primarily on the conflicts created when work life affects private life. Future research should also consider the conflict created when private life affects work performance (Carlson et al. 2000; Koch et al. 2012). Concerning the WHC dimensions, we base on Carlson et al. (2000) for the work-based dimensions and on Ayyagari et al. (2011) for the IT-based dimension and neglect whether individuals perform the work and private role compartmentalized such that they perform one role after another, overlapping such that the roles are party performed simultaneously, or encompassing such that the work and private role are performed completely simultaneously (cf. Sarker et al. 2012). Further research might consider the different types of role performance. In addition, we identify IT-based WHC as a contributing factor of the work-based dimensions of WHC and neglect further antecedents, so future literature should focus on antecedents of all four WHC dimensions.

Regarding the household life cycle, we combined several stages in line with past literature (see Brown et al. 2006; Brown and Venkatesh 2005; Schaninger and Danko 1993) because of sample size issues, but future research should investigate all stages. Also, we measured the contextual variables only with categorical variables and neglect, for example, the extent of telework or the age of the children, which should be considered in future research. Moreover, the household life cycle might be extended by future research in the way that modern living situations are considered as well because the current model consider only regular living situations. For example, the cycle might consider caregivers who care for people other than their own children, the presence of troubled or disabled children, situations where children are only present at weekends, or the consideration of the presence of parents or relatives in need of care.

8 CONCLUSION

In this paper, we propose and test a model to illustrate that IT-based WHC is not the sole factor leading to work exhaustion. By focusing on the WHC construct, the empirical analysis of our model reveals that IT-

based WHC influences work exhaustion not directly, but rather only indirectly via the work dimensions time-, strain-, and behavior-based WHC and IT-based exhaustion. Among the WHC dimensions, strain-based WHC and time-based WHC are the main factors contributing to work exhaustion. Moreover, we demonstrate that the effects of the different WHC dimensions are influenced by contextual characteristics from the work and private role.

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10 APPENDIX

Table 9: Overview of WHC dimension in previous literature

Authors	WHC dimensions					Dependent variables
	Not specified	Time	Strain	Behaviour	IT	
IS literature						
(Yun et al. 2012)					**X**	- Stress **- User resistance**
(Ayyagari et al. 2011)					**X**	**- Strain**
(Turel et al. 2011a)	X				**X**	**- Work-family conflict**
(Sarker et al. 2010)	X					**- Work-life conflict**
(Ahuja et al. 2007)	X					- Work exhaustion **- Organizational commitment**
(Ahuja 2002)	X					- Career choice in IT **- Persistence in IT**
(Duxbury et al. 1992)	X					**- role overload** **- spill over of interference from work to family** **- spill over of interference from family to work**
(Köffer et al. 2014)					X	**- Work-to-life conflict**
(Köffer et al. 2015)					X	**- Work-life blurring**
(Armstrong et al. 2015)	X					**- Exhaustion from IS career experience**
(Sarker et al. 2012)					X	**- Work life relationship**
Note: X = dimensions have been considered; not specified = WHC has been considered as aggregated construct. No dimensions have been specified; empty cell = dimension has not been considered						

Table 10: Research items

Construct	Items
Time-based WHC (Carlson et al. 2000) Cronbachs α = .901	On the job I have so much work to do that it takes away from my personal interests.
	I would like to spend the time I currently need to spend on my work on my family or my friends instead.
	The time I must devote to my job keeps me from participating equally in household responsibilities and activities.
	I feel guilty about spending too much time at work and not enough time with my family.
	I miss private activities because I spend too much time working.
Strain-based WHC (Carlson et al. 2000) Cronbachs α = .917	The stress from my job often makes me irritable when I get home.
	When I get home from work I am often too physically tired to participate in family activities/responsibilities.
	Tension and anxiety from work often creep into my family life.
	Due to all the pressures at work, sometimes when I come home I am too stressed to do the things I enjoy.
Behavior-based WHC (Carlson et al. 2000) Cronbachs α = .826	I am not able to act the same way at home as I do at work.
	The problem-solving behaviors I use in my job are not effective in resolving problems at home.
	I act differently in responding to interpersonal problems at work than I do at home.
	Behavior that is effective and necessary for me at work would be counterproductive at home.
	The behaviors I perform that make me effective at work do not help me to be a better parent and spouse.
IT-based WHC (Ayyagari et al. 2011) Cronbachs α = .845	Using ICTs blurs the boundaries between my job and my home life.
	Using ICTs for work-based responsibilities creates conflicts with my home responsibilities.
	I do not get everything done at home because I find myself completing job-based work using ICTs.
IT-based exhaustion (Ayyagari et al. 2011) Cronbachs α = .950	I feel drained from activities that require me to use ICTs.
	I feel tired from my ICT activities.
	Working all day with ICTs is a strain for me.
	I feel burned out from my ICT activities.
Work exhaustion (Ahuja et al. 2007) Cronbachs α = .926	I feel emotionally drained from my work.
	I feel used up at the end of the work day.
	I feel fatigued when I get up in the morning and have to face another day on the job.
	I feel burned out from my work.
Note: All items are assessed on a 7-point Likert scale (1= strongly agree to 7 strongly disagree)	

Table 11 : MICOM results IT-professionals

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.998	[.995;1.000]	YES	-.001	[-.264;.279]	YES	-.023	[-.366;.295]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	-.003	[-.280;.293]	YES	-.026	[-.389;.293]	YES
Time-based WHC	.998	[.996;1.000]	YES	.004	[-.258;.274]	YES	-.026	[-.437;.320]	YES
Behavior-based WHC	.985	[.963;1.000]	YES	-.008	[-.265;.259]	YES	-.022	[-.395;.316]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	-.002	[-.272;.258]	NO	-.020	[-.440;.339]	YES
Work exhaustion	1.000	[.999;1.000]	YES	.001	[-.266;.279]	YES	-.017	[-.345;.268]	YES

Table 12: MICOM results of the teleworking

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.998;1.000]	YES	.001	[-.181;.178]	No	-.004	[-.256;.233]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	.003	[-.177;.189]	YES	-.007	[-.226;.222]	No
Time-based WHC	.999	[.998;1.000]	YES	.002	[-.185;.191]	YES	-.003	[-.250;.260]	YES
Behavior-based WHC	.997	[.992;1.000]	YES	-.000	[-.177;.188]	YES	-.006	[-.244;.241]	YES
IT-based exhaustion	1.000	[1000;1.000]	YES	.004	[-.194;.184]	Yes	-.008	[-.288;.269]	YES
Work exhaustion	1.000	[.999;1.000]	YES	.005	[-.188;.177]	No	-.002	[-.212;.206]	No

Table 13: MICOM results of the work time

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.998;1.000]	YES	-.002	[-.184;.167]	No	-.009	[-.209;.201]	No
Strain-based WHC	1.000	[.999;1.000]	YES	-.007	[-.179;.175]	No	-.002	[-.231;.219]	YES
Time-based WHC	.999	[.998;1.000]	YES	-.000	[-.169;.174]	YES	-.007	[-.255;.212]	YES
Behavior-based WHC	.996	[.990;1.000]	YES	-.001	[-.178;.161]	No	-.013	[-.243;.223]	YES
IT-based exhaustion	1.000	[1000;1.000]	YES	-.005	[-.196;.164]	No	-.004	[-.274;.256]	YES
Work exhaustion	1.000	[1000;1.000]	YES	-.006	[-.177;.172]	No	-.004	[-.188;.189]	No

Table 14: MICOM results of the household life cycle 1 vs. 2

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.997	[.989;1.000]	NO	-.001	[-.305;.296]	YES	.011	[-.353;.402]	NO
Strain-based WHC	.999	[.998;1.000]	YES	-.008	[-.297;.270]	YES	.025	[-.336;.408]	YES
Time-based WHC	.998	[.995;1.000]	YES	-.004	[-.285;.281]	YES	.019	[-.425;.453]	YES
Behavior-based WHC	.975	[.931;1.000]	YES	-.001	[-.310;.283]	YES	.023	[-.395;.441]	YES
IT-based exhaustion	.999	[.998;1.000]	YES	-.003	[-.298;.286]	YES	.021	[-.375;.439]	YES
Work exhaustion	1.000	[1.000;1.000]	YES	-.013	[-.302;.293]	YES	.023	[-.338;.349]	YES

Table 15: MICOM results of the household life cycle 1 vs. 3

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.996;1.000]	YES	.003	[-.270;.266]	YES	.008	[-.334;.337]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	.003	[-.287;.262]	YES	.010	[-.303;.344]	YES
Time-based WHC	.998	[.996;1.000]	YES	-.008	[-.286;.266]	YES	.003	[-.345;.343]	YES
Behavior-based WHC	.991	[.977;1.000]	YES	-.002	[-.274;.261]	YES	.005	[-.356;.351]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	-.000	[-.286;.259]	YES	.007	[-.364;.344]	YES
Work exhaustion	1.000	[.999;1.000]	YES	-.000	[-.272;.246]	NO	.003	[-.301;.281]	NO

Table 16: MICOM results of the household life cycle 1 vs. 4

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.996;1.000]	YES	.009	[-.303;.320]	YES	.026	[-.324;.379]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	.006	[-.305;.316]	YES	.024	[-.360;.410]	YES
Time-based WHC	.999	[.996;1.000]	YES	.006	[-.304;.305]	YES	.028	[-.403;.461]	YES
Behavior-based WHC	.983	[.964;1.000]	YES	-.000	[-.306;.300]	YES	.043	[-.362;.501]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	.006	[-.324;.321]	YES	.031	[-.373;.463]	YES
Work exhaustion	1.000	[.999;1.000]	Yes	.012	[-.303;.323]	YES	.024	[-.323;.385]	YES

Table 17: MICOM results of the household life cycle 1 vs. 5

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.997;1.000]	YES	.002	[-.229;.237]	NO	-.006	[-.306;.260]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	.002	[-.228;.224]	YES	-.005	[-.275;.269]	YES
Time-based WHC	.999	[.998;1.000]	YES	.003	[-.227;.221]	YES	.002	[-.298;.317]	YES
Behavior-based WHC	.995	[.987;1.000]	YES	-.003	[-.234;.236]	YES	.003	[-.293;.300]	YES
IT-based exhaustion	1.000	[1000;1.000]	YES	.005	[-.219;.229]	YES	-.008	[-.327;.315]	YES
Work exhaustion	1.000	[.999;1.000]	YES	.006	[-.213;.215]	NO	-.002	[-.241;.238]	YES

Table 18: MICOM results of the household life cycle 1 vs. 6

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.998	[.994;1.000]	YES	.008	[-.335;.331]	YES	.007	[-.407;.427]	YES
Strain-based WHC	.999	[.998;1.000]	YES	-.005	[-.358;.327]	YES	.010	[-.374;.430]	YES
Time-based WHC	.998	[.994;1.000]	YES	.003	[-.344;.338]	YES	.014	[-.392;.437]	YES
Behavior-based WHC	.974	[.929;1.000]	YES	.003	[-.315;.332]	YES	.019	[-.388;.493]	YES
IT-based exhaustion	1.000	[.998;1.000]	YES	.001	[-.342;.335]	YES	.014	[-.397;.465]	YES
Work exhaustion	1.000	[.999;1.000]	NO	-.005	[-.349;.350]	YES	.012	[-.379;.396]	YES

Table 19: MICOM results of the household life cycle 2 vs. 3

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.995	[.984;1.000]	YES	-.006	[-.324;.292]	YES	-.010	[-.433;.416]	YES
Strain-based WHC	.999	[.997;1.000]	YES	.001	[-.325;.310]	YES	-.010	[-.425;.395]	YES
Time-based WHC	.996	[.989;1.000]	YES	.009	[-.333;.322]	YES	-.002	[-.497;.440]	YES
Behavior-based WHC	.987	[.970;1.000]	NO	-.000	[-.332;.322]	YES	-.011	[-.481;.436]	YES
IT-based exhaustion	.999	[.998;1.000]	YES	-.005	[-.323;.296]	YES	-.009	[-.479;.410]	YES
Work exhaustion	.999	[.998;1.000]	YES	-.005	[-.321;.297]	YES	-.003	[-.398;.387]	NO

Table 20: MICOM results of the household life cycle 2 vs. 4

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.997	[.988;1.000]	YES	.001	[-.368;.359]	YES	-.005	[-.448;.404]	NO
Strain-based WHC	.999	[.998;1.000]	YES	-.002	[-.359;.349]	YES	.001	[-.412;.429]	YES
Time-based WHC	.999	[.997;1.000]	YES	.004	[-.381;.378]	YES	-.005	[-.538;.519]	YES
Behavior-based WHC	.986	[.966;1.000]	YES	-.007	[-.387;.349]	YES	-.003	[-.513;.500]	YES
IT-based exhaustion	1.000	[.999;1.000]	NO	.005	[-.369;.378]	YES	-.001	[-.573;.580]	YES
Work exhaustion	.999	[.998;1.000]	YES	-.001	[-.384;.350]	YES	.003	[-.384;.417]	YES

Table 21: MICOM results of the household life cycle 2 vs. 5

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.998	[.991;1.000]	NO	-.009	[-.293;.281]	YES	-.032	[-.397;.313]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	.001	[-.270;.289]	YES	-.016	[-.392;.339]	YES
Time-based WHC	.999	[.997;1.000]	YES	-.003	[-.310;.294]	YES	-.019	[-.450;.394]	YES
Behavior-based WHC	.988	[.969;1.000]	YES	-.007	[-.295;.284]	YES	-.020	[-.448;.361]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	.001	[-.314;.285]	NO	-.032	[-.549;.446]	YES
Work exhaustion	1.000	[.998;1.000]	YES	-.003	[-.298;.289]	YES	-.019	[-.358;.303]	YES

Table 22: MICOM results of the household life cycle 2 vs. 6

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.994	[.979;1.000]	YES	-.008	[-.401;.353]	YES	.018	[-.469;.464]	YES
Strain-based WHC	.999	[.996;1.000]	YES	-.005	[-.397;.357]	YES	.006	[-.494;.512]	YES
Time-based WHC	.997	[.993;1.000]	YES	-.004	[-.390;.366]	YES	.006	[-.535;.523]	YES
Behavior-based WHC	.976	[.933;1.000]	YES	.000	[-.386;.403]	YES	.014	[-.542;.605]	YES
IT-based exhaustion	.999	[.998;1.000]	YES	-.006	[-.381;.372]	YES	.009	[-.550;.579]	YES
Work exhaustion	.999	[.998;1.000]	YES	-.009	[-.399;.380]	YES	.006	[-.405;.461]	YES

Table 23: MICOM results of the household life cycle 3 vs. 4

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.996;1.000]	YES	.008	[-.315;.321]	YES	.011	[-.421;.441]	YES
Strain-based WHC	.999	[.998;1.000]	YES	.012	[-.322;.335]	YES	.025	[-.331;.436]	YES
Time-based WHC	.998	[.994;1.000]	YES	.011	[-.338;.348]	NO	.024	[-.446;.491]	YES
Behavior-based WHC	.994	[.985;1.000]	YES	.013	[-.323;.330]	NO	.035	[-.410;.506]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	.008	[-.319;.312]	YES	.017	[-.402;.467]	YES
Work exhaustion	.999	[.997;1.000]	YES	.009	[-.348;.321]	YES	.020	[-.397;.425]	YES

Table 24: MICOM results of the household life cycle 3 vs. 5

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.996;1.000]	YES	.003	[-.235;.245]	NO	-.005	[-.323;.285]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	.001	[-.245;.250]	YES	-.006	[-.307;.299]	YES
Time-based WHC	.999	[.997;1.000]	NO	-.004	[-.251;.242]	YES	-.012	[-.351;.319]	YES
Behavior-based WHC	.996	[.989;1.000]	YES	-.003	[-.261;.232]	YES	-.013	[-.339;.316]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	-.005	[-.257;.233]	NO	-.003	[-.367;.379]	YES
Work exhaustion	.999	[.998;1.000]	YES	-.000	[-.255;.255]	YES	-.013	[-.303;.253]	YES

Table 25: MICOM results of the household life cycle 3 vs. 6

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.998	[.994;1.000]	YES	-.010	[-.332;.332]	NO	.016	[-.433;.479]	YES
Strain-based WHC	.999	[.997;1.000]	YES	-.004	[-.358;.320]	NO	.016	[-.420;.478]	YES
Time-based WHC	.996	[.988;1.000]	YES	-.007	[-.368;.345]	YES	.011	[-.423;.480]	YES
Behavior-based WHC	.988	[.967;1.000]	YES	-.008	[-.338;.342]	YES	.020	[-.410;.493]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	-.004	[-.336;.318]	NO	.017	[-.413;.452]	YES
Work exhaustion	.999	[.998;1.000]	YES	-.005	[-.347;.340]	NO	.007	[-.412;.425]	YES

Table 26: MICOM results of the household life cycle 4 vs. 5

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.996;1.000]	YES	-.000	[-.300;.282]	YES	-.021	[-.411;.334]	YES
Strain-based WHC	1.000	[.999;1.000]	YES	.006	[-.289;.307]	YES	-.026	[-.394;.309]	YES
Time-based WHC	.999	[.997;1.000]	YES	.000	[-.307;.304]	YES	-.025	[-.484;.343]	YES
Behavior-based WHC	.991	[.979;1.000]	YES	.009	[-.279;.290]	YES	-.021	[-.434;.340]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	.003	[-.284;.281]	YES	-.023	[-.528;.464]	YES
Work exhaustion	.999	[.997;1.000]	YES	.001	[-.291;.313]	YES	-.016	[-.341;.289]	YES

Table 27: MICOM results of the household life cycle 4 vs. 6

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.997;1.000]	YES	-.004	[-.404;.388]	YES	.019	[-.407;.467]	YES
Strain-based WHC	.999	[.997;1.000]	YES	-.010	[-.379;.395]	YES	.002	[-.422;.416]	YES
Time-based WHC	.999	[.997;1.000]	YES	-.008	[-.377;.357]	YES	.000	[-.552;.524]	YES
Behavior-based WHC	.991	[.978;1.000]	YES	-.007	[-.396;.398]	YES	.013	[-.498;.493]	YES
IT-based exhaustion	1.000	[1000;1.000]	YES	-.010	[-.358;.355]	NO	.001	[-.494;.509]	YES
Work exhaustion	.999	[.995;1.000]	YES	-.008	[-.376;.379]	YES	-.003	[-.462;.440]	YES

Table 28: MICOM results of the household life cycle 5 vs. 6

Composite	Step 2			Step 3					
	c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
IT-based WHC	.999	[.994;1.000]	YES	-.008	[-.344;.295]	YES	.023	[-.355;.414]	YES
Strain-based WHC	.999	[.998;1.000]	YES	-.009	[-.333;.330]	NO	.020	[-.344;.465]	YES
Time-based WHC	.999	[.996;1.000]	YES	-.005	[-.314;.294]	YES	.042	[-.395;.533]	NO
Behavior-based WHC	.985	[.964;1.000]	YES	.002	[-.321;.315]	YES	.036	[-.384;.523]	YES
IT-based exhaustion	1.000	[.999;1.000]	YES	-.005	[-.340;.315]	NO	.040	[-.454;.574]	YES
Work exhaustion	.999	[.998;1.000]	YES	-.002	[-.323;.332]	YES	.018	[-.322;.409]	YES

Paper II

THE NEGATIVE SIDE OF ICT-ENABLED COMMUNICATION

THE CASE OF SOCIAL INTERACTION OVERLOAD IN ONLINE SOCIAL NETWORKS

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Proceedings of the 21st European Conference on Information Systems (2013), Utrecht, Netherlands
https://aisel.aisnet.org/ecis2013_cr/86

Paper III

ENTERPRISE RESOURCE PLANNING SYSTEMS INDUCED STRESS

A COMPARATIVE EMPIRICAL ANALYSIS WITH YOUNG AND ELDERLY SAP USERS

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Sven Laumer
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Christoph Weinert
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Proceedings of the 12th International Conference on Wirtschaftsinformatik, Osnabrück, Germany
http://aisel.aisnet.org/wi2015

2. Chapter
Dark side of IT use: Outcomes

Paper IV

THE EFFECTS OF TECHNOSTRESS AND SWITCHING-STRESS ON DISCONTINUED USE OF SOCIAL NETWORKING SERVICES

A STUDY OF FACEBOOK USE

Christian Maier
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Sven Laumer
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Paper V

HOW DOES INTUITION INFLUENCE INFORMATION SYSTEMS USAGE BEHAVIOR?

AN INVESTIGATION INTO THE RELATION BETWEEN IMPLICIT ATTITUDES, EXPLICIT ATTITUDES, INTENTIONS, AND BEHAVIORS

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Abstract

Psychology research shows that an individual's behavior is grounded in the individual's reflective and intuitive system. The reflective system is characterized as rational and conscious, whereas the intuitive system is associative and unconscious. However, extant information systems (IS) usage research has mostly modeled the reflective system by considering explicit attitudes and intentions to predict IS usage. Yet it ignores the impact that the intuitive system might have on IS usage. Hence, we theorize that IS usage is not only determined by the traditional explicit factors but also goes beyond the reflective system. Therefore, we analyze the influence of the intuitive system on IS usage. We introduce the concept of implicit attitudes and the single category implicit association test (SC-IAT) approach for measuring them and suggest and evaluate a theoretical model of the influence of implicit attitudes on the reflective system and thereby on traditional IT usage variables. The results indicate that implicit attitudes have a noteworthy impact on IS usage. Positive implicit attitudes act as antecedents of IS habit in the intuitive system while positive and negative implicit attitudes influence intention to use in the reflective system. We discuss several theoretical and practical implications.

Keywords: implicit attitudes, explicit attitudes, reflective and intuitive system, implicit association test, dual process theory, IS usage

1 Introduction

Standard psychological research has shown that an individual's behavior is determined by two different cognitive systems (Kahneman 2011). First, the reflective system is characterized as controlled, rational, and conscious. Second, the intuitive system is characterized as uncontrolled, associative, and unconscious (Gawronski and Creighton 2013; Kahneman 2003; Stanovich and West 2000, 2000)[32]. Both systems are independent, operate in parallel, and interact to produce behavior (Epstein 2003).

Interestingly, the vast majority of IS usage research (Davis et al. 1989; Venkatesh et al. 2003; Venkatesh et al. 2012) solely models the reflective system. This is done by considering reasoning factors such as beliefs, explicit attitudes, and intentions (regarding an IS) and is consistent with the philosophical underpinnings of the underlying theories such as the theory of planned behavior (TPB; Ajzen 1991). In doing so, the IS usage literature overlooks the role and impact that the intuitive system might have on IS usage. In other words, most extant IS usage literature has come up with a clear view of the peak of the IS usage iceberg while the part underwater remains murky. Insights into the murky part of the iceberg might change, extend, refute previous assumptions of IS usage research and contributes to a more holistic understanding. A few recent approaches have incorporated some intuitive system phenomena by analyzing IS habits (Kim et al. 2005; Limayem et al. 2007; Soror et al. 2015) or using NeuroIS methods (Dimoka and Davis 2008; Ortiz de Guinea et al. 2014; Turel et al. 2014). This paper aims at further developing this view and suggests a theoretical and

[32] According to (Stanovich and West 2000) the systems are also called system 1 and system 2 (Kahneman 2011), associative system and rule-based system, heuristic processing and analytic processing, tacit thought processes and explicit thought processes, implicit cognition and explicit learning, experiential system and rational system, automatic processing and controlled processing, automatic activation and conscious processing system.

methodical perspective to integrate intuitive factors, such as implicit attitudes, into IS usage research that have been shown to influence behavior in the psychological literature (Strack and Deutsch 2004; Wilson et al. 2000). Our research question is: *How do the intuitive and the reflective systems influence IS usage?*

The paper thereby follows calls in the literature for discovering hidden intuitive and automatic components (Dimoka and Davis 2008) and for a more detailed investigation of attitudes in the IS discipline to understand IS usage in a more holistic manner (Yang and Yoo 2004; Zhang et al. 2008). We go beyond the traditional explicit processes of IS usage (e.g., Davis et al. 1989; Venkatesh et al. 2012), that are part of an individual's reflective system, by additionally considering intuitive factors which might influence IS usage. Based on the dual process theory, we introduce the concept of implicit attitudes into IS usage research, propose a suitable method to measure them and develop a research model which hypothesizes the direct and the indirect influence of implicit attitudes on IS usage. The results show an interesting impact of implicit attitudes on intention to use and IS habit. In particular, positive implicit attitudes indirectly influence IS usage and act as antecedents of IS habit in the intuitive system while negative implicit attitudes mainly reduce intentions in the reflective system and have an indirect effect on IS usage.

Next, we introduce the theoretical background, develop our hypotheses, and explain the methodology and, explicitly, the single category implicit association test (SC-IAT). After data analysis and an overview of the empirical results, we then discuss the results, limitations, contribution and promising avenues for future research.

2 THEORETICAL BACKGROUND

2.1 DUAL PROCESS THEORY

Dual process theory posits that cognitive processes underlying human behavior can be divided into two different systems, i.e., *reflective* and *intuitive*, depending on whether they are driven by reasoning or association (Gawronski and Creighton 2013; Kahneman 2003, 2011; Stanovich and West 2000).

The *reflective system* depends on reasoning processes that are intentionally initiated and need considerable cognitive resources. Reflective cognitive processes operate within conscious awareness and can be stopped voluntarily (Gawronski and Creighton 2013). They are slow, effortful, controlled, serial, rule-governed, explicit, and emotionally neutral (Gawronski and Creighton 2013; Kahneman 2003). The reasoning processes are relatively flexible and can be learned relatively quickly (Kahneman 2003). The output of the reflective system are judgments which are based on impressions or on deliberate reasoning (Gawronski and Creighton 2013; see Table 1). General examples of reflective activities are: check the validity of a complex logical argument, look for a woman with white hair, or count the occurrences of the letter "A" in a page of text. With regard to IS literature, one example is the deliberately express of users beliefs (e.g., perceived usefulness, perceived ease of use), explicit attitudes, or intentions.

The *intuitive system* depends on associations that are elicited unintentionally and require few cognitive resources. They occur outside of conscious awareness and cannot be stopped voluntarily (Gawronski and Creighton 2013). The intuitive operations in the intuitive system are described as fast, automatic, parallel, effortless, associative, implicit, and emotional (Gawronski and Creighton 2013; Kahneman 2003). Intuitive processes are difficult to control and modify and can only be learned slowly (Kahneman 2003). The outputs of the intuitive system are intuitive impressions (Gawronski and Creighton 2013; see Table 1). General examples of intuitive activities are: detect that one object is more distant than another, orient to the source of a sudden sound, or make a "disgust face" when shown a horrible picture. With regard to IS literature, examples are cognitive-emotional preoccupation with usage and automatic and unconscious reactions (Soror et al. 2015; Turel and Qahri-Saremi 2017).

Both systems are independent, operate in parallel, and are interactive (Epstein 2003). The intuitive system is able to provide an intuitive response as input for the reflective system. The reflective system may either

support this response, adjust the response, correct the response, or block the response (Gawronski and Creighton 2013). Since the intuitive system is the faster system, it can bias subsequent processing in the reflective system. Because it works automatically and pre-consciously, its influence usually occurs outside of consciousness. As already mentioned, this causes individuals to look for an explanation in their conscious reflective system, which often leads to rationalization. Hence, even if people believe that their thinking is completely rational, they are likely to be influenced by their intuitive processing (Epstein 2003). As we will discuss later in detail, traditional IS literature argues that (explicit) attitudes and beliefs are, in essence, a conscious phenomenon and part of the reflective system. This begs the question what role impulses from the intuitive system might play in the context of IS usage.

Table 1: Features commonly ascribed to the two systems adopted from (Frankish 2010) and (Stanovich and West 2000)

	Intuitive system	Reflective system
Properties	Fast Automatic Nonconscious or preconscious Low effort, high capacity Heuristic Associative	Slow Controlled Conscious High effort, low capacity Analytic Rule-based
Content	Actual Concrete Contextualised Domain-specific	Hypothetical Abstract Decontextualised Domain-general
Architecture	A set of systems, modular Parallel Does not use working memory	A single system Serial Use working memory
Evolution	Evolutionarily old Shared with animals Nonverbal Serves genetic goals ('short leash' control)	Evolutionarily recent Unique to humans Language involving Serves individuals goals ('long leash' control)
Variation	Independent of general intelligence Little variation across cultures and individuals Relative unresponsive to verbal instruction	Linked to general intelligence Variable across cultures and individuals Responsive to verbal instruction
Also called	System 1, associative system, heuristic processing, tacit thought processes, implicit cognition, experiential system, automatic processing, automatic activation system	System 2, rule-based system, analytic processing, explicit thought processes, explicit learning, rational system, controlled processing, conscious processing system

2.2 THE DUAL-ATTITUDES MODEL

Extent IS literature demonstrate that three major predictors – beliefs, (explicit) attitudes, and intentions – mainly determine IS usage behavior (Davis et al. 1989). (Explicit) attitudes are among the three most frequently studied influencing factors to explain user behavior (Jeyaraj et al. 2006). They have been investigated extensively (Wixom and Todd 2005; Zhang et al. 2008; Zhang and Sun 2009) but as traditional IS literature mostly examines the reflective system previous literature solely concentrates on explicit attitudes which occur on the reflective system. However, the dual-attitude model (Wilson et al. 2000) suggests that individuals can simultaneously have two types of attitudes toward the same target object: explicit and implicit attitudes (Greenwald and Banaji 1995; Wilson et al. 2000). In other words, attitudes are not only formed when thinking rationally with respect to a target object (explicit attitudes within the reflective system) but also based on past experience in association with a target object (implicit attitudes within the intuitive system) (Wilson et al. 2000).

Explicit attitudes are formed within the reflective system (Frankish 2010; Gawronski and Creighton 2013) and represent the favorable or unfavorable evaluations towards some target objects such as people, places, or things (Fishbein and Ajzen 1975; Greenwald and Banaji 1995). Explicit attitudes are defined as *"a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a* [target] *object"* (Fishbein and Ajzen 1975). They are characterized by a conscious awareness of the attitudes during the corresponding action or during self-reports, fast acquisition and change, and slow access (Frankish 2010; Myers and Twenge 2013). Explicit attitudes can form in response to consciously available information (Rydell et al. 2008), change faster in response to new information, and respond to intentional processing goals (Rydell and McConnell 2006).

Implicit attitudes are formed in the intuitive system (Frankish 2010; Gawronski and Creighton 2013) and understood as favorable or unfavorable traces of past experiences towards a target object, and introspectively unidentifiable (Greenwald and Banaji 1995). Implicit attitudes are attitudes to which people initially have no conscious access, and their activation cannot be controlled (Rydell et al. 2008). Implicit attitudes are hence based on past, unconscious experiences that are automatic associations individuals have with a target object that result in a favorable or unfavorable evaluation. Individuals' attitudes are stored in the implicit memory and cannot be transferred to short-term memory. These implicit attitudes are characterized by an unconscious association of the favorable or unfavorable feelings towards the target object, and individuals may not be consciously aware of the origin of their attitudes, the attitudes itself, or its consequences on other actions (Gawronski et al. 2006; Wilson et al. 2000). They are characterized by a slow acquisition and change but are fast accessible (Frankish 2010; Gawronski and Creighton 2013). Implicit attitudes are formed in response to the valence of subliminally-presented primes (Rydell et al. 2008) and change more slowly and are less affected by intentional processing goals (Rydell and McConnell 2006).

Implicit attitudes can be *ambivalent* as individuals might have a positive and a negative association with the target object (Thompson et al. 1995). An individual who simultaneously associated the target object with positive and negative traces of past experiences has two implicit attitudes towards different aspects of the target object (Wilson et al. 2000). For example, individuals implicitly associate with chocolate something delicious but also something unhealthy. Within IS context, individuals might associate with Facebook both positive implicit attitudes regarding positive features of Facebook (e.g., social interactions among friends) and negative implicit attitudes regarding negative features of Facebook (e.g., social anxieties).

Overall, the literature suggests that individuals have two different types of attitudes, namely explicit and implicit attitudes which emerge from the two different systems. Explicit attitudes are formed in the reflective system and are evaluations that individuals can report and for which expression can be controlled. Implicit attitudes are formed in the intuitive system, and individuals initially have no conscious access, and their activation cannot be controlled. Most importantly, explicit and implicit attitudes differ due to several reasons, including fast and slow changes and accessibility as well as different antecedents such as different kinds of information, which both might influences behavior.

2.3 The Dual Process Theory in the Context of IS Usage Literature

Psychology demonstrates that human behavior is predicted by two different cognitive systems, namely the reflective and intuitive system (e.g., Kahneman 2011). Despite this differentiation, IS usage literature mostly concentrates on the reflective system and neglects the intuitive system. To appraise the significance of this, we next exemplarily give an overview of the IS usage literature that mostly focuses on the reflective system and also summarize the rare IS usage literature which also considers the institutive system.

2.3.1 IS usage literature focusing on the reflective system

The vast majority of IS usage research follows the philosophical underpinnings of the reflective theories such as the theory of planned behavior (TPB; Ajzen 1991) or reasoned action (TRA; Fishbein and Ajzen 1975), which only take the reflective system into consideration as they based on conscious, rule-based, and analytical assumption (Kahneman 2011, see also Table 1) such as planned behavior and reasoned actions.

Therefore, the well-known and most cited models (Davis et al. 1989; Venkatesh et al. 2003; Venkatesh et al. 2012) focus only on the reflective system by considering reasoning factors. For example, most literature builds upon the theoretical assumptions manifested in the technology acceptance model (TAM; Davis et al. 1989) and its numerous extensions (Taylor and Todd 1995; Venkatesh et al. 2003; Venkatesh et al. 2012; Venkatesh and Davis 2000) that are based on the reflective system. All these models aim at predicting IS usage behavior that is influenced by the intention to use the IS. In TAM, for instance, intention to use is influenced by several antecedents such as explicit attitudes, which in turn are mostly influenced by beliefs about the target object, such as perceived usefulness (PU) and perceived ease of use (PEOU). From this basic

model, numerous extensions emerged which identified and examined further antecedents of IT usage behavior. A precise overview of the IS usage literature is given by Williams et al. (2009), Venkatesh et al. (2016), and Hornbæk and Herzum (2017).Overall, within the IS usage literature, investigations focusing on the reflective system predominate. However, a few studies consider the intuitive system at least partially and are discussed next.

2.3.2 IS usage literature focusing on the intuitive system

The intuitive system contains not only implicit attitudes but also unconscious, automatic and effortless behaviors. In addition, a relatively new research stream called NeuroIS has used alternative measurement techniques to shed light on the intuitive system. Both research strands are described in the following.

There is a relatively small body of literature that is concerned with unconscious behavior referring to the intuitive system. Here some investigations use the dual process theory and for example suggest that the decision to use an IS based on a conscious and reflective process and also on unconscious and intuitive process (Ferratt et al. 2018). In addition, the dual process theory has previously been used to understand problematic use of social networking sites (SNS), in particular, Facebook. Thereby it is argued that problematic use of the SNS is positively influenced by the intuitive system, whereas the reflective system negatively moderates this relationship an also has a negative effect on problematic use (Turel and Qahri-Saremi 2017). In the same vine, Constantiou et al. (2014) use the dual process theory and propose that the use of location-based services is influenced by reflective comparative processes as well as intuitive processes which both are influenced by different contextual factors.

More specifically, some investigations focus on IS habits (e.g., Limayem et al. 2007; Ortiz de Guinea and Lynne 2009; Polites and Karahanna 2012, 2013; Soror et al. 2015) claims that IS habits are formed in the intuitive system (Soror et al. 2015) and are defined as the extent to which an individual tends to use an IS (Limayem et al. 2007). IS habits can be understood as a special kind of mindset which enhances the sensitivity to habit-related cues and thus prevents individuals from performing other intentional actions (Verplanken and Aarts 1999). IS literature has revealed that IS habits influence reflective IS usage behavior (Limayem et al. 2001; Limayem and Hirt 2003) and moderate the intention-usage relation. A key insight is that the intention-usage relation is low when IS habit is high and vice versa (Kim et al. 2005). Correspondingly, the IS continuance usage literature discloses three key antecedes of IS habit, namely satisfaction, frequency of past behavior, and comprehensiveness of usage (Limayem et al. 2007) and shows that IS habit increases IS continuance usage and moderates the relationship between IS continuance intention and IS usage (Bhattacherjee and Lin 2014; Limayem et al. 2007). IS habit also reduces the intention to use a new IS by increasing the inertia of individuals (Polites and Karahanna 2012, 2013). Noticeable is that much of the literature in this research stream solely focuses on measurement techniques such as self-reports and introspection and neglects more sophisticated methods which are undoubtedly able to measure constructs on the intuitive system.

On the contrary, the research stream of *NeuroIS* draws on other measurement techniques than self-reports and introspection. Dimoka and Davis (2008) conduct a functional magnetic resonance imaging (fMRI) study, which uncovers the neural mechanisms that underlie individuals' technology adoption behaviors. They localize the neural correlations of the TAM constructs and uncover hidden processes associated with intentions to use. Ortiz de Guinea et al. (2014) investigate explicit and implicit antecedents of cognitive beliefs, which are according to the TAM antecedents of explicit attitudes, as well. They do so, by drawing on neurological measures such as electroencephalography (EEG). The results indicate that explicit and implicit antecedents work together and have a nonlinear effect on behavioral beliefs. In the context of IT addiction, one examination tries to understand whether Facebook addiction shows similar brain activities such as other substance and behavioral addictions. Turel and colleagues draw on a time-based measurement called go/no-go test and fMRI. The results show that at least to some extent technology-related "addictions" share some neuronal traits with substance and gambling addiction, but also differ from such brain actives, as related to an abnormal function of the inhibitory control brain system (Turel et al. 2014).

Overall, the IS usage literature is primarily based on the reflective system by building upon the philosophical assumptions of TPB and TRA and hence currently examines solely the peak of the iceberg. As psychology literature suggests that an individual's behavior is driven by both systems, the IS usage literature can profit from also considering the murky part of the iceberg still underwater, represented by the intuitive system. The goal hence is to theoretically and empirically understand the role and impact of the intuitive system regarding IS usage. As discussed, some early approaches have already incorporated parts of the implicit processes by analyzing IS habits or using NeuroIS techniques. We now need to develop a systematic understanding of implicit attitudes. This gap in IS usage research hence offers compelling opportunities to better explain IS usage behavior. To close this research gap, we go beyond the reflective system by also considering the intuitive system and investigate its direct effect on IS usage as well as its indirect effect on IS usage through the reflective system as depicted in Figure 1.

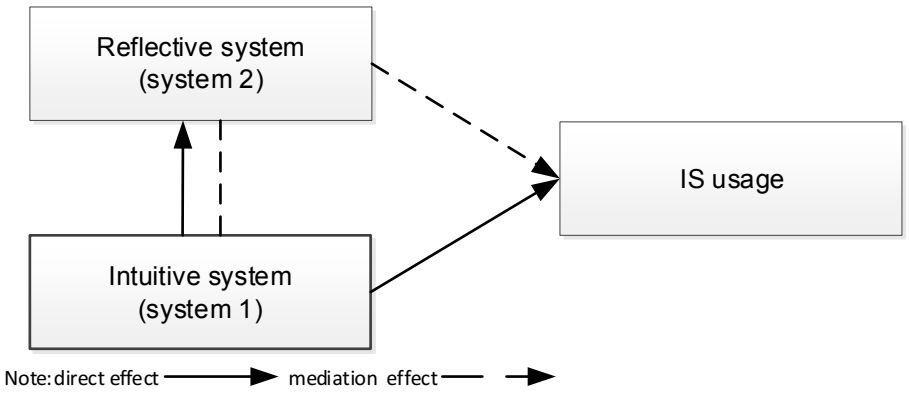


Figure 1: Focus of the research

3 THEORIZING THE DUAL-SYSTEM THEORY IN THE CONTEXT OF IS USAGE

As previously demonstrated, two systems (i.e., the reflective system, which operates on reasoning, and the intuitive system, which operates on association) determine IS usage behavior (e.g., Turel and Qahri-Saremi 2017). Consequently, there might be reflective and intuitive precursors of IS usage (Ortiz de Guinea et al. 2014). The latter has only rarely been investigated within the IS usage literature. However, the dual-attitude model (Wilson et al. 2000) suggests that attitudes, which are one of the three most investigate antecedent of IS usage (Jeyaraj et al. 2006), are simultaneously in the reflective system (explicit attitudes) and in the intuitive system (implicit attitudes). Explicit and implicit attitudes are discrepant because of several reasons such as fast and slow changes (Rydell and McConnell 2006) and accessibility (Gawronski and Creighton 2013) as well as different antecedents such as different kinds of information (Rydell et al. 2008). Hence, we theorize that the intuitive system, represented by implicit attitudes, influences IS usage directly or indirectly. The indirect influence is mediated by factors in the reflective system, such as explicit attitudes, intention to use or factors in the intuitive system such as IS habit. The research model is shown in Figure 2.

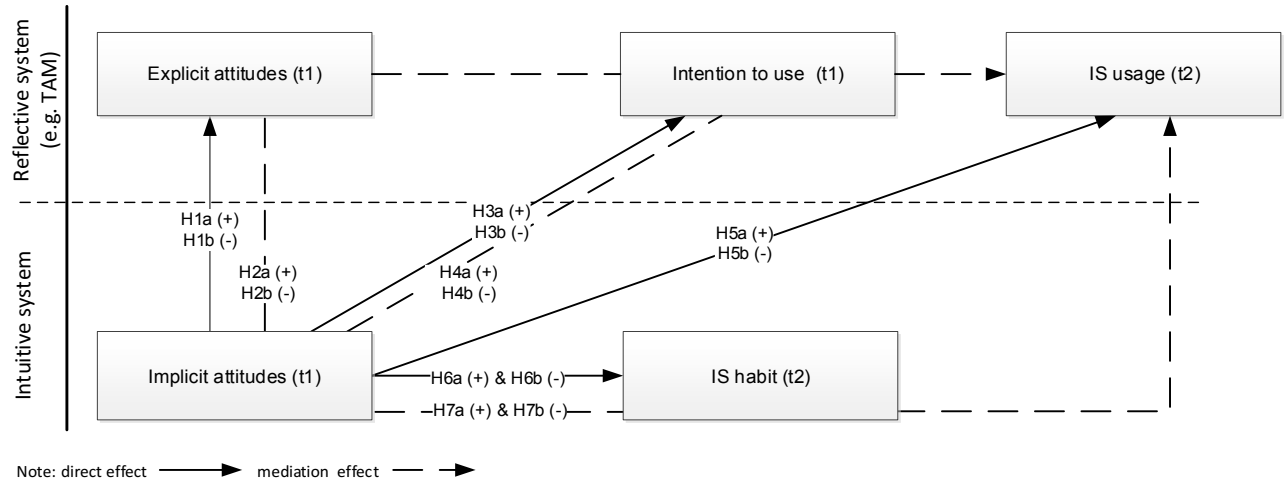


Figure 2: Research model

Implicit attitudes influence explicit attitudes: Prior literature indicates a relationship between explicit and implicit attitudes (Nosek 2007) and demonstrates that they are two independent phenomena (Wilson et al. 2000) which differ based on the cognitive effort needed to retrieve them from memory (Hofmann et al. 2005). The dual-model of attitudes (Wilson et al. 2000) argues that implicit attitudes reflect past experiences which are activated automatically by perceiving a relevant target object. Explicit attitudes in the reflective system, in contrast, receive an intuitive response as input from the intuitive system (cf., Gawronski and Creighton 2013). In line with the psychology literature, we assume that the explicit cognitive evaluation about the IS as either positive or negative is affected by implicit and past experience. The positive unconscious associations with the IS positively influence the rational evaluation of one's feelings towards the IS such that individuals rationally assess the IS as positive based on the unconscious positive association's et vice versa. For example, if a user is triggered to think of Facebook, they implicitly associate something positive or negative with Facebook which increases or decreases the rational evaluation such that they develop positive or negative evaluations towards using Facebook. Hence, we assume that:

H1a*: The higher the positive implicit attitudes, the higher the (positive) explicit attitudes.*

H1b*: The higher the negative implicit attitudes, the lower the (positive) explicit attitudes.*

The effect of implicit attitudes on IS usage is mediated by explicit attitudes and intention to use: Previous literature suggests that the responses from the intuitive system influence the reflective system (Gawronski and Creighton 2013). For example, the intuitive system is able to bias the processing in the reflective system because the former is the faster system as it operates in the unconscious. This often results in rationalization such that individuals believe their thinking is completely rational but it has rather been biased by the intuitive system (Epstein 2003). As past literature indicates a relationship between implicit attitudes and explicit attitudes (Nosek 2007) and as pertinent IS usage literature demonstrates that explicit attitudes have an effect on intention to use and hence on IS usage (Davis et al. 1989; Wixom and Todd 2005), we theorize that the effect of positive and negative implicit attitudes on IS usage is mediated by explicit attitudes and intention to use. For example, if users are triggered to thinking about Facebook, they implicitly associated something positive (negative) with Facebook which biases the explicit attitudes, which in turn, determine the intention to use Facebook and increase (decrease) the usage of Facebook. Hence, we assume that:

H2*: The effect of (a) positive and (b) negative implicit attitudes on IT use is mediated by (positive) explicit attitudes and intention to use.*

Implicit attitudes influence (explicit) intention to use: As the reflective system monitors the activities and inputs of the intuitive system (Gawronski and Creighton 2013), we theorize that intention to use an IS is influenced by the implicit association with the IS. The implicit positive and negative associations either increase or decrease the motivation and the willingness to use the IS because of implicit past experiences and

stereotypes. We assume that positive (negative) unconscious associations with the IS increase (decrease) the willingness and motivation to use the IS because individuals are implicitly reminded of positive (negative) experiences related to the IS. For example, if users are triggered to thinking about Facebook, they implicitly associated something positive (negative) with Facebook which increases (decrease) their motivation to use Facebook. Hence, we assume that:

***H3a**: The higher the positive implicit attitudes, the higher the intention to use.*

***H3b**: The higher the negative implicit attitudes, the lower the intention to use.*

The effect of implicit attitudes on IS usage is mediated by (explicit) intention to use: We already demonstrated that past literature suggests a relation between the reflective and intuitive system (Gawronski and Creighton 2013). The belief-bias effect explains the rationalization such that individuals believe their thinking is completely rational but it has rather been biased by the intuitive system (Epstein 2003; Evans 2003). In addition, we previously explained the influences from implicit attitudes on intention to use. Hence, we theorize that the effect of positive and negative implicit attitudes on IS usage is mediated by intention to use. For example, if users are triggered towards thinking about Facebook, they implicitly associate something positive (negative) with Facebook which biases the intention to use Facebook and increase (decrease) the usage of Facebook. Hence, we assume that:

***H4**: The effect of (a) positive and (b) negative implicit attitudes on IT use is mediated by intention to use.*

Implicit attitudes influence IS usage: Literature suggests that behavior is influenced by explicit facts and values as well as implicit associations (Strack and Deutsch 2004). In particular, behavior is predicted by explicit and implicit attitudes (Fazio and Olson 2003). One rationale for the effect of implicit attitudes on behavior is that the automatic and implicit categorization of the target object as either favorable or unfavorable has a direct influence on the behavior because this automatic process evokes past traces of experiences which result in actions (Chen and Bargh 1999; Greenwald and Banaji 1995). Hence, we theorize that IS usage is influenced by implicit attitudes such that when the automatic and implicit categorization of the IS is favorable, then IS usage is higher:

***H5a**: The higher the positive implicit attitudes, the higher IS usage.*

***H5b**: The higher the negative implicit attitudes, the lower IS usage.*

Implicit attitudes influences IS habit: A few IS usage researchers have focused on the intuitive system by examining IS habit (e.g., Limayem et al. 2007; Polites and Karahanna 2012, 2013; Soror et al. 2015). IS habit is defined as the extent to which individuals tend to use an IS automatically because of learning and past usage patterns (Limayem et al. 2007). Besides IS habits, the intuitive system also contains implicit attitudes (Frankish 2010; Gawronski and Creighton 2013) which, according to the dual-attitude model (Wilson et al. 2000), can influence implicit behaviors such as IS habits. Devos (2008, p. 75) states that *"evaluations operating outside of conscious awareness or control result in behavioral tendencies."* Implicit positive and negative associations with the IS stemming from hidden past experiences are unconscious and hence effect automatic usage tendencies without cognitive effort. Therefore, we theorize that positive implicit attitudes increase IS habit because positive implicit associations with the IS facilitate habitual behavioral tendencies. The positive unconscious associations with the IS based on past experiences support the specific mindset that the IS is positive and should be used. Conversely, negative implicit attitudes decrease IS habit. The negative unconscious associations with the IS based on bad past experiences reduce the specific mindset that the IS is positive and should be used. For example, if users have implicitly positive associations with Facebook, the tendencies to use Facebook increase, whereas negative associations decrease the behavioral tendencies to use Facebook. Therefore, we assume that:

***H6a**: The higher the positive implicit attitudes, the higher the IS habit.*

***H6b**: The higher the negative implicit attitudes, the lower the IS habit.*

The effect of implicit attitudes on IS usage is mediated by IS habit: Extent literature concentrating on IS habit provide evidence that IS habits increase IS usage (Limayem et al. 2001; Limayem and Hirt 2003). The reasoning is that IS habits reflect the extent of the tendencies to use the IS (Limayem et al. 2007) such that the higher the sensitivity to habit-related cues the higher the tendencies to perform the IS usage rather than other behaviors. Above we explained the relation between implicit attitudes and IS habits. If users are triggered to thinking about Facebook, they implicitly associated something positive (negative) with Facebook which increases (decreases) the tendencies to use Facebook and indirectly effects Facebook usage. Hence, we assume that:

***H7**: The effect of (a) positive and (b) negative implicit attitudes on IT use is mediated by IS habit.*

4 METHODOLOGY

We now describe the study design and explain how implicit and explicit constructs were measured. We follow previous literature that also investigated the dual process theory (e.g., Turel et al. 2014; Turel and Qahri-Saremi 2017) by concentrating on the domain of Facebook, which has been shown to be a proper application domain for this kind of research. Subsequently, we demonstrate the analysis of the SC-IAT data and make sure that our measurement model is valid and reliable.

4.1 STUDY DESIGN

The study design includes the procedure, material and apparatus, and the respondents.

4.1.1 Study procedure

A two-wave study was conducted. The first wave used a laboratory study for data collection, and the second wave consisted of a follow-up questionnaire to participants.

In the first wave, subjects were isolated from each other in our laboratory and completed the study independently. The laboratory procedure is classified into two stages because the order of implicit and explicit measurement is important (Karpinski and Steinman 2006) such that we first measured the implicit and then the explicit effects. In the first stage**,** we captured the implicit attitudes by asking the subjects to participate in a single category implicit association test (SC-IAT; Karpinski and Steinman 2006), which captures the response time to measure (fast) automatic associations towards target objects (the SC-IAT is described in detail in the measurement section). After the SC-IAT, participants filled out a questionnaire which captured explicit attitudes and intentions (constructs are described in detail in the Appendix). For the second wave of data collection, all subjects were sent a second questionnaire two weeks after the laboratory study to measure actual IS usage and IS habit.

4.1.2 Material and apparatus

Facebook has previously been investigated in the context of the dual-process theory differentiating between the reflective and intuitive systems (Turel et al. 2014; Turel and Qahri-Saremi 2017). Hence, we followed past litterateur and drew on the domain of Facebook to validate our research model. In addition, as we required participants who all know a common IS and who have positive as well as negative implicit attitudes towards it, we think that Facebook is the proper technology because it is the largest social network site (SNS) with an average of 1.18 billion active individuals a day and encompasses heavy or addicted user as well as stressed users (Maier et al. 2013; Turel 2014). For example, Facebook attracts extremely heavy users who might provide positive opinions and perceptions of using Facebook (Maier et al. 2013; Turel 2014) as well as stressed and overloaded individuals who might provide negative opinions and perceptions of using Facebook (Maier et al. 2014a; 2015c).

4.1.3 Respondents

The participants were students attending our university. To increase participation, each participant received five euros as an allowance. The laboratory study was conducted over a four-week period in the middle of 2016. The second survey was mailed out two weeks after the laboratory study. The characteristics of the respondents are displayed in Table 2.

The sample of the laboratory study includes 106 participants. The response rate of the second wave of data collection was 91 percent. The sample is coincidentally equally split into men 50% and women 50%. As shown in Table 2, approximately 85% of the sample is between 21 and 30 years old and holds a high school or bachelor's degree.

Demographics			**Marital status (%)**		**Highest educational status (%)**	
N	106		Single	59.5	High school graduation	50.0
Gender (%)	Men	50.0	Partnership	34.9	Bachelor	41.5
	Women	50.0	Marriage or any similar relationship	2.8	Master/diploma	6.6
Age (%)	15-20	8.5	Others	2.8	Other	1.9
	21-25	73.7				
	26-30	16.0				
	31-35	0.9				
	>35	0.9				

Table 2: Demographics

4.2 MEASUREMENT

We draw on two kinds of measurement, namely the SC-IAT, which measures the implicit attitudes, and self-reporting, which captures the other constructs. Next, we first describe the SC-IAT in detail and shortly elucidate on the self-reporting method.

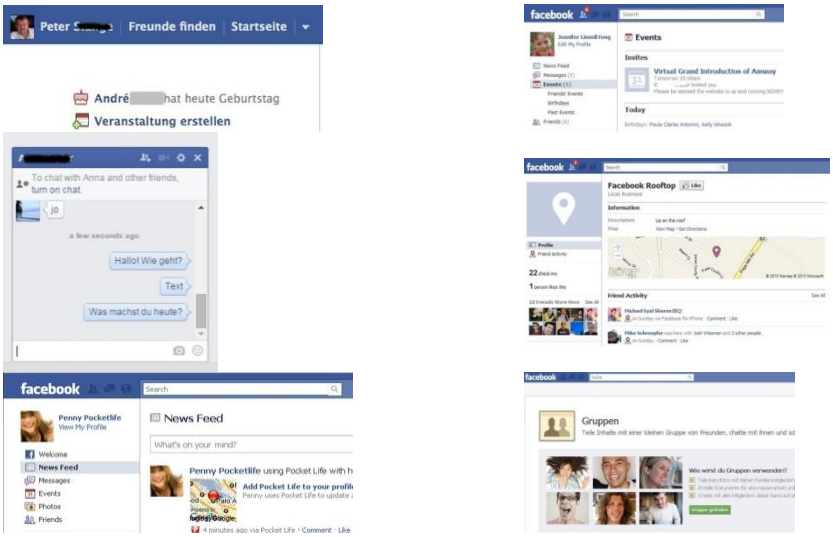
4.2.1 The single category implicit association test

To investigate implicit attitudes, we draw on an indirect measurement method called i*mplicit association test* (IAT) developed by Greenwald et al. (1998). As we concentrate only on one IS we use the single category IAT (SC-IAT; Karpinski and Steinman 2006) which measures the strength of evaluative associations with a single target object. We use the SC-IAT to capture implicit attitudes towards Facebook. This test records the reaction times in milliseconds from the onset of the task display to the response. The SC-IAT approach states that the faster individuals associate stimuli (words on a screen that have positive or negative connotations) with the target object, the higher is the implicit attitudes (Greenwald et al. 1998; Karpinski and Hilton 2001). The detailed procedure of the SC-IAT is explained in the following, a good online example for IAT is offered by Harvard University.

The test contains sequences of one **target object** and two **attributes** (see Table 3), such as positive (e.g., happy, vacation) and negative (e.g., ugly, poison) meaning words. The target object as well as the positive and negative meaning words are represented by several stimuli. The basic idea is to ask SC-IAT users to allocate target objects appearing at the middle of the screen (e.g. "social networking site") to positive or negative attributes (e.g., "peace, grief") that are located on the right and left side of the screen. Because implicit attitudes are part of the intuitive system that is much faster than the reflective system, implicit attitudes will allow much faster (automated) reaction times than explicit (thoughtful) attitudes.

In the present research, we adapted the SC-IAT to our study purpose by considering Facebook as our target object and two attributes in terms of positive and negative meaning word. To represent Facebook as target object, we used 14 words and images as stimuli (see Table 3). We adopted positive and negative meaning-words from Greenwald et al. (1998) to represent positive and negative associations (see Table 3). The SC-IAT is conducted by using an online-based SC-IAT provided by Socialsci.

Target object	Stimuli
Facebook	Social network site, post, comment, event, private message, birthday reminder, chat, group



Attributes	Stimuli
Positive meaning words	caress, freedom, health, love, peace, cheer, friend, heaven, loyal, pleasure, diamond, gentle, honest, lucky, rainbow, diploma, gift, honor, miracle, sunrise, family, happy, laughter, paradise, vacation
Negative meaning words	abuse, crash, filth, murder, sickness, accident, death, grief, poison, stink, assault, disaster, hatred, pollute, tragedy, bomb, divorce, jail, poverty, ugly, cancer, evil, kill, rotten, vomit, agony, prison

Table 3: Target, attributes and their stimuli

Next, we first explain the basic structure of the SC-IAT and then show the SC-IAT procedure by explaining the four-different blocks.

The SC-IAT is **structured** as shown in Figure 3. The target object (e.g., Facebook) and the attributes (e.g., positive and negative) are presented in the left and right upper corners of a computer screen. Thereby, throughout different stages, the target object and one of the two attributes (e.g., positive and negative) are displayed in the same corner. Stimuli regarding the target object and both attributes (e.g., positive and negative; see Table 3) are randomly presented in the middle of the screen such as the stimulus "social network site" representing the target object (see Figure 3). Subjects are instructed to assign these stimuli to the related category in the left or right upper corner by pressing designated keys on the keyboard (e.g., "e" for the left and "i" for the right category). For example, "social network site" represents a stimulus of the target object Facebook (see Table 3) and should, therefore, be assigned to the left category by pressing the key "E" because Facebook is shown in the left upper corner. In assigning the stimulus, participants should react as fast as possible and make as few errors as possible, which occur when stimuli are assigned to an incorrect category such as the assignment of "social network site" to the right category which does not contain Facebook. An "X" is displayed when a response is incorrect, and the subjects must correct their answer (see Figure 3). The stimuli presented in the middle of the screen are randomly picked out of all stimuli representing Facebook, or the positive and negative meaning words (see Table 3).

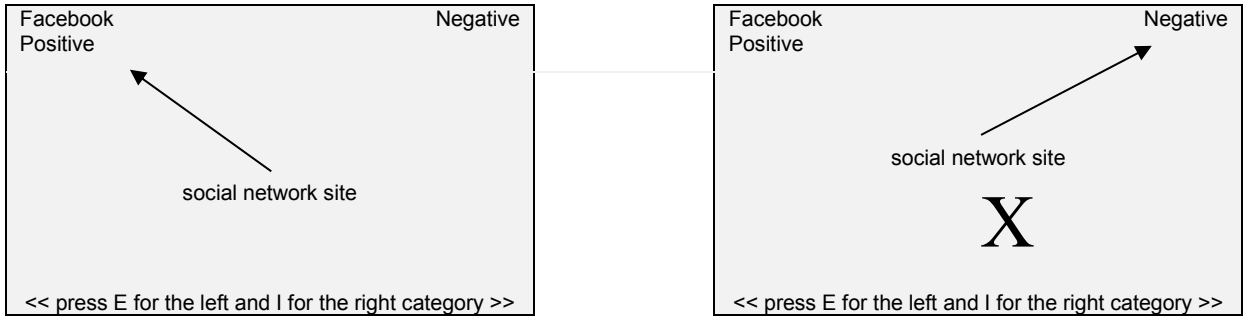


Figure 3: Example of a computer screen of the SC-IAT with a correct response left and an incorrect response right

Next, we explain the **SC-IAT procedure**. The process of SC-IAT encompasses four different blocks (see Table 4). Each block starts with instructions describing the target object for each block and the designation of response keys on the keyboard to the categories (left or right). Also, the combination of the target and the meaning words in the left or right upper corner change across the blocks. An overview of each block its goals and the assignment and pairing for the left and right key is given in Table 4.

Block	No. of stimuli	Goal	Left key	Right key
1	24	Practice: learning the meaning words and stimuli dimension	Facebook + positive meaning words	Negative meaning words
2	72	Test: target and meaning words pairing 1	Facebook + positive meaning words	Negative meaning words
3	24	Practice: learning to switch the spatial location of the construct	Positive meaning words	Facebook + Negative meaning words
4	72	Test: target and meaning words pairing 2	Positive meaning words	Facebook + Negative meaning words

Table 4: Structure of the SC-IAT

The four different blocks are described in detail in the following, and an example of one situation in each block is given in Table 5.

In **block I,** the subjects are familiarized with the first combination, in which positive meaning words and the target object Facebook are categorized onto the left response key and presented in the left upper corner. Negative meaning words are categorized onto the right key and presented in the right upper corner (see **Table 5**). Subjects are asked to assess whether the stimuli displayed in the middle of the screen belongs to the left or the right category. Stimuli about Facebook and positive meaning words should be assigned to the left-corner category, whereas negative meaning words should be assigned to the right-corner category. Participants must act as quickly and accurately as possible by pressing one of two designated keys on the keyboard (e.g., “E” or “I”). 24 random stimuli from the target object (e.g., posts, news feed, or screenshots; see Table 3), positive meaning words (e.g., pleasure, lucky; see Table 3), and negative meaning word (sickness, accident, death; see Table 3) are presented in the middle of the screen. To practice, the subjects assign the stimuli to the corresponding category (left or right). The goal of this block is to practice and to get used to the stimuli.

Block II has the similar structure as block I. However; this block contains 72 stimuli which are assessed in the analysis. As previously described, subjects assess whether the stimuli belong to the left or the right categories by pressing one of two designated keys (see **Table 5**).

In **block III,** the key assignment for the target object is reversed such that negative meaning words and Facebook are categorized on the right response key and presented at the upper right corner, and positive meaning words are categorized on the left key and presented at the upper left corner. This block again contains 24 stimuli, and the goal of this block is to accustom the subjects to the new combination (see **Table 5**).

Finally, in **block IV**, the constellation is similar to block III except that subjects assign 72 stimuli and the association is assessed in the analysis (see **Table 5**).

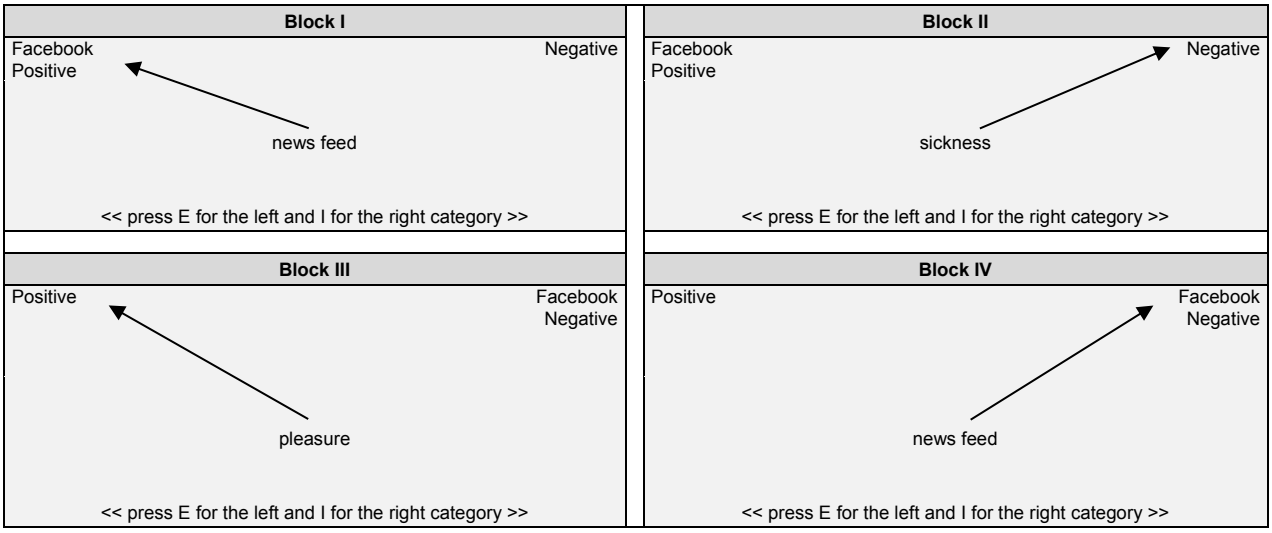


Table 5: Example of the SC-IAT process

Hence, the SC-IAT procedure can measure implicit attitudes towards Facebook. The target object Facebook is used in combination with positive meaning and negative meaning words. We used the SC-IAT procedure to operationalize positive implicit attitudes by revealing the association between Facebook and positive meaning words and to operationalizing negative implicit attitudes by revealing the association between Facebook and negative meaning words. Furthermore, the SC-IAT procedure is divided into two conditions to avoid distorted individual SC-IAT scores. When the block order remains constant, correlations between the SC-IAT scores and the predictor criteria can be biased (Messner 2010). Therefore, in line with Bluemke and Friese (2008), we varied whether participants started with the combination Facebook and positive meaning words or with the combination Facebook and negative meaning words by randomly assigning the participants to the different conditions.

4.2.2 Self-reporting

The participants also filled out two surveys (t1 and t2), the first immediately after the SC-IAT during the laboratory study. It contained several control variables such as age (t1) and gender (t1), explicit attitudes (t1), and intention to use (t1) that were measured by the existing and valid scales provided by Venkatesh et al. (2003) and (2012). We adjusted the questions only slightly to fit the study context by focusing on Facebook instead of mobile Internet. The second survey was filled out in the second wave of data collection approximately two weeks later. It captures IS usage (t2) with the measurement items provided by Yang and Yoo (2004) and IS habit (t2) with the scale by Limayem et al. (2007). Both scales were slightly adapted to the study context. All measurement constructs are summarized in the Appendix Table 10.

4.3 Analysis, Validity, and Reliability

4.3.1 SC-IAT algorithms

The results of the SC-IAT are data points in millisecond (ms) for each stimulus across the four blocks of analyses, which represents in total 192 data points. Before analyzing and interpreting these results, the SC-IAT data must be adjusted. Therefore, we based on two conventional algorithms suggested by Karpinski and Steinman (2006) and Wigholdus et al. (2005).

The algorithm suggested by Karpinski and Steinman (2006) follows five steps described below. As the first and third block of the SC-IAT only contain 24 practice trails, and their purpose is to practice using the SC-IAT, the data from these blocks are not analyzed. Consequently, only the responses from the second and fourth blocks are used for data analysis. In the second and third step, outliers in the SC-IAT data are identified, trials with latency below 350 ms were eliminated, and nonresponses were eliminated. In step four,

the error responses are replaced with the block mean plus an additional error penalty of 400 ms is given. In step five, the mean latency for blocks II and IV is calculated. In the last step six, average response times of block 2 and block 4 were calculated and subsequently log-transformed for normalization.

The algorithm suggested by Wigholdus et al. (2005) only uses the data from block 2 and 4. Outliers were dealt with by replacing reaction times below 300 ms with 300 ms and by replacing reaction times higher than 3,000 ms with 3,000 ms. Reaction times were log-transformed to normalize the skewed distributions that result from reaction time measurements. All remaining responses within each block were averaged. Contrary to the original algorithms we do not compute one implicit attitude score because we aim to obtain two independent measurement items for positive and negative implicit attitudes towards Facebook. To do so, we interpret reaction time regarding positive meaning-words and Facebook as positive attitudes and the reaction time regarding negative meaning-words and Facebook as negative attitudes. Both algorithms are summarized in Table 6.

Eventually, we reversed the positive and negative implicit attitudes values, because the faster the association, the stronger the implicit attitudes such that strong implicit attitudes are represented by high values and weak implicit attitudes are represented by low values.

Algorithm based on Karpinski and Steinman (2006)	Algorithm based on Wigholdus et al. (2005)
1. Data from trial blocks were discarded (blocks 1 and 3) 2. Responses below 350 ms were eliminated 3. Non-responses were eliminated 4. Error responses were replaced with the block mean plus an error penalty of 400ms 5. Average response times of block 2 and block 4 were calculated 6. Average values were log-transformed to normalize the data	1. Data from trial blocks were discarded (blocks 1 and 3) 2. Outliers were dealt with by replacing reaction times below 300 ms with 300 ms and replacing reaction above 3,000 ms with 3,000 ms. 3. Reaction times were log-transformed to normalize the skewed distributions that result from reaction time measurements 4. All remaining responses within each block were averaged

Table 6: SC-IAT algorithms

5 MEASUREMENT MODEL

As the data obtained through SC-IAT is not normally distributed, we use a partial least square (PLS) method because this approach does not require normally distributed data (Hair et al. 2011; Ringle et al. 2012). First, we transfer the research model illustrated in Figure 2 into a structural equation model (Chin 1998a) and use SmartPLS 3.2.6 (Ringle et al. 2015). To ensure that the structural model is valid and reliable, we control the common method bias (CMB), content validity, indicator reliability, construct reliability, and discriminant validity as follows (Bagozzi 1979).

CMB. A potential issue with subjective measures is common method bias (Podsakoff et al. 2003). As we used subjective measures to capture individuals' responses to a given situation such as beliefs or intention, we tested the research model without the objective data for CMB using Harman's single factor test (Harman 1976) and the procedure suggested by Williams et al. (2003). The results of the Harman's single factor test show that one factor explains 40.9% of the variance, which is not the majority, so we conclude that CMB is of no great concern. Furthermore, we follow the procedure suggested by Williams et al. (2003), during which an additional factor is entered into the PLS model, which contains each indicator of the original model. The remaining factors are transformed into single-item constructs, and the ratio of R^2 with the CMB factor is compared with the R^2 without the CMB factor. The CMB factor explains an average R^2 of 0.099, yielding a ratio of 1:165. By comparing this ratio with the ratio of prior research using this approach (Liang et al. 2007), we can state that no signs of CMB influence are observed.

Content Validity. We used only measurement items which have been used in prior research, which are described in the measurement section and listed in Appendix Table 10 below. Implicit positive and negative attitudes are measured through the SC-IAT, described above.

Indicator Reliability. The indicator reliability reflects the relation of the variance of one indicator that comes from the corresponding latent variables. To explain at least 50 percent of the variance of a latent variable by the indicators, values should be greater than 0.707 (Carmines and Zeller 2008). To fulfill this condition, we used only items with values higher than 0.707, as shown in Table 7. Also, a bootstrap method with 5,000 samples is performed and shows significant levels of all loadings of at least 0.001.

Construct Reliability. The construct reliability reflects criteria to determine the quality at the construct level. Therefore, composite reliability (CR) should be higher than 0.7 and average variance extracted (AVE) should be higher than 0.5 (Fornell and Larcker 1981). Table 7 demonstrates that the CR criteria, as well as the AVE criteria, are fulfilled.

Discriminant Validity. Discriminant validity describes the extent to which measurement items differ from each other (Campell and Fiske 1959). Discriminant validity is the degree to which a scale measures the variable it is intended to measure, rather than other variables, and it is indicated by low correlations between the measure of interest and the measure of other constructs (Fornell and Larcker 1981; Hulland 1999). The square root of the AVE for each construct is located on the diagonal of Table 7 and is higher for all constructs. As Henseler et al. (2015) state that the Fornell-Larcker criterion does not detect a lack in discriminant validity in each case, we also ensure that the 0.85 heterotrait-monotrait (HTMT) criterion is fulfilled (Voorhees et al. 2016). As the highest correlation between IS usage and IS habit is 0.82 – and hence lower than 0.85 – and the bootstrapping approach shows that HTMT is significantly different from 1, we can state that discriminant validity, when using $HTMT_{0.85}$ is not an issue in the present research.

	Constructs	Mean	SD	AVE	CR	Loadings	1	2	3	4	5	6
1	Explicit attitudes	4.02	1.20	0.667	0.890	0.807-0.829	0.817					
2	Intention to use	4.54	1.50	0.831	0.936	0.884-0.952	0.317	0.912				
3	IS usage	3.25	1.16	0.955	0.977	0.977-0.978	0.276	0.438	0.977			
4	Pos. implicit attitudes	6.58	0.15	0.922	0.960	0.924-0.986	0.066	0.131	0.088	0.960		
5	Neg. implicit attitudes	6.65	0.17	0.942	0.970	0.953-0.983	0.036	-0.012	0.036	0.693	0.971	
6	IS habit	5.23	1.64	0.845	0.956	0.802-0.976	0.263	0.556	0.778	-0.228	-0.135	0.919
Note: Square root of AVE is listed on the diagonal of bivariate correlations.												

Table 7: Measurement model

6 STRUCTURAL MODEL

To validate the structural model (see Figure 4), we use R^2 and the significance levels of the path coefficients (Chin 1998b).

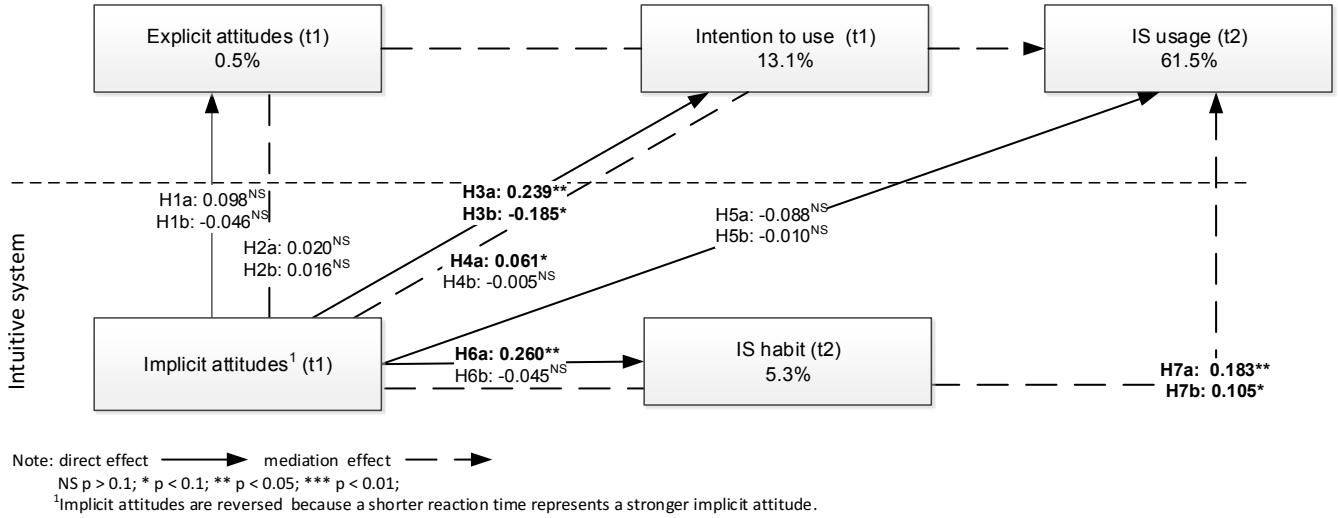


Figure 4: Structural model

Direct effects: The findings show that implicit attitudes (either positive or negative) have no significant effect on explicit attitudes and on IS usage, which indicates that H1a/b and H5a/b cannot be supported. We revealed a significant effect from positive and negative implicit attitudes on intention to use, though, which supports H3a and H3b. In addition, a significant effect from positive implicit attitudes on IS habit is found, whereby negative implicit attitudes have no significant effect. These results support H6a but not H6b. This model explains 0.5% of the variance of explicit attitudes, 13.1% of intention to use, 61.2% of IS usage and

5.3% of IS habit. Post-hoc analyses determining the strength of the effects show, based on Cohens f² measure (Cohen 2013), that positive implicit attitudes have a low effect on intention to use and IS habit, whereas negative implicit attitudes only show a low effect on intention to use. Explicit attitudes also have a low effect on intention to use and IS habit shows a high effect on IS usage.

Mediation effects: To validate whether the influences of implicit attitudes on IS usage is mediated by explicit attitudes, intention to use, or IS habit, we use a bootstrapping method (Preacher and Hayes 2004) and follow the two-step approach by Hair (2014) which suggests first to assess the significance of the direct effect without including the mediator variable. In the second step, the mediator variable is included, and the indirect effect is evaluated. The method suggests calculating the 95 percent-bias-corrected confidence intervals (5,000 bootstrap resamples) of each independent variable. If zero does not lie within the bias-corrected interval, the independent variable has an indirect effect through the mediator on the depended variable. The results show that the effect of positive implicit attitudes on IS usage is, indeed, mediated by the intention to use and IS habit, which supports H4a and H7a. The effects of negative implicit attitudes on IS usage are also mediated by IS habit, which supports H7b. H2a, H2b, H4b. H7b could not be supported (see Table 8).

	Mediators								
	Explicit attitudes			**Intention to use**			**IS habit**		
	Direct effect	**Indirect effects**	**Bias corrected 95% confidence interval**	**Direct effect**	**Indirect effects**	**Bias corrected 95% confidence interval**	**Direct effect**	**Indirect effects**	**Bias corrected 95% confidence interval**
Pos. implicit attitudes → IS usage	0.042^{NS}	0.009^{NS}	[0.031; 0.000]	0.035^{NS}	**0.061***	[0.144; 0.007)	**-0.095****	**0.183****	[0.349; 0.028]
Neg. implicit attitudes → IS usage	0.042^{NS}	0.004^{NS}	[0.008; 0.000]	0.041^{NS}	-0.005^{NS}	[-0.000; -0.005]]	**-0.069****	**0.105***	[0.234; 0.013]
Note: NS p > 0.1; * p < 0.1; ** p < 0.05; *** p < 0.01;									

Table 8: Mediation analysis and total effects

7 DISCUSSION, CONTRIBUTIONS, LIMITATIONS AND FUTURE RESEARCH

Prior IS usage literature currently investigates the peak of the iceberg by mostly concentrating on the reflective system (e.g., Davis et al. 1989; Venkatesh et al. 2003; Venkatesh et al. 2012). The majority examines the explicit, reasoning factors of IS behaviors such as beliefs, explicit attitudes, and intentions by following the theoretical underpinnings of the underlying TPB and TRA. However, research indicates that behavior is not only determined by the reflective but also the intuitive system (e.g., Ferratt et al. 2018; Turel and Qahri-Saremi 2017). Therefore, the present research focuses on the murky part of the iceberg currently still underwater, which represents the intuitive system and its direct and indirect effects on IS usage.

Our study is based on the dual process theory (Kahneman 2003) which posits that individuals are influenced by a reflective and an intuitive system, which are independent, operate in parallel, and interact to produce behavior (Epstein 2003). We introduce the concept of implicit attitudes and the SC-IAT approach for measuring implicit attitudes to IS usage research and we are one of the first which theorize, measure, and statistically evaluate a theoretical model that shows their direct and indirect effects on IS usage. Our results indicate that positive and negative implicit attitudes have a noteworthy impact on the reflective system and influence IS use intentions. Positive implicit attitudes influence IS habit and act as an implicit antecedent within the intuitive system. Moreover, the findings show that implicit attitudes also indirectly influence IS usage. These results contribute to literature and practice in several ways, as described below and illustrated in Table 9.

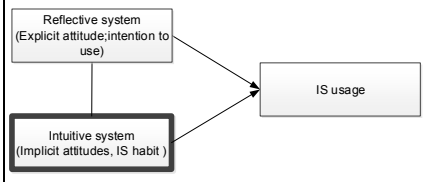
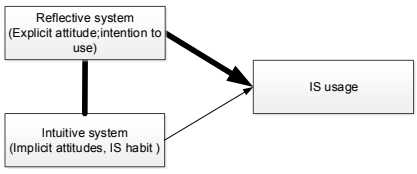
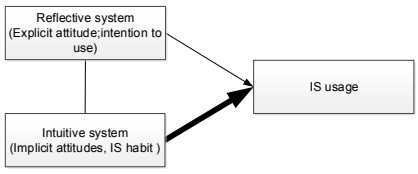
Beyond the reflective IS usage process	Effects of the intuitive system on the reflective system and IS usage	Effects of the intuitive system on IT usage
		

Table 9: Implications of the present study

7.1 BEYOND THE REFLECTIVE IS USAGE PROCESS

The research model goes beyond traditional research and is among one of the first empirical approaches in IS usage research to consider both the reflective system's and the intuitive system's effects on behavior. Our results strengthen traditional IS usage model such as TAM (Davis et al. 1989) and the unified theory of acceptance and use (UTAUT; Venkatesh et al. 2012) that both predict IS usage by concentrating on reasoning factors such as beliefs, explicit attitudes, and intentions, by providing a more comprehensive prediction logic of IS usage.

Reflecting the findings of Dimoka and Davis (2008) who use fMRI to localize the neural correlations of the TAM constructs and uncover hidden affective processes associated with intentions to use, we contribute to the literature by strictly separating the intuitive and reflective systems and concentrate on explicit and implicit attitudes. Also, by theorizing and evaluating the influence of the intuitive system on the reflective system we reveal that positive and negative implicit attitudes occurring in the intuitive system affect the intention to use occurring in the reflective system. Furthermore, we extend the findings by Ortiz de Guinea et al. (2014) who investigate implicit antecedents of cognitive beliefs by following the dual process theory and focusing on implicit attitudes to hypothesize their effect on the reflective system.

Before this study, evidence of the investigations based on the dual process theory was purely conceptional or neglect method other than introspection (e.g., Constantiou et al. 2014; Ferratt et al. 2018; Soror et al. 2015; Turel and Qahri-Saremi 2017). Hence the present study contributes to the literature on the unconscious by not only conceptually differentiate between the reflective and intuitive system but also hypothesize, measure, and empirically test the influences of the different systems. In particular, the present study extends the work by Ferret et al. (2018) and Constantiou et al. (2014) who conceptually assume the effect of the reflective and intuitive system on IS usage and the work by Turel et al. (2017) and Soror et al. (2015) who include a measure of the intuitive system but use only methods which go beyond introspection by using a measurement technique which captures the intuitive system and empirically testing the effect of the reflective and intuitive system on IT usage.

In sum, our results extend the IS usage literature by following a dual process theory and separating the reflective and the intuitive system. We contribute to the literature by demonstrating an influence between the reflective and the intuitive system and reveal insights into the intuitive system. In addition, we contribute to the literature by going beyond conceptualization and introspection as we conduct one of the first comprehensive assessment of the dual process theory by theorizing, measuring, and empirically evaluating the effects of the reflective and intuitive system in the contest of IT usage. This research will serve as a base for future studies as it lifts the iceberg a little bit out of the water and clears some of the murky implicit parts in the context of IS usage.

7.2 EFFECTS OF THE INTUITIVE SYSTEM ON THE REFLECTIVE SYSTEM AND IS USAGE

7.2.1 Implicit attitudes and its effects

Prior literature in the research stream of IS usage primarily focuses only on explicit attitudes (e.g., Davis et al. 1989; Venkatesh et al. 2003; Venkatesh et al. 2012) with several investigations drawing particular

attention to the explicit attitudes construct (Wixom and Todd 2005; Yang and Yoo 2004; Zhang et al. 2008; Zhang and Sun 2009). The present research contributes to the literature by introducing the implicit attitude construct into the IS context and posit a complementary research approach by also considering implicit attitudes. We assume theoretically that explicit and implicit attitudes are two distinct constructs and confirm this theoretical assumption empirically in the context of IS usage. The present research extends the work by Kim (2009) who devotes particular attention to the role of memory in the post-adoption stage by focusing on the role of implicit memory regarding implicit attitudes. Moreover, as we show that explicit and implicit attitudes co-exist and differ from each other, we extend existing acceptance models (e.g., Davis et al. 1989; Venkatesh et al. 2003; 2012) by including past and unconscious experience in terms of implicit attitudes occurring in the intuitive system.

In sum, the present study sheds a contemporary light on attitudes by differencing between explicit and implicit attitudes by using the dual process theory as a theoretical lens in the context of IT usage. The consideration of intuitive factors such as positive and negative implicit attitudes enhances our understanding of the intuitive system in the context of IT usage and strengthen the assumption to take intuitive factors more into consideration.

7.2.2 Implicit attitudes influence intention to use

Attitudes are among the important antecedents of intention to use (Jeyaraj et al. 2006), and several acceptance models contain an explicit attitudes construct which influences intention to use (e.g., Davis et al. 1989). The present research contributes to this research stream by also focusing on implicit attitudes and arguing that individuals can hold positive and negative implicit attitudes simultaneously (Thompson et al. 1995). The empirical results demonstrate that, indeed, not only explicit but also positive and negative implicit attitudes significantly influence intention to use.

Surprisingly, the explicit attitude construct has been removed from several explicit attitude models (Davis 1989; Venkatesh et al. 2012). We counteract this tendency to neglect that attitude construct and remove it from research models by taking a closer look at attitudes. By distinguishing between explicit and implicit attitudes on the two systems and specifying that individuals hold positive and negative implicit attitudes simultaneously, we reveal that positive and negative implicit attitudes predict intention to use. Besides the direct effects of implicit attitudes on the intention to use, we additionally reveal an indirect effect. The findings show that the effect of positive implicit attitudes on IS usage is mediated by intention to use. This contrasts with past literature, such as Davis (1989) and Venkatesh et al. (2012), who both removed the attitude construct from the research model as it seemed to have no influences on IS usage. Therefore, we encourage future literature to investigate intuitive factors in the intuitive system rather than simply neglect the attitude construct.

In summary, the present research reveals that positive and negative implicit attitudes significantly affect intention to use, which extends prior literature especially focusing on attitudes. Also, we counteract the argumentation to remove the attitude construct from IS usage models by revealing direct and indirect effects on implicit attitudes.

7.3 The Effect of the Intuitive System on IS usage

By examining automatic behavioral tendencies such as IS habits, some IS acceptance research focuses on aspects of the intuitive system (e.g., Limayem et al. 2007; Polites and Karahanna 2012, 2013; Soror et al. 2015). Our results reveal that positive implicit attitudes act as antecedents of IS habit. This enhances prior literature such as Limayem et al. (2007) who examine the role of IS habits and its antecedents, such as frequency of past behavior and comprehensiveness of usage, by identifying the positive influences of positive implicit attitudes on IS habits. Our study also goes beyond literature such as Polites and Karahanna (2013) who explain the formation of IS habits and investigate IS habit disruption strategies by revealing positive implicit attitudes as intuitive and unconscious antecedents of IS habits. These findings especially contribute

to the understanding of the formation of IS habits as well as to the development of disruption strategies because the implicit attitudes are stored in the implicit memory and are difficult to change (Gawronski and Creighton 2013). As the development of disrupting strategies is concerned with the change of user attitudes toward the new IS (Polites and Karahanna 2013), we extend these findings by paying attention to implicit attitudes and show that actions should be taken into account that change implicit attitudes as well.

Besides the effect of positive implicit attitudes on IS habit behavior, we also reveal an indirect effect of positive and negative implicit attitudes on IS usage, mediated by IS habit. These results extend prior literature such as Limayem et al. (Limayem et al. 2001; 2007) who demonstrate the effect of IS habits on IS usage by explaining that IS habit not only acts as an antecedent of IS habit and represents an intuitive precursor of IS usage but also acts as a mediator for the relation between positive implicit attitudes and IS usage. IS habit might, therefore, be a central mediator which translates the effect of the intuitive system to the reflective system. Hence, future research might concentrate on the role of IS habit when considering the reflective and intuitive system in the context of IS usage.

In summary, our results regarding the effect of IS habit align well with past literature as we find a direct relation to IS usage. Moreover, the influence of positive implicit attitudes on IS habit extends past literature, which has focused on the formation as well as the disruption of IS habits. In addition, IS habit depicts not only an antecedent of IS usage but also mediates the influences of positive and negative implicit attitudes on IS usage and might represents a gate from the intuitive system on the reflective system.

7.4 Introducing the SC-IAT as a Measurement for Implicit Attitudes in IS Research

By identifying and measuring the effect of implicit attitude on intention to use, we extend the findings of Dimoka and Davis (2008, p. 13) and address their call to "*uncover other hidden components of IS constructs that cannot be easily inferred by self-reported measurement scales."* We adapted the SC-IAT (Karpinski and Steinman 2006) commonly used in psychological research, which originates from the IAT developed by Greenwald et al. (1998), to measure individuals' implicit associations with the IS. Furthermore, the semantical analysis of IS usage literature by Williams et al. (2009) reveals that over 70% of the investigations in this research stream use surveys and case studies. Hence, by introducing the SC-IAT into IS research as a means of measuring unconscious associations stored in implicit long-term memory, we contribute to a greater diversity of methods in IS research (e.g., Williams et al. 2009) and propose a suitable approach to measuring implicit attitudes. In addition, we are the first who follow the theoretical assumption of implicit attitudes ambivalence and adjust the SC-IAT in the way that we are able to separately measure positive and negative implicit association with a target object. Hence, the method in this paper can be used to investigate other implicit attitudes, both positive and negative, towards a specific target object.

7.5 Practical Implication

The present research also has potential practical implications. As implicit attitudes reflect the association with past experiences, organizations might tap into these implicit attitudes to increase the adoption of their products or internal systems. If an organization develops a new enterprise social network site (ESN; Kügler et al. 2015; Riemer et al. 2015) and knows that a specific kind of user group has positive implicit attitudes towards Facebook, for example, they could adopt a similar functionality or design in order to implicitly increase the intention to adopt the new product. On the contrary, organizations should develop different functionalities and designs when individuals have negative implicit attitudes towards an existing social network site. Firms face similar challenges as part of their regular change management efforts when, for example, they replace an old and outdated IS and have to disrupt automatic usage habits among staff to develop new intentions to use the new IS. Change managers can develop more effective IS habit disruption and training strategies if they consider the effects of implicit attitudes because changing implicit attitudes will likely take much more effort than changing explicit attitudes by merely explaining the advantages of the

new system. Overall, triggering positive implicit attitudes by connecting the IS with positive experience or stereotypes might be even more beneficiary when implicit attitudes are considered. Interesting future research in this area should look at how change management could benefit from considering implicit attitudes by drawing on experience, stereotypes, and childhood impressions when promoting and advertise their IS. For example, individuals who played many computer games in the past might now have positive implicit attitudes towards associated systems beyond what one might expect from a purely rational evaluation. Inversely, individuals whose strongest family and societal role models criticized rampant consumerism and cut-throat capitalism are more likely to have negative implicit attitudes toward IS provided by a global player accused of tax evasion and data privacy loopholes.

7.6 Limitation and Further Research

Like all empirical research, the present study is subject to several limitations. The data sample mostly consists of students between 21 and 30 years of age. However, we followed the practice recommended by Compeau et al. (2012) and intentionally selected this sample population as it reflects the overall Facebook population. In addition, the objective of the paper is to investigate the implicit attitudes towards Facebook, which are unconscious associations with the system such that we see no reason to expect a difference between populations.

Nevertheless, the empirical generalizability is still limited to the used technology and sample. While the SC-IAT is well established and we counterbalanced the order of blocks depicted in Table 4 in Appendix A such that one condition starts with Facebook plus positive meaning-words and the other with Facebook plus negative meaning-words, there is, of course, more than one possibility to adjust the SC-IAT data. Hence, the results of the present study should be interpreted under the conditions described in the SC-IAT algorithms section. In general, the IAT has on the one side used and published in high ranked journals (e.g., Baccus et al. 2004; Greenwald et al. 1998; Greenwald et al. 2003), but on the other side, current literature indicates some issues concerning the method. For example, the literature demonstrates that the results of the IAT show lower stability over time than explicit measures (Gawronski et al. 2017) and have issues by measuring especially discrimination outcomes (Carlsson and Agerström 2016). However, current literature state that *"the IAT as a tool to learn about automatic associations can be a good way to start a rich discussion about attitudes […] [and that] […] the IAT can still be a useful tool for researchers […]*" (Carlsson and Agerström 2016, p. 286).

In line with past literature (Thompson et al. 1995), we have distinguished between positive and negative implicit attitudes in the intuitive system and their influence on the traditional explicit attitudes construct of the reflective system. Future research might also distinguish between positive and negative explicit attitudes and investigate the interplay between positive and negative implicit and explicit attitudes and their compound influences on behavior. As our study focuses on one specific hedonic technology and considers only the voluntary use of an IS, further research should ideally examine different kinds of technology. In line with Ortiz de Guinea (2014) further research might also focus on the antecedence and the development of implicit attitudes, which might be complemented by combining EEG measures with the SC-IAT to analyze what happens in the brain when individuals unconsciously associate the usage of an IS as positive and negative. As implicit and unconscious phenomena such as implicit attitudes, implicit antecedents of beliefs (Ortiz de Guinea et al. 2014), or unconscious and automatic behavior (Kim 2009) become more present in IS research, we call for an investigation of a potential implicit acceptance process.

Specifically, the relationship between implicit attitudes and IS habit should be of interest in future research as both derive from prior use. Moreover, the consideration of continued IS use, and the possible feedback effect from IS usage back to both IS habit and implicit attitudes, should be investigated. Thereby, further research should use measurement techniques which are able to capture the hidden components of IS acceptance.

8 CONCLUSION

Implicit attitudes are an essential piece of the IS usage puzzle. This study indicates that IS usage behavior depends on a reflective and intuitive system associated with explicit and implicit attitudes. Both are independent, operate in parallel, and interact to produce behavior. We developed and validated a model that considers both explicit and implicit usage antecedents and their interaction. The empirical findings show an influence on the intention to use and IS habit. More precisely, positive implicit attitudes act as antecedents of IS habits in the intuitive system while positive and negative implicit attitudes influence intention to use in the reflective system. We extend IS theory by going beyond traditional usage research and considering intuitive factors such as implicit attitudes besides the well understood reasoning factors (e.g., explicit attitudes, intentions) and show that implicit attitudes indirectly influence IS usage.

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10 APPENDICES

Construct	Items
Explicit attitude (Venkatesh et al. 2003) Cronbach's α= 0.838	Using Facebook is a good idea.
	Facebook makes surfing the Internet more interesting.
	Using Facebook is fun.
	I like using Facebook.
Intention to use (Venkatesh et al. 2012) Cronbach's α= 0.899	I intend to continue using Facebook in the future.
	I will always try to use Facebook in my daily life.
	I plan to continue to use Facebook frequently.
IS usage (Yang and Yoo 2004) Cronbach's α= 0.953	On the average, how often do you use Facebook per day?
	How often do you use Facebook on average per week?
IS habit (Limayem et al. 2007) Cronbach's α= 0.937	Using Facebook has become automatic to me.
	Using Facebook is natural to me.
	When I get on the Internet, Facebook is the first website I visit.
	I have a habit of using the IS.
Note: All items are assessed on a 7-point Likert scale (1 = strongly agree to 7 = strongly disagree) except IS usage, which was assessed on a 5-pint Likert scale (1 = never to 7 = many times per day) and implicit attitudes, which was measured using the SC-IAT. Positive implicit attitudes: Cronbach's α= 0.917, Negative implicit attitudes: Cronbach's α= 0.937	

Table 10: Measurement items

Effect sizes (f^2)				
	Explicit attitudes	Intention to use	IS habit	IS usage
Pos. implicit attitudes	0.005	0.034	0.037	0.010
Neg. implicit attitudes	0.001	0.020	0.001	0.000
Explicit attitudes		0.107		
Intention to use				0.000
IS habit				1.092
Note: f^2 means effect size; Cohen (2013) interprets effect sizes as follows: >0.35 = high effect; >0.15 = medium effect; >0.02 = low effect				

Table 11: Effect sizes

3. Chapter
Coping with the dark side of IT use

Paper VI

COPING WITH DISCREPANT INFORMATION TECHNOLOGY EVENTS
A LITERATURE REVIEW

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Proceedings of the 26st European Conference on Information Systems (2018), Portmouth, UK
https://aisel.aisnet.org/ecis2018_rp/137/

Paper VII

HOW DO USERS COPE WITH TECHNOSTRESS?

CONTEXT-SPECIFIC THEORIZING OF COPING IN TECHNOSTRESS RESEARCH

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How Do Users Cope with Technostress?

Context-Specific Theorizing of Coping in Technostress Research

Abstract

Literature shows that information systems (IS) usage results in technostress. Coping research aims to address these issues by examining the coping strategies that users apply in such situations. Plenty of coping strategies exist, varying in their approach and method. However, the literature on IS coping shows substantial heterogeneity in the examination of coping strategies and neglects their differences in the context of technostress. This paper explores the contextualization of coping in the domain of technostress. The result is a theoretical model of coping families to disclose different kinds of coping strategies. Following context-specific research and decomposing coping by structure and classification leads to an investigation of four different coping strategies and examples from four families of coping strategies, along with an evaluation of their effects on techno-exhaustion and end-user performance.

Keyword: coping structure and classification, coping strategy and family, technostress, techno-exhaustion, end-user performance

1 Introduction

Recent information systems (IS) research demonstrates that information technology (IT) use results in technostress, stress perceived when using IS (Ragu-Nathan et al. 2008). Users perceive several techno-stressors, defined as technology-related stimuli resulting in negative consequences (Ayyagari et al. 2011; Tarafdar et al. 2010). Techno-stressors and their consequences represent a threat to user well-being and mental health (Tarafdar et al. 2015a), also affecting user task performance (e.g., Tams et al. 2014; Tarafdar et al. 2007; Tarafdar et al. 2014). The psychological research stream on coping aims to address these issues, mainly concentrating on cognitive appraisal to understand how users behave when confronted with stressors (Lazarus and Folkman 1984). In particular, prior research reports that when users face stressors, they appraise the situation and perform various coping strategies (Lazarus and Folkman 1984). Plenty of coping strategies exist, all of which are actions to handle these stressful situations (Skinner et al. 2003).

However, past IS coping literature shows substantial heterogeneity in the examination of coping strategies, and fails to provide a theory that explains the differences among the various coping strategies investigated in the context of technostress. For example, IS coping research investigates coping strategies such as venting (Pirkkalainen et al. 2017), resource and method control (Galluch et al. 2015), and cognitive avoidance (Love et al. 2004), ending with discontinuance of IS usage (Maier et al. 2015c). These coping strategies differ according to their method; some focus on behavioral efforts, others on cognitive measures. For example, seeking social support aims to deal with techno-stressors, whereas discontinuation focuses on avoiding the stressful IT at all. This heterogeneity in the extant research regarding coping strategies enhances the dilemma of specificity and generality in the context of technostress. Context-specific research argues that theories and the results of empirical testing might differ, depending on the context (Johns 2006, 2017). For example, coping strategies that are effective in a work-stress context might not apply in a technostress context. In addition, research suggests aiming for a balance between the context-specific results and their generalizability (Sarker 2016). Hence, progress toward a context-specific investigation of coping in the domain of technostress is needed. Applying the coping theory (Lazarus and Folkman 1984) in the domain of technostress requires understanding what kinds of coping strategies exist, their differences, and their different kinds of effects on individuals in this specific context. Therefore, the present paper aims to answer the research question:

How can coping be contextualized into the domain of technostress?

To respond to this research question, we contextualize coping into the domain of technostress by decomposing the general construct of coping, and building upon the hierarchical structure of coping (Skinner et al. 2003) and its classification (Holahan et al. 1996) to identify context-specific coping strategies. To analyze how the context-specific coping strategies affect technostress, four coping strategies (one from each coping family) were used to develop and validate a research model. Therefore, this paper contributes to the research by contextualizing coping into the domain of technostress. By examining one context-specific coping strategy for each of the four identified coping families, and investigating the effect of each on technostress, the present research reveals decreasing and increasing effects of coping strategies on techno-exhaustion and end-user performance.

The remainder of this paper is as follows. The theoretical background section introduces the general theory of coping, followed by a demonstration of coping in the context of technostress. Then, the hierarchical structure of coping (Skinner et al. 2003) and its classification (Holahan et al. 1996) are explained, and past IS coping literature is classified. Fourth, a context-specific model of coping with technostress is proposed, and the methodology and research results are presented. Finally, the theoretical and practical contributions, as well as limitations and future research directions, are outlined.

2 THEORETICAL BACKGROUND

This section first describes the coping theory; then explains coping in the domain of technostress and demonstrates the structure and the classification of coping strategies; and concludes by classifying previous IS coping literature.

2.1 COPING THEORY

Context-specific guidelines (Hong et al. 2014) lead to development of a context-specific model of coping in the domain of technostress. The first guideline—*grounded in a general theory*—suggests that context-specific research is built on a general theory that is relevant to the research domain of interest. The present study builds upon the coping theory of Lazarus and Folkman (1984). Coping is defined as a function of behavioral, cognitive, and perceptual efforts to handle stressful situations (Lazarus and Folkman 1984; Pearlin and Schooler 1978). To understand how individuals cope, the theory focuses on two cognitive processes—primary and secondary appraisal (Lazarus and Folkman 1984). A specific situation initiates the process. Primary appraisal comprises the evaluation of the situation as threat or opportunity. Individuals evaluate the potential negative consequences of being threatened by the situation, representing the extent of the danger that an individual perceives in the situation (Lazarus and Folkman 1984). The secondary appraisal comprises the assessment of the individual's ability to handle the perceived situation. Individuals assess available action options and decide what they can do to cope by evaluating their abilities to handle the situation (Lazarus and Folkman 1984). Based on the strength of the situation (primary appraisal) and the individual's ability to handle the situation (secondary appraisal), each individual selects a coping strategy (Lazarus and Folkman 1984). As coping and technostress are closely related, an introduction to technostress will explain its relationship with coping.

2.2 TECHNOSTRESS AND COPING

The second guideline—*contextualizing and refining a general theory*—implies contextualization of the general theory to a specific research domain. The general model might require modification by including a minimal set of core constructs that are relevant to the context of interest. Following the second guideline contextualizes the general coping theory in the specific research domain of technostress. Thus, the research domain is explained by demonstrating the transactional process of technostress. Then, the coping theory is contextualized to the technostress context by adopting an existing domain-specific contextualized model of coping and technostress to further contextualize it, as Hong et al. (2014) suggest.

Technostress. Technostress reflects the stress individuals perceive when using IS (Ragu-Nathan et al. 2008), and is a transactional process overstretching causes and consequences. Techno-stressors—technology-related stimuli or actions encountered by the individual (Ayyagari et al. 2011; Tarafdar et al. 2010)—reflect causes. Adapted from past literature (Ayyagari et al. 2011), techno-stressors in the present research manifest along five dimensions (Ayyagari et al. 2011). First, work-home conflict is the discrepancy between the demands of work and private life. Second, the invasion of privacy is defined as the perception that a person's privacy is impaired. Third, work overload is the perception that tasks exceed an individual's capability. Fourth, role ambiguity is understood as uncertainty about the performance of one's role. Fifth, job insecurity is the perception of the threat of a job loss. Techno-stressors are in turn capable of producing strain, psychologically defined as an emotional reaction to the encountered stimuli such as techno-exhaustion (Ayyagari et al. 2011), or behaviorally defined as reduced end-user performance (Tarafdar et al. 2010).

Coping and technostress. General stress research shows that coping and stress are closely intertwined with each other, as the consequences of stressors depend on the cognitive evaluation and the resulting coping effort of each individual (Lazarus and Folkman 1984). One context-specific model of coping and technostress demonstrates that coping moderates the relationship between techno-stressors and strain (Pirkkalainen et al. 2017). The domain-specific contextualized model of coping and technostress is shown in Figure 1, and will be further contextualized by decomposing coping into its different parts.

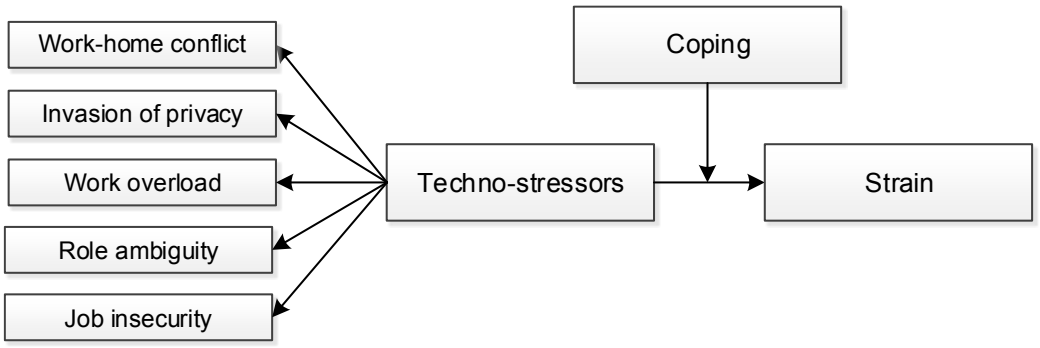

Figure 1: Context-specific model of coping and technostress (Pirkkalainen et al. 2017)

2.3 Coping Structure and Families

After defining the core model shown in Figure 1, the next guideline suggests identifying context-specific factors. One possibility for revealing context-specific factors is reviewing past research. According to the suggestion by Hong et al. (2014), the core constructs in the general model (see Figure 1) can be decomposed into context-specific-factors by utilizing a decomposition approach applied in prior research (e.g., Karahanna et al. 2006; Taylor and Todd 1995). The decomposing approach is especially appropriate when the core perceptions are understood (Hong et al. 2014), as in the case of coping. Therefore, analyzing the structure (Skinner et al. 2003) of the core construct (e.g., coping), is followed by decomposing the general coping construct into four distinct families of coping, by applying the approach of Holahan et al. (1996). Finally, analyzing prior literature based on the structure and the distinct coping families enables identification of different context-specific coping strategies.

Coping structure. Psychological research suggests a hierarchical structure of coping (see Figure 2; Skinner et al. 2003) on three different levels: the coping instance, coping strategies, and coping families. Coping instances reflect the responses toward the perceived techno-stressor and its consequences—for example, by talking with others or reevaluating the situation. Researchers can observe coping instances or such instances can be captured by self-report. They are categorized within different coping strategies, which are different efforts to approach or avoid the techno-stressors and their consequences, such as active coping, denial, positive reinterpretation, or venting. Each coping strategy, such as positive reinterpretation, contains numerous coping instances, such as the observation that people look for something good in what is happening when perceiving the techno-stressor. According to their adaptive functions, these coping strategies are again

categorized into different higher-order coping families (e.g., cognitive-approach, behavioral-approach, cognitive-avoidance, behavioral-avoidance). Each coping family also contains numerous coping strategies that share certain characteristics (see Figure 3).

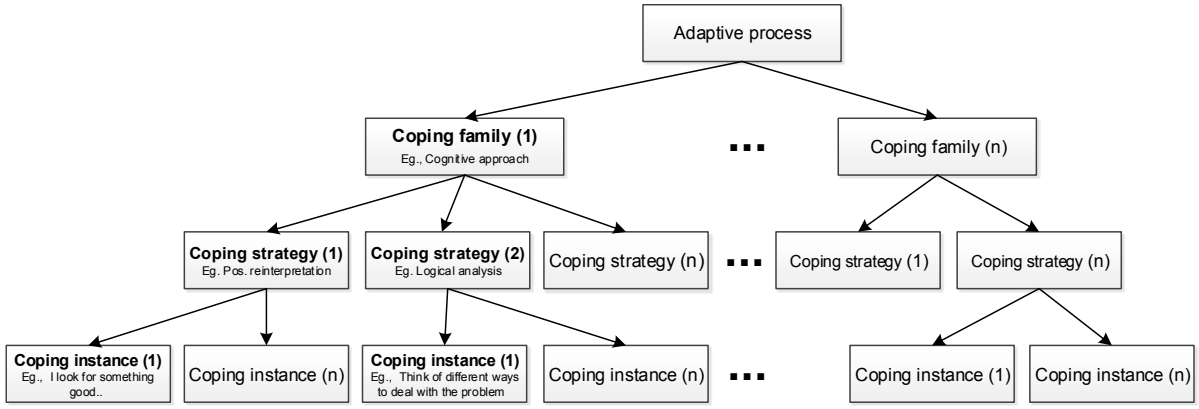

Figure 2. Hierarchical structure of coping (Skinner et al. 2003)

Coping families. As described within the structure of coping, coping families could contain numerous coping strategies. Determining which coping strategies belong to which coping family requires a theoretical model of coping families. This study adopted an approach that follows a topological distinction (e.g., approach vs. avoidance and cognitive vs. behavioral) to differentiate four coping families on the basis of the method used (behavioral vs. cognitive) and the focus of the coping strategy (approach vs. avoidance) (Holahan et al. 1996). By following a behavioral method, individuals make behavioral efforts such as performing a specific kind of behavior to handle the situation. In contrast, by following a cognitive method, they apply cognitive efforts such as reinterpreting a situation. The distinction between approach and avoidance has a long history in the coping literature (Liang and Xue 2009). By utilizing approach strategies, individuals actively do something about the problem, such as performing active coping; whereas by adopting avoidance strategies, individuals try to avoid the problem through such means as denying the situation or behaviorally disengaging from the situation.

As demonstrated in Figure 3, the distinction between coping focus and coping method enables distinguishing four different coping families: behavioral-approach, behavioral-avoidance, cognitive-approach, and cognitive-avoidance. The first family**,** *behavioral-approach*, represents coping strategies that use behavioral efforts and approach the problem by making active efforts to resolve it (see Figure 3, top-right quadrant). This family includes coping strategies such as active coping and seeking guidance and support. The second family, *behavioral-avoidance***,** represents coping strategies that use behavioral efforts and try to avoid the problem, focusing mainly on managing the consequences associated with the techno-stressors (see Figure 3, bottom-right quadrant). For example, coping strategies such as denial or emotional discharge are classified into the second family. The third family, *cognitive-approach*, focuses on cognitive efforts and approaching the problem to make active efforts to resolve it. This family represents coping strategies such as positive reinterpretation and logical analysis (see Figure 3, top-left quadrant). The fourth family, *cognitive-avoidance*, represents coping families that use cognitive efforts and try to avoid the problem by focusing mainly on managing the responses associated with techno-stressors. Venting or resigned acceptance are classified within the last family, cognitive-avoidance (see Figure 3, bottom-left quadrant).

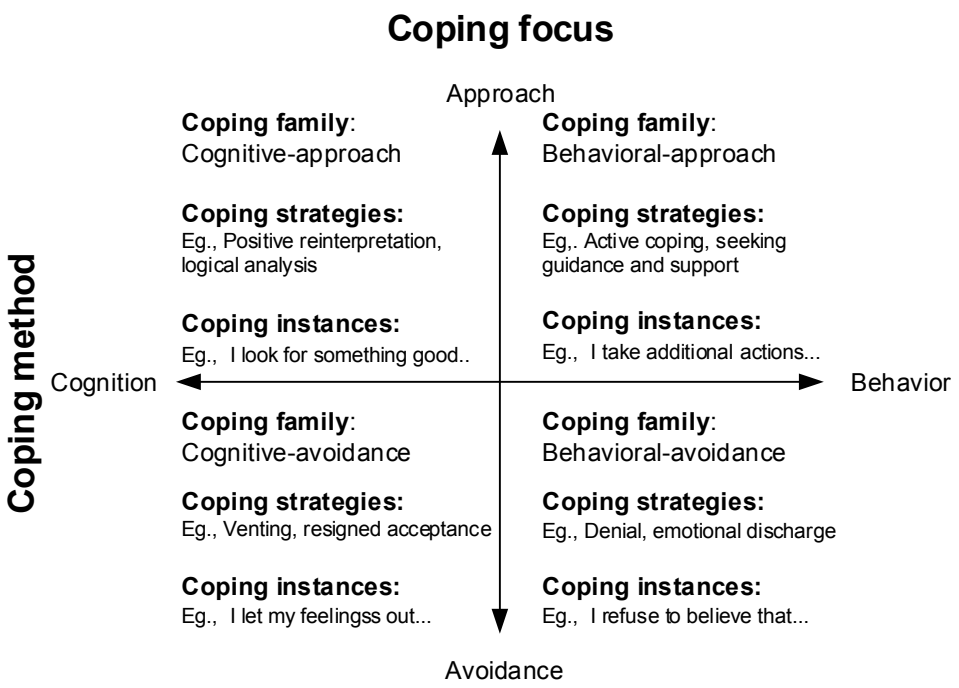

Figure 3. Theoretical model of coping families (Holahan et al. 1996)

Identification of context-specific coping strategies. Past literature on coping in the domain of technostress is very heterogeneous, and only some studies consider individual coping strategies. The following short overview of past literature focuses especially on the applied coping strategies, categorizing them into the four coping families to identify context-specific coping strategies.

D'Arcey et al. (2014b) investigate the coping strategies of moral disengagement, which can be classified into the cognitive-avoidance family because they follow a cognitive method and focus on avoiding the situation. The results of their study show that moral disengagement mediates the relationship between security-related stressors and the intention to violate the information-security policy of an organization. Furthermore, the literature also investigates coping strategies, such as method control, which can be classified into the behavioral-approach family because they follow a behavioral method in terms of skill performance and focus on helping to accomplish a task. The research also considers resource control, which can be classified into the cognitive-approach family because it follows a cognitive method as users perceive that they have control and focus on reducing the problem. Results show that the performance of method and resource control moderating the relationship between techno-stressors and strain responses (Galluch et al. 2015). In particular, the results show that control over methods, i.e., the skills to perform a method that helps to accomplish a task, and control over resources reduce the influence of the techno-stressor on physiological strain. Moreover, the relationship between conflict and psychological strain responses is negatively influenced by control over resources (Galluch et al. 2015). An early examination investigates whether coping strategies influence anxiety, stress, and depression among IT personnel. This study investigates five different coping strategies, such as social support and active coping, which can be classified into the behavioral-approach family, as they follow a behavioral method and try to approach the problem. Cognitive avoidance and accepting responsibility are classified into the cognitive-avoidance family because they avoid the problem by cognitively changing the situation. In addition, self-controlling coping is classified into the cognitive-approach family because this strategy focuses on the cognition of the user and tries to take active measures against the problem. Findings indicate that active coping has no significant effect on anxiety, stress, and depression, whereas all other coping strategies are positively related to these dependent variables (Love et al., 2004). Another examination shows that users cope with technostress and switching-stress by stopping the use of IS at all (Maier et al. 2015c), which can be classified as a behavioral-avoidance strategy, as it follows a behavioral method that focuses on avoiding the problem. A recent investigation examined whether emotion-focused coping strategies, such as distress venting and distancing from IT, moderates the relation

between technostress creator and strain. Results showed that distress venting reduces the effect of techno-stressors on strain, but only when users have low IT control. Furthermore, they reveal that distress venting has a direct positive effect on strain, such that the higher distress venting is, the higher the strain is (Pirkkalainen et al. 2017). In addition, Salo et al. (2017) suggest that users proactively cope with techno-stressors by performing strategies such as modification of IT features and use routines; reactively coping with strains through performing strategies such as disengagement from IT, venting, or tolerating the techno-stressor by modifying personal reaction to the techno-stressor.

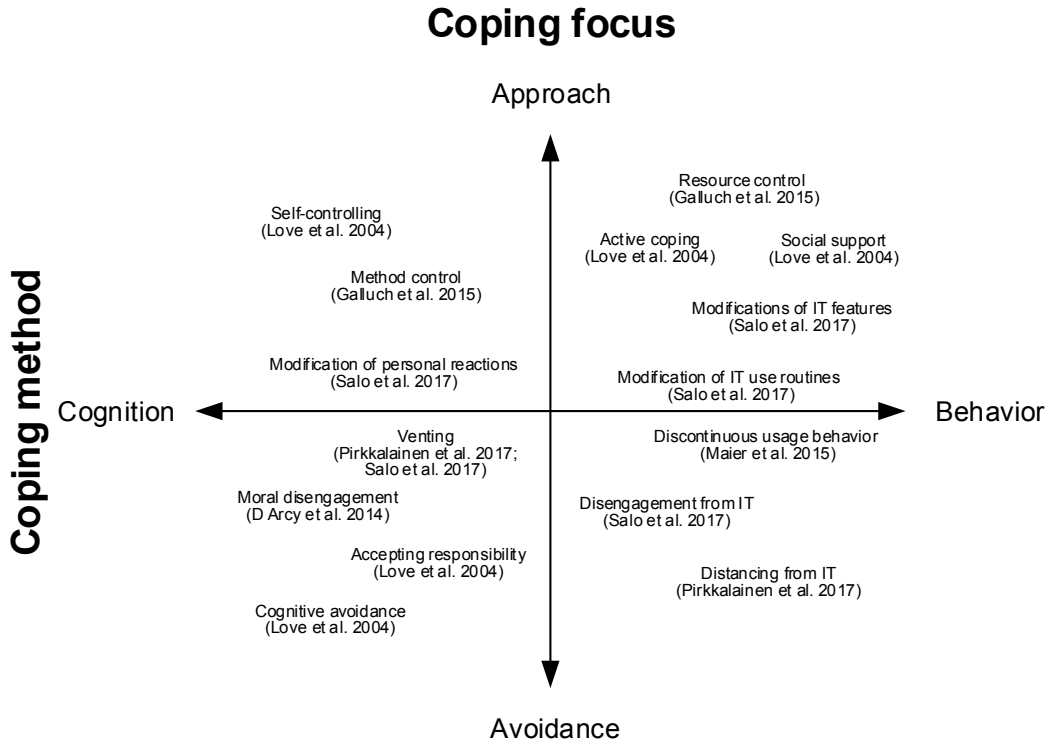

Figure 4. Overview of individual coping literature and its classification

Figure 4 summarizes the classification of the coping strategies investigated in past literature into the four suggested coping families, to identify context-specific coping strategies within each coping family. It reveals that each approach has applied at least one coping strategy within a coping family, and has focused on different dependent variables. Based on the analysis in Figure 4, the present study identifies one coping strategy from each coping family. From the behavioral-approach family, active coping is identified, as prior literature investigates strategies that actively do something against the situation. Active coping is defined as "the process of taking active steps to try to remove or circumvent the [techno]-stressor or to ameliorate its effects*"* (Carver et al. 1989, p. 268), which encompasses its active nature. The context-specific coping strategy for the behavioral-avoidance family is denial, which represents the disengagement and distancing from IT, defined as "refusal to believe that the [techno]-stressor exists or of trying to act as though the [techno]stressor is not real" (Carver et al. 1989, p. 270). Positive reinterpretation has been identified as the coping strategy for the cognitive-avoidance family, because it reflects the modification of personal reaction and the self-control of users. For the present study, it is defined as "reconstruing the situation in such a way as to put the best light on it so that it seems better or less stressful" (Scheier et al. 1986, p. 1261). Lastly, the cognitive-avoidance family is represented by the dominant strategy of venting, which has been investigated several times and is defined as "the vocal and open expression of negative emotions to others" (Beaudry and Pinsonneault 2010, p. 699).

Now that the context-specific coping strategies for each family have been identified, the research model is developed by integrating the identified strategies into the core model.

3 HYPOTHESES DEVELOPMENT

Following the guideline—*examination of the interplay between the IT artifact and other factors*—which recommends examining the effects between the context-specific factors pertaining to the specific technology, user, and usage context, the context-specific coping strategies are included in the refined general model shown in Figure 1. In line with context-specific research, the direct as well as the moderating effect of the four distinct context-specific coping strategies are developed. In line with past literature, the core model is developed by theorizing the influence of techno-stressors on strains, in terms of techno-exhaustion and end-user performance. Then, the effect of the four distinct context-specific coping strategies on techno-exhaustion and end-user performance is investigated and their moderating effects theorized.

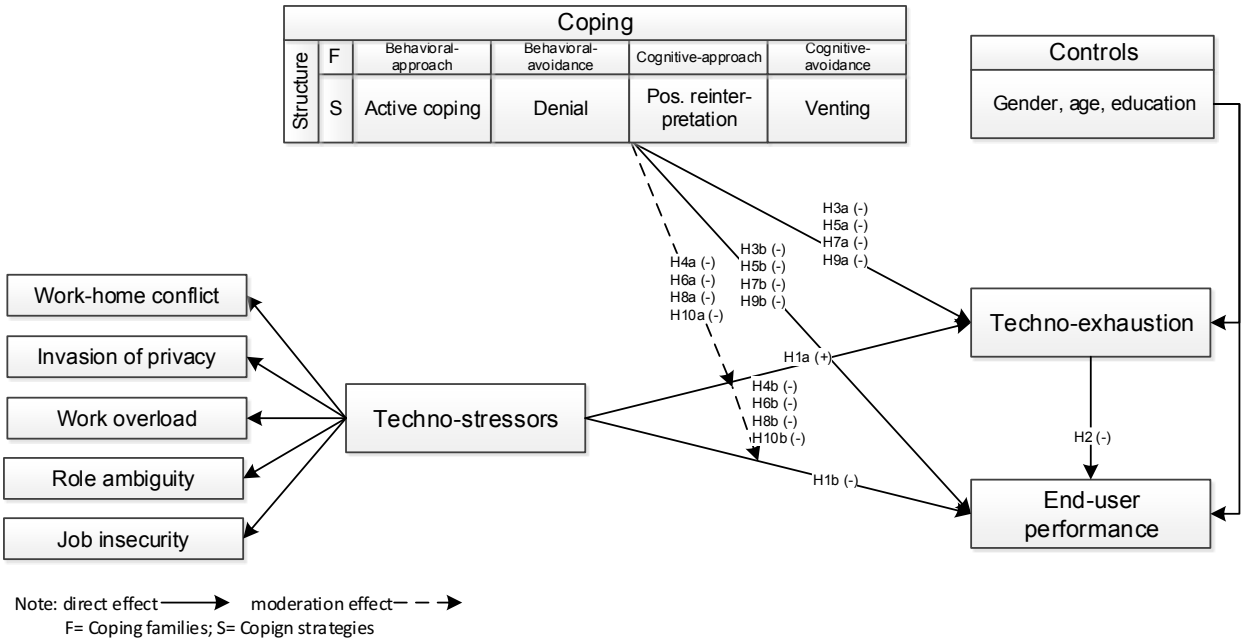

Figure 5. Research model

3.1 THE INFLUENCE BETWEEN TECHNO-STRESSORS, TECHNO-EXHAUSTION, AND END-USER PERFORMANCE

Past technostress research reveals that techno-stressors—i.e., work-home conflict, invasion of privacy, work overload, role ambiguity, and job insecurity—lead to techno-exhaustion, understood as the depletion of mental resources due to IT (Ayyagari et al. 2011; Maier et al. 2015c). In general, the relationship between techno-stressors and techno-exhaustion is well researched in the literature (Ahuja et al. 2007; Moore 2000). The perception of techno-stressors costs users' mental resources, leading on the one hand to tiredness and fatigue reflecting techno-exhaustion **(H1a),** and on the other hand to decreases in end-user performance (Tarafdar et al. 2007; Tarafdar et al. 2010; Tarafdar et al. 2014) **(H1b)**.

> ***H1:*** *The higher the perception of techno-stressors is,* ***(a)*** *the higher techno-exhaustion and* ***(b)*** *the lower end-user performance.*

Technostress research shows the consequences of techno-stressors, such as increased techno-exhaustion (Ayyagari et al. 2011) and decreased end-user performance (Tarafdar et al. 2010; Tarafdar et al. 2014). Moreover, users who perceive techno-exhaustion are tired and fatigued to the extent that they have only a few mental resources left to perform their tasks (Ayyagari et al. 2011; Maier et al. 2015c). When users do not have enough mental resources, end-user performance will decrease (Wilke et al. 1985), leading to the following hypothesis:

> ***H2:*** *The higher the perception of techno-exhaustion, the lower end-user performance.*

3.2 Behavioral-Approach: The Influence of Active Coping

The following focuses on the coping strategy referred to as active coping, out of the behavioral-approach family. This strategy follows a behavioral method and focuses on approaching the problem by taking active steps. First, the direct effect of active coping on techno-exhaustion and end-user performance is theorized, and its moderating effects developed.

The direct effect. Previous literature assumes that coping has a direct effect on strain (Lamontagne et al. 2007; Salo et al. 2017). In particular, active coping reduces techno-exhaustion because users try to extend the effort to perform active coping strategies to remove or circumvent the techno-stressors (Carver et al. 1989). This leads to the rebuilding of users' emotional stability (Beaudry and Pinsonneault 2005) and hence increases their mental resources **(H3a)**.

Furthermore, the application of active coping increases end-user performance because one purpose of active coping is to take active actions to ameliorate the consequences of techno-stressors (Carver et al. 1989). Users will handle the problems and find effective and efficient ways to fulfill their task (Carver et al. 1989). Active coping gains the benefits associated with techno-stressors, resulting in end-user performance enhancements such as reducing errors, doing the work faster, and increasing revenues (Beaudry and Pinsonneault 2005). When users perform active coping strategies, they put effort into doing something about the problems so that they can fulfill their tasks more effectively and efficiently **(H3b)**.

> ***H3:*** *The higher active coping,* ***(a)*** *the lower techno-exhaustion, and* ***(b)*** *the higher end-user performance.*

The moderation effect. Several examinations demonstrate that coping has a moderating effect on the relationship between techno-stressors and strain (Lamontagne et al. 2007; Pirkkalainen et al. 2017; Salo et al. 2017). We assume that active coping reduces the effect of techno-stressors on techno-exhaustion because taking active steps to remove or circumvent the effect of techno-stressors (Carver et al. 1989) reduces their effects on techno-exhaustion. One explanation is that users take additional action to eliminate techno-stressors, which lower the influences of techno-stressors on techno-exhaustion **(H4a)**.

In addition, we assume that taking active steps to remove or circumvent techno-stressors (Carver et al. 1989) reduces their effect on end-user performance. The rationale is that users take additional action to get rid of techno-stressors so that their effect on end-user performance is reduced **(H4b)**.

> ***H4:*** *Active coping moderates* ***(a)*** *the relationship between techno-stressors and techno-exhaustion and* ***(b)*** *the relationship between techno-stressors and end-user performance such that the influence of techno-stressors on techno-exhaustion and end-user performance is decreased.*

3.3 Behavioral-Avoidance: The Influence of Denial

Next, we concentrate on the coping strategy of denial out of the behavioral-avoidance family. This strategy follows a behavioral method and focuses on avoiding the problem in terms of refusing to believe that the problem really exists. Following is a discussion of the direct and the moderation effects of denial.

The direct effect. We assume that denial reduces techno-exhaustion because users reject a situation in which they feel tired and fatigued, creating a boundary between reality and the experience of users (Carver and Connor-Smith 2010). Users act as if the tiredness and fatigue do not exist or are not real (Carver et al. 1989) such that the refusal lowers the perception of techno-exhaustions **(H5a)**.

Also assumed is that denial increases end-user performance because users deny the situation in which they perceive a decrease in their performance. This creates a boundary between reality and the experience of users (Carver and Connor-Smith 2010), protecting the motivation to decrease techno-exhaustion and, in turn, increasing end-user performance **(H5b).**

> ***H5:*** *The higher denial,* ***(a)*** *the lower techno-exhaustion, and* ***(b)*** *the higher end-user performance.*

The moderation effect. Denial is seen as a buffer between techno-stressors and their consequences (Lazarus and DeLongis 1983). Refusing to accept the situation also moderates the effect of techno-stressors

on techno-exhaustion, because users deny that techno-stressors occurred, reducing the perception of the techno-stressors and their influences on techno-exhaustion. One explanation for this is that users act as if the techno-stressors are not real and refuse to believe that the techno-stressors really exist (Carver et al. 1989) **(H6a)**.

An additional assumption is that denial moderates the effect of techno-stressors on end-user performance because the influence of the techno-stressors on end-user performance is reduced as users deny that the techno-stressors occurred. As users act as if the techno-stressors are not real, they find effective and efficient ways to fulfill their task (Carver et al. 1989) **(H6b)**.

> ***H6:*** *Denial affects the relationships between* ***(a)*** *techno-stressors and techno-exhaustion and* ***(b)*** *techno-stressors and end-user performance, such that the influence of techno-stressors on techno-exhaustion and end-user performance is decreased.*

3.4 COGNITIVE-APPROACH: THE INFLUENCE OF POSITIVE REINTERPRETATION

The following section focuses on the coping strategy of positive reinterpretation, out of the cognitive-approach family. This strategy follows a cognitive method and focuses on approaching the problem and making active efforts to resolve it by reconstruing the situation. The direct and moderating effects of positive reinterpretation on techno-exhaustion and end-user performance are presented as hypotheses.

The direct effect. We theorize that positive reinterpretation reduces techno-exhaustion because users positively reinterpret the situation regarding benefits to one's values, beliefs, and goals (Folkman and Moskowitz 2004). Users try to see the situation in a better light, so that it seems less stressful (Scheier et al. 1986). They maintain hope that the negative consequences will not occur and positively compare themselves to other users who are worse off (Beaudry and Pinsonneault 2005), which restores emotional stability. As users positively reinterpret the stressful situation, the anxiety and fatigue that reflect techno-exhaustion can be reduced **(H7a)**.

Moreover, positive reinterpretation increases end-user performance because users reinterpret the situation in terms of its benefits (Folkman and Moskowitz 2004), such that the situation is more positive and users can more effectively and efficiently fulfill their tasks. Trying to see the situation in a better light makes it seem less stressful (Scheier et al. 1986). Users who positively reinterpret the stressful situation put a better light on the situation and can concentrate on their tasks **(H7b).**

> ***H7:*** *The higher positive reinterpretation,* ***(a)*** *the lower techno-exhaustion, and* ***(b)*** *the higher end-user performance.*

The moderation effect. Positive reinterpretation is theorized to reduce the influence of techno-stressors on techno-exhaustion, because users put the best light on the situation, making it seem better (Scheier et al. 1986). Users look for something good in what is happening when perceiving techno-stressors (Carver et al. 1989), requiring fewer mental resources and resulting in a moderating effect of techno-stressors on techno-exhaustion. **(H8a)**.

The companion assumption is that positive reinterpretation reduces the influence of techno-stressors on end-user performance because users put the best light on the situation, so that it seems better (Scheier et al. 1986). They become more positive and can more effectively and efficiently fulfill their tasks. Users looking for something good in what is happening when they perceive techno-stressors (Carver et al. 1989) will reduce the effects of the techno-stressors on end-user performance because the negative perceptions are reduced, and users can concentrate on their tasks **(H8b)**.

> ***H8:*** *Positive reinterpretation affects* ***(a)*** *the relationship between techno-stressors and techno-exhaustion and* ***(b)*** *the relationship between techno-stressors and end-user performance such that the influence of techno-stressors on techno-exhaustion and end-user performance is decreased.*

3.5 COGNITIVE-AVOIDANCE: THE INFLUENCE OF VENTING

This section focuses on the coping strategy of venting, in the cognitive-avoidance family. This strategy

follows a cognitive method and focuses on avoiding the problem by expressing one's negative emotions. Following is the development of the direct and moderating effects of venting on techno-exhaustion and end-user performance.

The direct effect. It is assumed that venting decreases techno-exhaustion because users vent to let out negative emotions about the situation (Carver et al. 1989) and re-establish emotional stability (Beaudry and Pinsonneault 2010). Strategies such as venting do not reduce the techno-stressors, but they can make the person feel better (Wang et al. 2008). Users who let out their emotion through venting will reduce the perception of anxiety and fatigue that reflects techno-exhaustion **(H9a)**.

Also theorized is the contention that venting increases end-user performance because when users vent they "let off steam" and "clear the air" (Bushman et al. 2001), such that emotions can escape. This reestablishes emotional stability (Beaudry and Pinsonneault 2010) so that users can more effectively and efficiently fulfill their tasks **(H9b)**.

H9: *The greater venting,* ***(a)*** *the lower techno-exhaustion, and* ***(b)*** *the higher end-user performance.*

The moderation effect. The literature indicates that venting has a moderating effect on techno-stressors and techno-exhaustion (Pirkkalainen et al. 2017). Venting reduces the effect of techno-stressors on techno-exhaustion because the vocal and open expression to others of negative emotions about the techno-stressors reduces the effect of techno-stressors on techno-exhaustion (Scheibe and Blanchard-Fields 2009). Emotions tied to the techno-stressors can be let out, and emotional stability reestablished (Beaudry and Pinsonneault 2010), leading to the theory that venting reduces the effect of techno-stressors on techno-exhaustion **(H10a)**.

Likewise theorized is the contention that letting out the emotions regarding the techno-stressors reduces the effect from techno-stressors on end-user performance, as the literature shows that venting reduces the effect of techno-stressors on end-user performance (Scheibe and Blanchard-Fields 2009). One explanation is that the vocal and open expression to others of negative emotions about the techno-stressors reduces the effect of techno-stressors on the extent to which IT users contribute positively to their task **(H10b)**.

H10: *Venting moderates* ***(a)*** *the effect of techno-stressors on techno-exhaustion and* ***(b)*** *the effect of techno-stressors on end-user performance, such that the influence of techno-stressors on techno-exhaustion and end-user performance is decreased.*

4 RESEARCH METHODOLOGY: DESIGN AND MEASUREMENT

This section describes the research design and the data-collection process to validate the research model. It focuses on the study procedure and presents the measurement model used. To validate the research model, data was captured through an online survey from employees of different organizations, using a database of 500 employees at different organizations who were sent a hyperlink to the questionnaire. In addition, the questionnaire was promoted in several interest groups on Facebook and other social-media platforms such as LinkedIn. Responses were received from 194 respondents, of which 110 were able to be used, and the rest were deleted due to missing values. This constituted a suitable data sample, as the majority of the sample are workers who use IT. Table 1 shows the participant demographics. Because negative perceptions such as techno-exhaustion might cause skewed distributions (Turel et al. 2011b); and since partial least squares (PLS) regression does not require normally distributed data (compared to covariance-based structural equation modeling), structural equation modeling (SEM) was applied, utilizing SmartPLS 3.2.6 (Ringle et al. 2015). and SPSS 23.0.

Demographics (N=110)			Age (%)		Educational status (%)	
Gender (%)	Men	47.7	15-24	17.8	Lower secondary education	8.4
	Women	52.3	25-34	59.4	Secondary school	24.3
			35-44	8.9	Higher school	26.2
			45-54	9.9	Bachelor's degree	34.6
			55-64	3.0	Master's degree	6.5
			> 65	1.0		

Table 1.Study participants

5 RESEARCH RESULTS

In line with the last two guidelines (Hong et al. 2014), the interplay between the core model and the context-specific factors was investigated. Not only the direct effect on the outcome variables, but also the moderation effects were investigated. The researchers checked data to rule out common method bias (CMB) and ensure that the measurement model was valid and reliable. The resulting evaluated structural model is presented.

5.1 COMMON METHOD BIAS

Perceived and subjective measures are used to capture individual responses to a given situation. A potential issue with subjective measures is common method bias (Podsakoff et al. 2003). To evaluate the extent of CMB, Harman's single factor test (Harman 1976) and the procedure suggested by Williams et al. (2003) were utilized. The results of the Harman's single factor test showed that one factor explains 24.6% of the variance, which is not the majority, indicating that CMB is of no great concern. Furthermore, we follow the procedure suggested by Williams et al. (2003) calling for entering an additional factor into the PLS model, which contains each indicator of the original model. The remaining factors are transformed into single-item constructs, and the ratio of R^2 with the CMB factor is compared to R^2 without the CMB factor. The CMB factor explains an average R^2 of 0.004 so that a ratio of 1:190 results. Comparison of this ratio with the ratio of prior research using this approach (Liang et al. 2007) indicated that no signs of CMB influence were observed in consideration of the circumstances that this method is subjected to several flaws (Chin et al. 2012).

5.2 MEASUREMENT MODEL

To provide a valid and reliable measurement model for testing the hypotheses, the measurement model used was assessed. As all constructs are measured with reflective indicators, the measurement model was validated by focusing on content validity, indicator reliability, construct reliability, and discriminant validity (Bagozzi 1979).

#	Constructs	Mean	SD	AVE	CR	No. items	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Gender	1.52	.50	NA	NA	1	NA													
2	Age	3.24	1.02	NA	NA	1	-0.058	NA												
3	Education	3.07	1.10	NA	NA	1	0.036	0.381	NA											
4	Work-home conflict	3.25	1.51	0.792	0.919	3	-0.127	-0.317	-0.360	0.890										
5	Invasion of privacy	4.56	1.30	0.654	0.882	3	0.100	-0.204	-0.125	0.388	0.809									
6	Work overload	3.78	1.21	0.699	0.902	4	0.006	-0.202	-0.222	0.587	0.462	0.836								
7	Role ambiguity	2.87	1.14	0.685	0.897	4	0.032	-0.206	-0.107	0.523	0.334	0.680	0.828							
8	Job insecurity	2.80	1.29	0.780	0.914	3	0.061	-0.160	-0.098	0.375	0.288	0.336	0.401	0.883						
9	Active coping	3.58	1.32	0.726	0.913	4	-0.115	-0.097	-0.040	0.335	0.321	0.431	0.433	0.222	0.852					
10	Denial	1.95	1.05	0.821	0.948	4	-0.031	-0.035	-0.082	0.321	0.138	0.179	0.273	0.209	0.131	0.906				
11	Positive reinterpretation	3.62	1.39	0.729	0.890	4	-0.074	-0.231	-0.147	0.177	0.038	0.176	0.247	0.024	0.395	0.161	0.854			
12	Venting	3.79	1.38	0.723	0.912	4	0.110	-0.161	-0.271	0.396	0.257	0.370	0.363	0.345	0.179	0.348	0.055	0.850		
13	Techno-exhaustion	3.02	1.43	0.810	0.945	4	0.042	-0.333	-0.216	0.448	0.365	0.428	0.409	0.324	0.124	0.295	0.050	0.416	0.900	
14	End-user performance	4.86	1.11	0.679	0.894	4	-0.098	-0.162	-0.060	0.048	-0.006	0.055	-0.098	-0.184	-0.095	-0.185	0.118	-0.076	-0.096	0.824

Note: Square root of AVE is listed on the diagonal of bivariate correlations. NA= not applicable, as the construct was measured with a single-item

Table 2.Measurement model of overall sample

Content validity. To ensure content validity, the researchers used items that had been used in prior research articles (see Appendix Table 3) and the project team discussed. Techno-stressors were measured according to prior research (Ragu-Nathan et al. 2008) as a superordinate second-order construct (reflective first-order, reflective second-order construct; Polites and Karahanna 2012), using the dimensions work-home conflict, invasion of privacy, work overload, role ambiguity, and job insecurity, as suggested by Ayyagai et al. (2011). Strain was measured by using the questions of Ayyagari et al. (2011) to measure techno-exhaustion and the questions of Kuvaas (2006) to capture self-reported end-user performance. Coping strategies—active coping, denial, positive reinterpretation, and venting—were adopted from Carver et al. (1989). In line with Ayyagari et al. (2011), these items were adjusted to the study context by tailoring the

questions to the IT context. For example, the original question "I take additional action to try to get rid of the problem" was adjusted to read, "I take additional action to try to get rid of the IT problem."

Indicator reliability. This reflects the rate of the variance of an indicator that comes from the latent variables. To ensure that 50% or more of the variance is explained by the indicators, each value should be at least .707 (Carmines and Zeller 2008). Table 3 in the Appendix shows that this condition was fulfilled and each loading has a significance level of at least .001.

Construct reliability. To determine construct quality, we use composite reliability (CR), which should be at least 0.7, and average variance extracted (AVE), which must be at least 0.5 (Fornell and Larcker 1981). Both criteria were fulfilled (see Table 2). In addition, the Cronbach's Alpha values of all constructs in the main model were higher than 0.7 (see Appendix Table 3).

Discriminant validity. This reflects the extent to which items differ from others (Campell and Fiske 1959). The square root of AVE should be greater than the corresponding construct correlations (Fornell and Larcker 1981; Hulland 1999). Table 2 shows that this study fulfilled this requirement. The researchers also ensured that the most conservative 0.85 heterotrait-monotrait (HTMT) criterion was fulfilled (Henseler et al. 2015). The highest correlation between active coping and positive reinterpretation is 0.67 (hence, lower than 0.85), and the bootstrapping approach shows that HTMT in each sample is significantly different from 1. Hence, discriminant validity is not an issue in the present research.

Approximate model fit. The model indicates an acceptable fit, as the standardized root mean square residual (SRMR) (Hu and Bentler 1998; Hu and Bentler 1999) is 0.065, which is lower than the cut-off value of 0.08 suggested by Henseler et al. (2016a).

5.3 Structural Model

Figure 6 shows the results of the structural model. The research model was validated by the use of the significance levels of the path coefficients and the coefficient of determination (R^2) (Chin 1998b). The analysis of interaction effects followed the two-step approach suggested by Henseler and Chin (2010). In a first step, the main effects were validated without the moderation variables. The second step focused only on the moderation and validated the interaction effects.

The findings show that techno-stressors increase techno-exhaustion, which supports H1a. Regarding the coping strategies, the results show that venting increases techno-exhaustion, and denial reduces end-user performance, which contradicts H5b and H9a. Looking at the moderators, the results show that denial reduces the effect of techno-stressors on techno-exhaustion, which supports H6a. However, venting increases this effect, which contradicts H10a. In the case of end-user performance, active coping reduces the effect of techno-stressors on end-user performance, which supports H4b. Positive reinterpretation increases the effect of techno-stressors on end-user performance, which contradicts H8b. Among the control variables, age negatively influences techno-exhaustion, which aligns well with past literature (Moore 2000). Thus, 44.8% of the variance for techno-exhaustion and 20.9% of end-user performance are explained, and these observed effects are discussed next.

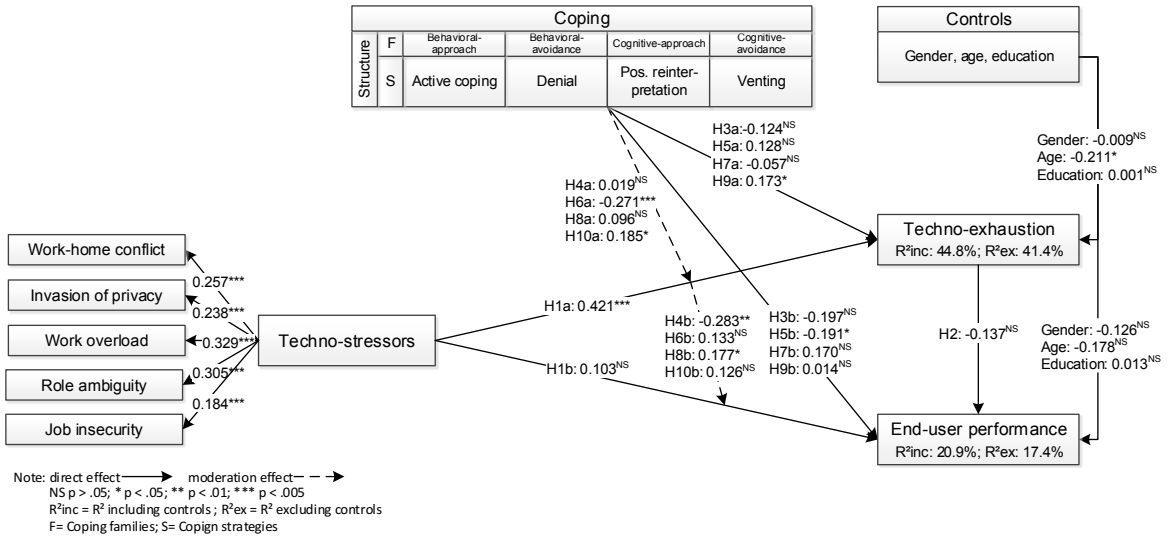

Figure 6. Structural model results

6 DISCUSSION

Previous IS coping literature shows substantial heterogeneity in the examined coping strategies, and neglects the differentiation of coping strategies, leaving different kinds of coping strategies undisclosed. The diversity of coping strategies enhances the dilemma of specificity and generality in the context of technostress. Therefore, the present paper conceptually contextualizes coping into the domain of technostress by following the strict guidelines offered by Hong et al. (2014). Revealing how coping can be contextualized into the domain of technostress enables an understanding of different kinds of context-specific coping strategies. To do so, a core model of coping and technostress was defined and coping was contextualized by decomposing it structurally and classifying it using four different coping families. The present paper validates the context-specific research model, which explains the influences of four different context-specific coping strategies, each one belonging to one of the suggested coping families, on the consequences of techno-stressors in terms of techno-exhaustion and end-user performance. Furthermore, we omit ascertaining how these coping strategies influence technostress to reduce negative consequences and the resulting outcomes for organizations and individuals. The results and their implications follow.

6.1 THEORETICAL CONTRIBUTION

The paper contains several theoretical contributions and implications for coping and technostress literature.

6.1.1 Contextualization of coping in the domain of technostress

The present paper contributes to IS coping literature (e.g., Galluch et al. 2015; Pirkkalainen et al. 2017; Salo et al. 2017) by conceptually contextualizing coping to the domain of technostress, following the guidelines of context-specific IS research (Hong et al. 2007). In particular, this study extends the core coping and technostress model by Pirkkalainen et al. (2017), by contextualizing the model to the second level of deeper contextualization suggested by Hong et al. (2014). Thereby, the literature is extended by decomposing coping into its structure and into four distinct families of coping based on prior literature (Holahan et al. 1996; Skinner et al. 2003). Hence, the present paper contributes to theory, as the decomposition approach helps to improve an existing theoretical model (e.g., technostress and coping model) by making it more context sensitive. While coping and technostress have been investigated in the literature (D'Arcy et al. 2014b; Galluch et al. 2015; Pirkkalainen et al. 2017), the identification of context-specific coping strategies out of four distinct coping families is new in this research stream, adding another component to the investigation of coping. It not only answers the question of how coping reduces technostress, but also sheds light on how each kind of coping strategy mitigates technostress. This differentiation of coping strategies might guide future research toward selecting coping strategies, interpreting, and comparing results.

6.1.2 Providing a structure and theoretical model of coping families for IS coping research

The related work on IS coping shows substantial heterogeneity in the existing coping strategies, some of which have been investigated (cf. Figure 4). However, the literature neglects to concentrate on their differences. Hence, it is uncertain what kinds of coping strategies are applied in the domain of technostress, and it is difficult to compare and generalize results for which specificity and generality might be out of balance. Therefore, the present research extends IS coping literature (e.g., D'Arcy et al. 2014b; Galluch et al. 2015) by combining a hierarchical structure of coping with a topological approach to classifying coping strategies. The present paper indicates that coping instances, which can be observed or measured, can be catalogued as to coping strategies such as active coping, positive reinterpretation, denial, or venting. Coping strategies can be categorized into various coping families by combining the coping structure (Skinner et al. 2003) and the topological approach, to classify coping strategies according to their focus and method (Holahan et al. 1996). The theoretical model contains four distinct coping families, namely cognitive-approach, behavioral-approach, cognitive-avoidance, and behavioral-avoidance. By combining and applying the structure and the classification of coping, we increase the comparability, abstraction, and generality of IS coping research.

More precisely, the present paper contributes to IS coping literature (e.g., D'Arcy et al. 2014b; Galluch et al. 2015) by classifying previously investigated coping strategies according to the adapted classification introduced here. Each previously investigated coping strategy is thereby assigned to one of the four coping families presented, depending on the method and focus of each strategy. The findings extend past the coping literature by showing which past examination focuses on which coping family, and enabling researchers to compare these results more fruitfully. Moreover, it indicates what kind of dependent variables have been investigated in each approach. Having investigated different variables that techno-stressors can influence, the classification indicates areas for future research. First, for all dependent variables, the effect of all four coping families remains unknown. Hence, future research might analyze the effect of coping strategies being part of the coping families not investigated, to reveal their effect on the respective dependent variable in the technostress context. Second, the classification indicates that past research neglects to investigate coping strategies out of the four coping families simultaneously, to reveal whether different coping strategies can have different effects. This gap is addressed by this research in its investigation of a research model analyzing the effect of four different coping strategies on technostress.

6.1.3 Decreasing and increasing effects of coping strategies in the domain of technostress

The present model of coping with technostress theoretically developed and empirically evaluated is the first approach in the IS coping literature, which considers four different coping strategies, each out of another coping family, and theorizes their direct and moderating effects on techno-exhaustion and end-user performance. This approach resulted in counterintuitive effects, explained and discussed as follows.

One the one hand, the findings indicate a decreasing effect of coping strategies, as denial, out of the behavioral-avoidance family, reduces the effect of techno-stressors on techno-exhaustion. Furthermore, active coping, out of the behavioral-approach family, decreases the effect of techno-stressors on end-user performance. This enhances prior work, such as D'Arcy et al. (2014b), who demonstrate that coping strategies such as moral disengagement mediate the effect of techno-stressors on outcomes by showing that coping strategies such as denial and active coping moderate, rather than mediate, the impact of techno-stressors on techno-exhaustion and end-user performance. Also, these results extend previous work, such as that of Galluch et al. (2015), who found a significant moderation effect of method and resources control on the relation between techno-stressors and physiological strain regarding alpha-amylase, but no effect between techno-stressors and techno-exhaustion, by revealing the moderating effects of denial. Hence, these results support and indicate that coping strategies belonging to one of the two behavioral families reduces technostress. Hence, an active behavioral engagement to deal with technostress results in positive effects for the individual.

On the other hand, the results demonstrate a counterintuitive effect of the coping strategies. For example,

venting, out of the cognitive-avoidance family, increases techno-exhaustion and the effect from techno-stressors on techno-exhaustion. Pirkkalainen et al. (2017) also report these results. Moreover, positive reinterpretations, out of the cognitive-approach family, increase the effect of techno-stressors on end-user performance. Although these effects contrast with our hypotheses, similar effects have been found in previous research. For example, Beaudry and Pinsonneault (2010) reveal that the coping strategy of distancing, another coping strategy out of the cognitive-avoidance family, reduces IT use rather than increasing it. Love et al. (2004) also show that avoidance, out of the same family, increases depression and anxiety. Hence, we contribute to the literature by adding insight into the counterintuitive effects of coping strategies, which increase the effect rather than reducing it, and reveal similarities with prior literature such that coping strategies out of the cognitive families increase rather than decrease the effects. In line with prior research, the results reported here indicate that coping strategies belonging to the cognitive-avoidance or cognitive-approach families enhance the effect of technostress instead of reducing it. Therefore, we call for a greater investigation of these decreasing and counterintuitive effects by comparing results across different coping strategies out of these families. Our results, which are in line with prior research, and the cited theoretical model of coping families, indicate that coping strategies out of the two behavioral families reduce the effect of technostress, and coping strategies out of the two cognitive families increase these effects. Nonetheless, our approach is just a starting point, as testing additional coping strategies from these four families to support the conclusion that different families have different effects requires additional research. Future research could use the theoretical model to classify the investigated coping strategy and to compare the results with the effects of coping strategies belonging to the same family. Without our theoretical model, a comparison demonstrating that the proposed theoretical model increases the generalizability and comparability of IS coping studies would not be possible.

In sum, the present research shows that coping strategies have a decreasing, as well as an increasing effect on techno-exhaustion and end-user performance. Either way, coping plays a significant role in stressful situations, and both effects—decreasing and increasing—should be investigated in future coping research. The proposed theoretical model of coping families enables research to better compare the obtained results with those reported in previous literature.

6.1.4 The effect of techno-stressors on techno-exhaustion and end-user performance

The present research also enhances technostress literature. Its results align well with the prior findings of Ayyagari et al. (2011) in revealing that techno-stressors increase techno-exhaustion. Moreover, unlike Tarafdar et al. (2007; 2010) who indicates that techno-stressors reduce end-user performance, these results demonstrate no significant effect. However, this study also considers the relation between techno-exhaustion and end-user performance, which was considered in the work by Tarafdar and colleagues. Therefore, both approaches are extended (Ayyagari et al. 2011; Tarafdar et al. 2010) by considering techno-exhaustion and end-user performance as dependent variables in one research model. We show that techno-stressors have no significant effect on end-user performance, but indicate that the effect of techno-stressors on end-user performance is mediated by techno-exhaustion.[33]

In line with the IT coping implications discussed, the present results also enhance these two seminal technostress studies. Ayyagari et al. (2011) examine the relation between techno-stressors and techno-exhaustion, extended here by indicating that this relation is moderated by denial, such that the effect of techno-stressors on techno-exhaustion is reduced. We also extend the work by Tarafdar et al. (2007, 2010), who investigate the relation between techno-stressors and end-user performance, by demonstrating that this effect is moderated by active coping, such that the influences of techno-stressors on end-user performance are reduced.

In sum, techno-exhaustion and end-user performance are considered within one study. We extend

[33]We tested the significance of this mediation effect using bootstrapping procedures of SmartPLS. The indirect effects were computed for each of 5,000 bootstrapped samples. The bootstrapped unstandardized indirect effect was -0.072, and the 95% confidence interval ranged from -0.156, -0.004. Thus, the indirect effect was statistically significant.

technostress research by providing empirical evidence for a mediating effect of techno-stressors on end-user performance by techno-exhaustion and by demonstrating that coping strategies such as denial and active coping moderate the relationship between techno-stressors and techno-exhaustion, as well as end-user performance. As coping strategies have a significant effect on the stressor-strain relation, we call for a greater in-depth analysis of coping in technostress research.

6.2 Practical Contribution

Improving end-user performance and reducing techno-exhaustion through individual coping is highly relevant to practice as well. Technostress costs companies a significant amount of money, so examining coping mechanisms that might reduce these costs is highly relevant to practitioners. The present research provides a classification of coping strategies that can guide managers toward supporting appropriate coping strategies in an organizational setting. Our results show that coping strategies out of the two behavioral families decrease techno-exhaustion and increase end-user performance. Hence, managers can foster the denial strategy to lower the techno-exhaustion among their employees, and support the strategy of active coping to increase end-user performance. Furthermore, we suggest a structure and classification of coping, which companies can adopt to enhance their training programs, focusing on the reduction of negative consequences of techno-stressors. For example, companies might support users with the required resources needed to apply one coping strategy, especially out of the two behavioral families.

7 Limitations and Future Research

As with all empirical research, the present examination is limited in several ways. It focuses only on coping within the domain of technostress, whereas coping has been investigating in other domains such as IT usage or IT security. Hence, our empirical results are only valid for this domain. Future research should extend this study to the other domains by applying this proposed theoretical model of coping families to different contexts. Also, we only focus on one strategy out of the four identified coping families. Future research should focus on more strategies from each family. The investigation of patterns within each coping family might be a fruitful research direction, such that future research might identify different situations or techno-stressors in which different coping families could be applied. In addition, different effects of the coping strategies should be investigated in future research. As the research sample used here does not consist purely of employees from one company, future research should examine the effect of coping on technostress in an organizational context in which all participants use the same IT within one company to reduce the effect of environmental factors that might limit the investigation. The present paper follows the approach by Ayyagarie et al. (2011) and concentrates on IT in general, rather than one specific IT system. Future research should focus on a specific IT system and investigate differences between its mandate and voluntary usage.

8 Conclusion

This study contextualizes coping to the domain of technostress. Based on the guidelines of context-specific research, a theoretical model of four coping families helps to investigate different kinds of context-specific coping strategies and their effect on technostress. As a result, we discuss decreasing and increasing effects of context-specific coping strategies on techno-exhaustion and end-user performance, comparing them to the coping classification in previous literature. Future research could adapt the theoretical model of coping families to validate further the observed counterintuitive effects of different coping strategies belonging either to the cognitive-approach or avoidance families (increasing effect), or the behavioral approach or avoidance families (decreasing effect).

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10 APPENDIX

Constructs	Items	Loadings
Innovation of privacy (Ayyagari et al. 2011) α = 0.821	I feel uncomfortable that my use of IT can be easily monitored.	0.884
	I believe that my privacy can be compromised because the activities with IT can be easily tracked.	0.932
	I believe that the use of IT makes it easier to invade my privacy.	0.781
Work overload (Ayyagari et al. 2011) α = 0.855	I believe that the number of requests, problems or complaints I deal with is more than expected.	0.754
	I believe that the amount of work I do interferes with how well it is done.	0.789
	I feel busy or rushed.	0.890
	I feel pressured.	0.906
Role ambiguity (Ayyagari et al. 2011) α = 0.847	I am unsure whether I have to deal with IT problems or with my work activities.	0.808
	I am unsure what to prioritize: dealing with IT problems or my work activities.	0.829
	I can NOT allocate time properly for my work activities because my time spent on IT-activities varies.	0.859
	Time spent resolving IT problems takes time away from fulfilling my work responsibilities.	0.816
Work-home conflict (Ayyagari et al. 2011) α = 0.868	Using IT blurs boundaries between my job and my home life.	0.879
	Using IT for work-related responsibilities creates conflicts with my home responsibilities.	0.898
	I do not get everything done at home because I find myself completing job-related work due to IT.	0.891
Job insecurity (Ayyagari et al. 2011) α = 0.861	IT will advance to an extent where my present job can be performed by a less skilled individual.	0.885
	I am worried that new IT may pose a threat to my job.	0.846
	I believe that IT make it easier for other people to perform my work activities.	0.922
Active coping (Carver et al. 1989) α = 0.876	I take additional action to try to get rid of the IT problem.	0.915
	I concentrate my efforts in doing something about the IT problem.	0.892
	I do at any time what needs to be done to get rid of the IT problem.	0.763
	I take direct action to get around the IT problem.	0.829
Denial (Carver et al. 1989) α = 0.929	I refuse to believe that the IT problem has happened.	0.910
	I pretend that the IT problem hasn't really happened.	0.945
	I act as though the IT problem hasn't even happened.	0.896
	I say to myself "the IT problem isn't real."	0.872
Positive reinterpretation (Carver et al. 1989) α = 0.820	I look for something good in what is happening when perceiving the IT problem.	0.884
	I try to see the IT problem in a different light, to make it seem more positive.	0.841
	I try to grow as a person as a result of the experience when perceiving the IT problem.	0.831
Venting (Carver et al. 1989) α = 0.872	When perceiving an IT problem, I get upset and let my emotions out.	0.879
	I let my feelings out when perceiving an IT problem.	0.915
	When perceiving an IT problem, I feel a lot of emotional distress, and I find myself expressing those feelings a lot.	0.798
	When perceiving an IT problem, I get upset and am really aware of it.	0.803
Techno-exhaustion (Ayyagari et al. 2011) α = 0.922	I feel drained from activities that require me to use IT.	0.913
	I feel tired from my IT activities.	0.934
	Working all day with ITs is a strain for me.	0.839
	I feel burned out from my IT activities.	0.912
End-user performance (Kuvaas 2006) α = 0.844	I often perform better than can be expected from me.	0.808
	I often put in extra effort in my work.	0.860
	I try to work as hard as possible.	0.791
	The job is like a hobby to me.	0.841
Note: All items are assessed on a 7-point-likert scale (1 = strongly disagree to 7 = strongly agree)		

Table 3. Measurement items

Paper VIII

HOW DO USERS RESPOND TO TECHNOSTRESS?

AN EMPIRICAL ANALYSIS OF PROACTIVE AND REACTIVE COPING

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Proceedings of the 52nd Hawaii International Conference on System Sciences (2019), Maui, USA
http://hdl.handle.net/10125/59947

Paper IX

TECHNOSTRESS INHIBITION

AN EXPERIMENTAL STUDY OF HOW SOCIAL SUPPORT MITIGATE STRAIN RESPONSES TO TECHNO-STRESSORS

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TECHNOSTRESS INHIBITION

AN EXPERIMENTAL STUDY OF HOW SOCIAL SUPPORT MITIGATE STRAIN RESPONSES TO TECHNO-STRESSORS

Abstract

Technostress research demonstrates that individuals respond behaviorally, psychologically and physiologically towards techno-stressors and that technostress inhibitors reduce these strain responses. However, extant literature only investigates technostress inhibitors on a highly-aggregated level and neglects the mitigating effect of each independent inhibitor. In addition, literature indicates that technostress research to date has failed to investigate different types of social support, a likely key component of technostress inhibitors, even though they have been well-established in psychological research. The present research focuses on the technostress inhibitor social support, investigating how two types of social support, instrumental and emotional support, influence the three strain responses. Our findings indicate that social support reduces behavioral, psychological and physiological strain responses. In particular, instrumental support directly affects all three strain responses, whereas emotional support only influences psychological strain. Moreover, we reveal that providing inappropriate social support can lead to an increased strain response depending on inter-individual differences.

Keywords: Technostress inhibitors, Instrumental and emotional support, Social support, Behavioral strain, Psychological strain, Physiological strain, Skin conductance

1 INTRODUCTION

Technostress, the perception of stress while using information technology (IT), has been the subject of much information system (IS) research (for a review, see Riedl (2013) or Srivastava et al. (2015)) as it costs organizations financial resources, threatens the investments of organizations in implementing new IT, and threatens the well-being of individual users (Tarafdar et al. 2015a). For instance, technostress cost Intel nearly $1 billion per year in time spent responding to email overload (Hemp 2009), and the industrial sector in the United States (US) loses approximately $300 billion a year (Pearl 2014). The rationale for this is that individuals who perceive techno-stressors make more mistakes and waste time, for example handling high volumes of emails or recovering from interruptions, which decreases user performance. Users respond to technostress physiologically by feeling fatigued, exhausted and drained and are physically stressed, as indicated by sweaty hands or a faster heartbeat. Some studies indicate that 70 percent of individuals experience physical responses, lower productivity, and emotional disruptions when perceiving stress related to IT use (Pearl 2014; Wall 2014).

From a theoretical perspective, technostress research theorizes that the perception of techno-stressors, which are negative stimuli experienced by the individual when using stressful IT (Ayyagari et al. 2011) lead to psychological, physiological and behavioral strain responses (Ayyagari et al. 2011; Riedl et al. 2012; Tarafdar et al. 2010). As previously explained, these strain responses threaten the investments of organizations in implementing new IT and the well-being of individuals (Tarafdar et al. 2015a). Little attention has been paid to actions which inhibit technostress and hence protect organizational capital and the well-being of the users. Research indicates that technostress inhibitors decrease the perception of techno-stressors (Tarafdar et al. 2014) and reduce strain responses (e.g., end-user performance or satisfaction) (Fuglseth and Sørebø 2014; Ragu-Nathan et al. 2008; Tarafdar et al. 2011).

However, most of the inhibition literature considers general techno-stressors associated with IT usage, such as the invasion of privacy or work overload (e.g., Ragu-Nathan et al. 2008) rather than focusing on techno-stressors associated with IT malfunctions (e.g., Riedl et al. 2013), such as computer freezes.

Moreover, past literature examines technostress inhibitors on a highly-aggregated level rather than concentrating on single technostress inhibitor (e.g., Ragu-Nathan et al. 2008; Tarafdar et al. 2011, 2014). For example, most studies combine the effects of technical support and involvement into one overall technostress inhibitor rather than investigating them individually (e.g., Ragu-Nathan et al. 2008; Tarafdar et al. 2011, 2014). Hence, past literature indicates that aggregated technostress inhibitors reduce the strain responses but neglects to dismantle the aggregated technostress inhibitors into its separate components and investigate their effects on strain responses, so we do not know to what degree each single technostress inhibitors reduce the strain responses.

To close this research gap, the present study uses an experimental study design and therefore focuses in line with Riedl et al. (2012, 2013) on one techno-stressor associated with IT malfunctions and in addition concentrates on one specific technostress inhibitor, namely social support, to dismantle the aggregated technostress inhibitor into one of its components. To date, technostress inhibitor research has not investigated the effects of different types of social support (e.g., emotional and instrumental support), which have been well-established in psychological research (Cohen and Wills 1985; Taylor 2011). In this study, we investigate the independent effects of instrumental and emotional support on technostress. As psychological literature suggests that social support reduces the negative strain responses (Taylor 2011) and the technostress literature suggest that individuals respond to technostress behaviorally, psychologically, and physiologically (Ayyagari et al. 2011; Riedl et al. 2012; Tarafdar et al. 2010) the present research examined how instrumental and emotional support reduce the three strain responses. Specifically, our research question is:

How does social support influence the three strain responses to techno-stressors?

To answer this research question, we developed a research model of how social support influences the three strain responses induced by a techno-stressor, including a laboratory experiment. Our investigation of how social support influences behavioral, psychological, and physiological responses distinguishes between two types of social support: instrumental support and emotional support. We examine how strain responses to techno-stressors differ when users receive sympathy and understanding or help and instructions. Thereby, we contribute to the literature by investigating one single technostress inhibitor, social support, and by distinguishing instrumental from emotional support to demonstrate that their effect on behavioral, psychological, and physiological strain responses differ. Moreover, we shed light on the different effects of instrumental support and emotional support on strain responses by investigating the moderation effect of several individual factors.

The paper is organized as follows. We first describe technostress, technostress inhibitors, and social support. Subsequently, we develop hypotheses and describe our research model and the methodology of the laboratory experiment. Then the resulting data is analyzed, and the findings are presented. Finally, the contributions of our research to the IS discipline and limitations as well as future research streams are discussed.

2 THEORETICAL BACKGROUND

The following description of our theoretical foundation explains technostress, introduces three different strain responses caused by a techno-stressors and explains organizational inhibiting mechanisms. Subsequently, we explain the different types of social support before developing a theoretical model of technostress and technostress inhibitors.

2.1 TECHNOSTRESS

Technostress is defined as *"any negative impact on attitudes, thoughts, behaviors, or body physiology that is caused either directly or indirectly by technology"* (Weil and Rosen 1997, p. 5). More specifically, technostress is stress perceived when using IT and should be understood as an umbrella term comprising techno-stressors as well as strain responses to them (Ragu-Nathan et al. 2008; see Figure 1). Techno-stressors are technology-related stimuli perceived by individuals (Ayyagari et al. 2011) and can be grouped into two

categories. One category focuses on techno-stressors associated with IT usage, such as the invasion of privacy or work overload (Ayyagari et al. 2011; Maier et al. 2014a; Maier et al. 2015c; Ragu-Nathan et al. 2008; Tarafdar et al. 2010). The second focuses on techno-stressors associated with IT malfunctions, such as computer freezes, poor response times, or techno-unreliability (Riedl et al. 2012, 2013; Trimmel et al. 2003; for an overview see Appendix Table 11). The responses to techno-stressors are called strain responses and can be behavioral, psychological or physiological strain (Cooper et al. 2001).

Behavioral strain includes behavioral responses to the techno-stressor. This response includes behaviors such as lower performance levels, mistakes, errors, absenteeism and turnover (Cooper et al. 2001; Tarafdar et al. 2010). From an organizational point of view, this strain response is quite crucial because it can result in substantial costs to organizations (Cooper et al. 2001).

Psychological strain reflects the state of mind at a conscious level (Tams et al. 2014). This strain response includes emotional reactions to the techno-stressor and has been interpreted as emotional exhaustion in prior technostress literature (Ayyagari et al. 2011). Emotional exhaustion is the feeling of tension and depletion of one's emotional resources (Maslach et al. 2001; Moore 2000).

Physiological strain includes bodily responses to stressors such as cardiovascular, biochemical and gastrointestinal symptoms (Cooper et al. 2001) and has been the subject of recent investigations of users biological responses to techno-stressors (Riedl et al. 2012; Riedl 2013). This response is based on two major stress systems in the brain: autonomous nervous system (ANS) and the hypothalamus-pituitary-adrenal axis (HPA axis) (Hellhammer and Schubert 2012). The HPA axis plays a primary role in the body's reactions to techno-stressors by balancing hormones released by the adrenaline-producing adrenal medulla and the corticosteroid-producing adrenal cortex (Riedl 2013). The activation of the ANS leads to emotional sweating, pupil dilation, faster heartbeat as well as to an increase in the cortisol level (Riedl 2013). Unlike psychological strain, physiological strain may be experienced at an unconscious level (Monat et al. 2007; see Riedl (2013) for an extensive description of physiological strain). The results of previous examinations indicate that psychological strain often does not correlate with physiological responses (Riedl 2013). In other words, psychological strain reflecting the emotional state is often different from physiological strain including bodily responses to techno-stressors. Also, psychological and physiological strains are influenced by different antecedents. Psychological strain is caused by the interaction between demands and an individual's conscious assessment of those demands, whereas physiological strain is directly caused by environmental stimuli (Tams et al. 2014). There is some initial evidence that psychological and physiological strains in a technostress context are distinct responses (Riedl 2013; Tams et al. 2014).

2.2 TECHNOSTRESS INHIBITORS

In addition to techno-stressors and strain response, several investigations also consider technostress inhibitors, which are organizational mechanisms that reduce technostress (e.g., Ragu-Nathan et al. 2008; Tarafdar et al. 2010; see Figure 1). Facilitation, involvement, and support are examples of technostress inhibitors. Technical support guides the user on how to use new systems which reduce anxiety. Involvement and literacy facilitation includes the user into the planning, and implementation phase of an IS to consider how the system can be used and to address all the requirements of the user (Fuglseth and Sørebø 2014; Ragu-Nathan et al. 2008). Innovation support encourages users to learn, which includes a good and friendly working climate among users, supports communication and discussion, and facilitates new ideas (Tarafdar et al. 2011). Only a few examinations consider technostress inhibitors and most of them treat technostress inhibitors as aggregated construct such that we next give an overview of the previous literature on technostress inhibitors.

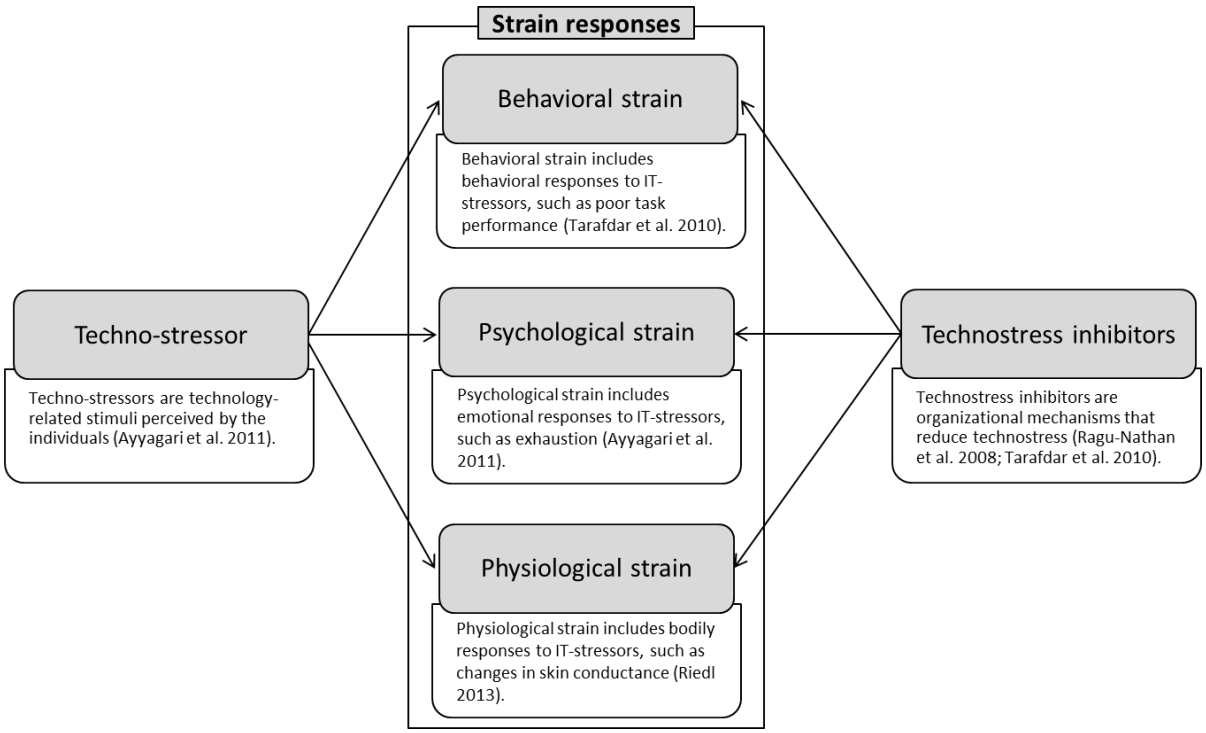

Figure 1: Technostress and technostress inhibitors

2.2.1 Related work on technostress inhibitors

At the beginning of IS technostress research, examinations already concentrate on technostress inhibitors and revealed that they reduce strain responses such as job satisfaction, organizational commitment, and continuance commitment which result out of the perception of techno-stressors (Ragu-Nathan et al. 2008). One study focuses on the two technostress inhibitors - involvement facilitation and innovation support - and theorizes that involvement facilitation decreases techno-stressors and user satisfaction, whereas innovation support is only positively related to user satisfaction. In addition, research demonstrates that technostress inhibitors increase employee innovation, employee productivity, end-user satisfaction, job satisfaction, organizational commitment and decreases role overload and role conflict (Tarafdar et al. 2011). In more recent studies, technostress inhibitors were found to decrease the perception of techno-stressors and increase technology-enabled innovation (Tarafdar et al. 2014) as well as satisfaction (Fuglseth and Sørebø 2014; Table 1 shows an overview).

In summary, technostress inhibitor research focuses on organizational mechanisms which reduce strain responses such as lowered productivity and lowered user satisfaction. However, most technostress examinations consider technostress inhibitors as an aggregated construct (see Table 1). These rather aggerated and scattered results from previous literature does not provide a consistent picture of the independent effect of technostress inhibitors such that the question which inhibitor reduces the strain responses remains unclear. Hence, the present research focuses on one single technostress inhibitor, namely social support, rather than focus on one aggregated countermeasures to address this gap in the literature. To do so, we next outline literature on social support and differentiate between instrumental and emotional support.

Table 1: Overview of the technostress inhibitor literature and their main results

Authors	Inhibitors	Dependent variables	Results
Ragu-Nathan et al. 2008	Technostress inhibitors$_1$ (literacy facilitation, technical support provision, involvement facilitation)	Job satisfaction	Technostress inhibitors increase job satisfaction.
		Organizational commitment	Technostress inhibitors increase organizational commitment.
		Continuance commitment	Technostress inhibitors increase continuance commitment.
Tarafdar et al. 2010	Innovation support	End-user satisfaction	Innovation support increases end-user satisfaction.
		Innovation facilitation	Innovation support increases innovation facilitation.
	Innovation facilitation	End-user performance	Innovation facilitation increases end-user performance.
		Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Innovation facilitation decreases techno-stressors.
Tarafdar et al. 2011	Technostress inhibitors$_1$ (technical support provision, technology involvement facilitation, innovation support)	Job satisfaction	Technostress inhibitors increase job satisfaction.
		Organizational commitment	Technostress inhibitors increase organizational commitment.
		Role conflict	Technostress inhibitors decrease role conflict.
		Role overload	Technostress inhibitors decrease role overload.
		Employee innovation	Technostress inhibitors increase employee innovation.
		Employee productivity	Technostress inhibitors increase employee productivity.
		End user satisfaction	Technostress inhibitors increase end-user satisfaction.
Tarafdar et al. 2014	Technostress inhibitors$_1$ (technical support provision, technology involvement facilitation, innovation support)	Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Technostress inhibitors decrease techno-stressors
Fuglseth and Sørebø 2014	Technostress inhibitors$_1$ (involvement, support, literacy)	Satisfaction	Technostress inhibitors increase satisfaction.
		Intention	Technostress inhibitors have no significant effect on intention.
Note: 1 = second order construct			

2.2.2 Social support: instrumental and emotional support

Social support is understood as the exchange of resources between at least two persons (Shumaker and Brownell 1984). Someone who receives social support experiences or perceives that she is cared about by others, esteemed and valued by others, and part of a network of people exchanging mutual help and obligations (Wills 1985). Social support might come from different sources such as a partner, relatives, friends, or coworkers (Allen et al. 2002).

Sociological research suggests that social support is especially important for individuals in stressful situations (Cohen and Wills 1985). Although the effect of social support is less important for individuals perceiving no stress, social support can influence the assessment of the environment by providing support for the process of appraising the situation or by directly influencing the strain responses to the situation (Cohen and Wills 1985). The literature consistently shows that social support decreases negative strain responses in stressful life situations (Taylor 2011) and recognizes the relationship between health and social support (Langford et al. 1997) and claims that it is one of the most significant predictors of physical health and reduces health consequences (Cobb 1976; McCorkle et al. 2008; Yan and Tan 2014).

Past sociological research has identified four different types of social support: informational support, emotional support, companionship, and instrumental support[34] (Cohen and Wills 1985; Taylor 2011). In the IS context, Beaudry and Pinsonneault (2010) demonstrate that individuals draw on instrumental support to receive help from colleagues and emotional support to receive sympathy, understanding, and encouragement to restore emotional stability to be able to face the stressful situation. In line with past literature (Beaudry and Pinsonneault 2010) indicating that instrumental and emotional support are significant in terms of managing the consequences of techno-stressors, the present examination focuses on these two types of social support.

[34] According to Cohen and Wills (1985), information support has also been referred to as advice, appraisal support, and cognitive guidance. Emotional support has also been referred to as esteem support, expressive support, self-esteem support, ventilation, and close support. Companionship has also been referred to as diffuse support and belongingness. Instrumental support has also been referred to as aid, material support, and tangible support.

Instrumental support is defined as help by co-workers and supervisors to get a job done (Beehr et al. 2000). It includes the provision of financial or tangible assistance, such as services, and other specific help (Cohen and McKay 1984; Taylor 2011). Examples include driving an injured friend to the emergency room or helping a coworker by solving an IT-related issue. Instrumental support may help reduce strain responses by directly resolving the perceived issue (Cohen and McKay 1984).

Emotional support is defined as *"warmth and nurturance to another individual and reassuring a person that he or she is a valuable person for whom others care*" (Taylor 2011, p. 193). Emotional support is the sharing of happiness or showing care and concern. It sends a signal that the individual is not alone, that one is taken care of and valued (Yan and Tan 2014). Receiving sympathy from colleagues, friends, and relatives in trying situations is useful in overcoming the stressful situations (Beaudry and Pinsonneault 2010).

In line with past literature, we concentrate on instrumental and emotional support (Beaudry and Pinsonneault 2010) as two specific technostress inhibitor to address the issue of previous literature which treats technostress inhibitors on a too aggregated level.

3 HYPOTHESES DEVELOPMENT

Based on the theoretical background we develop a research model to explain the influence of techno-stressors on behavioral, psychological and physiological strain and derive hypotheses on the impact of instrumental and emotional support on the three strain responses.

Table 2: Instance-level variables

Theoretical level	Instance level	Definition of instance level
Techno-stressor	Techno-unreliability	Techno-unreliability is defined as the degree to which the technology is not dependable (Ayyagari et al. 2011; Trimmel et al. 2003).
Behavioral strain	End-user performance	End-user performance is defined as how fast users fulfill their tasks while working with IT (Gattiker and Goodhue 2005; Tarafdar et al. 2010; 2014).
Psychological strain	Techno-exhaustion	Techno-exhaustion is defined as the perception of being drained, tired, fatigued or frustrated as the results of working with IT (Ayyagari et al. 2011).
Physiological strain	Physiological arousal	Physiological arousal is defined as the activation of different physiological systems such as CNS and subsequently occurring peripheral adaptive responses such as emotional sweat (Riedl 2013).
Technostress inhibitors	Instrumental support	Instrumental support is defined as help by co-workers and supervisors to get a job done (Beehr et al. 2000)
	Emotional support	Emotional support is defined as the warmth, nurturance, and caring provided by others (Taylor 2007).

To develop the hypotheses, we go from the theoretical level to the instance level by focusing on one specific techno-stressor, three strain responses, and two specific technostress inhibitors (see Table 1). We use an experimental study design to enable clear boundaries to analyze the effect of a specific technostress inhibitor and to ensure that no other effects distort the results. Consequently, on the instance level, we focus in line with other investigations (Riedl et al. 2012, 2013; Trimmel et al. 2003) only on one **techno-stressor** associated with IT malfunctions named techno-unreliability. We chose *techno-unreliability* as a concrete techno-stressor and defined it as the degree to which technology is not dependable. An example of techno-unreliability is when a computer freezes (Riedl et al. 2013; Trimmel et al. 2003). Among the strain responses, **behavioral strain** is understood as *end-user performance* and corresponds to how fast users fulfill their tasks while working with IT (Gattiker and Goodhue 2005; Tarafdar et al. 2010; Tarafdar et al. 2014). In line with prior examinations, we instantiate **psychological strain** as *techno-exhaustion*, which is defined as the perception of being drained, tired, fatigued or frustrated as the results of the perception of techno-stressors (Ayyagari et al. 2011). **Physiological strain** is understood as *physiological arousal* of the body and comprises the activation of different physiological systems such as central nervous system (CNS) and subsequently occurring peripheral adaptive responses such as elevated sweat secretion (Riedl 2013). The **technostress inhibitors** instrumental and emotional support are considered. *Instrumental support* is when someone receives instrumental support, such as help or assistance in solving a problem or getting something done (Beehr et al. 2000; Taylor 2007). *Emotional support* is when someone receives emotional support from others who provide warmth and nurturance and who care about the person (Taylor 2007). Furthermore, it

considers receiving sympathy, understanding, encouragement, and moral support from others, including family, friends, and colleagues (Beaudry and Pinsonneault 2010). Table 1 summarizes the relevant constructs and their definitions.

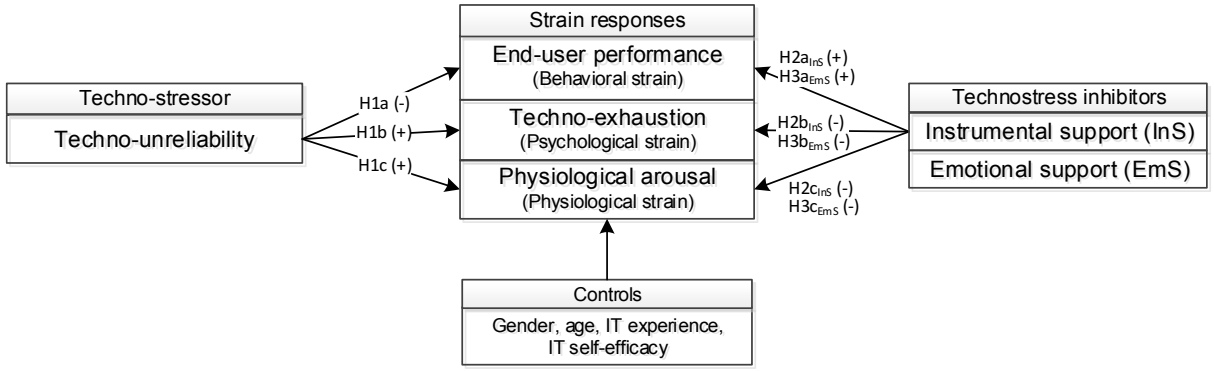

Figure 2: Research model

3.1 The Impact of Techno-Unreliability on End-User Performance, Techno-Exhaustion and Physiological Arousal

First, we look at the influence of techno-unreliability on end-user performance. Second, we hypothesize the relationship between techno-unreliability and techno-exhaustion, and finally, we focus on the effect of techno-unreliability on physiological arousal.

Prior research indicates that techno-stressors lead to a decrease in end-user performance (Tarafdar et al. 2010; Tarafdar et al. 2014). Users frequently experience the unreliability of IT during their daily tasks (Butler and Gray 2006), and their performance often worsens as the result of unreliable IT. For example, when users have to repeat work due to computer freezes or when their workload increases due to actions taken out of fear of techno-unreliability (Ayyagari et al. 2011), their performance might decline. When perceiving a techno-stressor, individuals tend to evaluate themselves negatively, which leads to a self-evaluative feeling of incompetence and lack of achievement. People feel unhappy and dissatisfied with their accomplishments (Maslach et al. 2001), which might lead to lower performance. When the computer freezes, organizational demands exceed individuals' abilities, which leads to lower performance by the user (H1a).

Research on the relationship between techno-stressors and psychological strain indicates that users confronted with techno-stressors face techno-exhaustion (Ayyagari et al. 2011). Software and hardware errors, quality problems, and general failures cannot be avoided (Lee et al. 2016). As a result, the perception of an unreliable IT leads to techno-exhaustion because users cannot perform their daily tasks which lead to the tension and depletion of one's emotional resources. For example, the situation in which a computer freezes, and an individual is not able to perform their work cost emotional resources and lead to the feelings of tiredness and fatigue (H1b).

IT users react not only psychologically, but also physiologically when technology use is perceived as stressful (Riedl 2013). Statistical evidence shows that techno-stressors such as computer freezes or pressure to perform lead to elevated cortisol levels (Riedl et al. 2012) and increased skin conductance (SC) (Eckhardt et al. 2012; Riedl et al. 2013). Techno-stressors activate several physiological mechanisms in the endocrine system, the central nervous system, and the autonomic nervous system (Riedl 2013). Techno-stressors influence physiology in several ways, including through specific affective and cognitive processes and basic brain mechanisms (Riedl et al. 2012). Sensory information regarding a perceived techno-stressor such as techno-unreliability is processed in the thalamus and in particular in the frontal cortex. After that, the brain subconsciously evaluates the significance of a stimulus in a particular context, and this assessment may lead to the generation of a response (Riedl et al. 2012). In other words, this activation leads to physiological arousal measurable as higher heart rate, blood pressure, SC, and hormone levels (e.g., adrenaline and cortisol;

Riedl 2013). Regarding SC, techno-stressors cause an increase in the activity of sweat glands (Randolph et al. 2005). More specific, there are three different pathways from the central nervous system (CNS) to electrodermal activity (Boucsein 2012). All three pathways lead to sweat secretion elicited in the lateral horn of the spinal cord. The stronger the activity of sweat glands, the more sweat wets the palms of the hands, improving the electric conductivity of the skin (Boucsein 2012; Randolph et al. 2005), which indicates physiological arousal of the individual (H1c).

H1: Users who experience unreliable IT (a) have lower end-user performance, (b) are more techno-exhausted, and (c) are more physiologically aroused than those who do not perceive techno-unreliability.

3.2 The Impact of Instrumental Support on End-User Performance, Techno-Exhaustion and Physiological Arousal

In the organizational setting, instrumental support refers to help provided by co-workers and supervisors to get the job done (Beehr et al. 2000). When receiving assistance from co-workers, performance levels which had slipped due to techno-stressors might be restored because the instrumental support from co-workers helps to remove the techno-stressor and because individuals feel more motivated when they receive instrumental support (Van Yperen and Hagedoorn 2003). Past literature shows that technostress inhibitors such as instrumental support provision increase satisfaction (Ragu-Nathan et al. 2008). For instance, in a situation where a user is registering invoices using IT and the computer freezes, she will not be able to register invoices, and her performance will fall. One potential way for her to restore work performance levels is to receive instrumental support from co-workers, so the invoices get registered (H2a).

Instrumental support encompasses goods and services that support the individual and decreases the feeling of loss of control (Taylor 2007). Techno-exhaustion is reduced by receiving concrete assistance from a co-worker or the IT help desk, which might decrease feelings of loss of control (Hogan et al. 2002). From a rational point of view, it is efficient to manage the consequences of techno-stressors by providing instrumental support because many techno-stressors result from the nature of the IT usage or organizational norms that cannot be changed (Weiss 1983). For example, when a user is registering invoices using an IS and feels exhausted because her computer freezes, if the user receives instrumental support to unfreeze her computer, she can handle the techno-stressor better, which might mitigate techno-exhaustion (H2b).

The perception of techno-stressor activates the behavioral inhibition system (BIS) (Morgan 2006; Sutton and Davidson 1997). The BIS is responsible for guiding behavior in response to threats and novel stimuli. This requires individuals with limited resources to execute behaviors leading to behavioral inhibition (Sutton and Davidson 1997). When instrumental support is provided by others during stressful situations, the physiological response is decreased as stress-responsive physiologic systems are suppressed (Heinrichs et al. 2003). There is evidence that perceiving support also reduces the physiological response, and it has been shown that receiving support is associated with lower blood pressure (Uchino et al. 1996). We theorize that when a user is physiologically aroused in response to an unreliable IT and receives instrumental support, the provision of assistance and help from others will also influence the activity of the HPA axis and the ANS (H2c).

H2: Users who receive instrumental support when experiencing unreliable IT (a) perform better, (b) perceive less techno-exhaustion, and (c) have a lower physiological arousal than those who receive no instrumental support.

3.3 The Impact of Receiving Emotional Support on End-User Performance, Techno-Exhaustion, and Physiological Arousal

Studies have shown that individuals who receive the desired amount of emotional support perform better because receiving support from others lead to higher task accuracy (Searle et al. 2001). Receiving emotional

support also restores the self-esteem of the individual (Hogan et al. 2002), which is a significant factor in performance. For example, receiving emotional support from supervisors and co-workers is associated with higher self-rated performance (Kaufmann and Beehr 1986). In the invoice registration example, the user's performance decreases due to an IT malfunction, but receiving emotional support may restore her self-esteem and influence her task performance. Therefore, we hypothesize that receiving warmth and nurturance from others leads to higher accuracy and end-user performance (H3a).

One result of being exposed to techno-stressors are emotional responses such as the perception of exhaustion (Ayyagari et al. 2011). Individuals might be able to stay in a stressful situation when they feel valued and appreciated, but develop exhaustion when there is no emotional support (Moore 2000). Receiving emotional support restores the self-esteem of the individual and allows him to express his feelings better in response to the care and concern communicated by others (Hogan et al. 2002). The negative feeling of techno-exhaustion might be mitigated when self-esteem is restored or due to the emotional support in the form of caring and concern communicated by co-workers, which may decrease techno-exhaustion. We hypothesize that if a user receives emotional support from others, her level of techno-exhaustion is lower than the level of techno-exhaustion of user receiving no emotional support (H3b).

Several studies have shown that receiving emotional support has a positive influence on cardiovascular activity (Uchino et al. 1996). Receiving a nod of agreement or a smile from others may lead to less physiological activation during stressful situations (Christenfeld et al. 1997). Users who receive emotional support might experience the techno-stressor as less threatening and perceive that they have greater control of the situation than users who receive no emotional support (Kirschbaum et al. 1995). Positive emotional interactions might modulate the activity of the HPA axis and the ANS (Heinrichs et al. 2003). For example, in a situation where a user is physiologically aroused because of an unreliable IT, she may receive emotional support to reduce the perception of stress associated with the unreliability and the resulting physiological-arousal (H3c).

> *H3: Users who receive emotional support when experiencing unreliable IT (a) have a higher end-user performance, (b) are less techno-exhausted, and (c) are less physiologically aroused than those who do not receive emotional support.*

3.4 CONTROLS

Several previous investigations consider individual differences regarding technostress (Ayyagari et al. 2011; Ragu-Nathan et al. 2008) and techno-stressors. The results show that men perceive techno-stressors stronger than women and that the perception of techno-stressors decrease as age, education, and computer confidence increase (Ragu-Nathan et al. 2008). On the contrary, Galluch et al. (2015) find a positive influence of age on the techno-stressor conflict and demonstrate that grade point average (GPA) positively influences this techno-stressor. They also show that age has a significant positive influence on psychological strain. Riedl et al. (2013) demonstrate that men show a higher level of physiological strain than women when encountering a computer freeze under time pressure. In our study, we control for the effect of gender, age, IT experience, and IT self-efficacy on end-user performance, techno-exhaustion, and physiological arousal.

Also, the literature on social support indicates that the effects on strain responses are subjected to inter-individual differences (Cohen and Wills 1985; Taylor 2011). Research suggests that social support functions which are effective for women are not equally effective for men and vice versa. Furthermore, women derive satisfaction more from talking about feelings, problems, and people, whereas men derive satisfaction from instrumental task accomplishment (Cohen and Wills 1985). To sheds light on the different effects of instrumental support and emotional support, we investigate the impact of group differences (gender, age, IT experience, and IT self-efficacy) on the relationship between social support and strain responses.

4 METHODOLOGY

In our laboratory experiment, participants completed tasks working with MS SharePoint. This situation

was manipulated by simulating a computer freeze during which three treatment groups receive different support types (no support, instrumental support, and emotional support). To analyze our research model, we captured subjective data using two surveys at the pre- and post-experimental stage and objective skin conductance (SC) data during the experimental stage. In this section, we present the methodology of the experiment, including experimental design, manipulations, experimental procedure, and measurement as well as data analysis.

4.1 Experimental Design and Sample

The experiment follows a bi-factorial, inter-subject design. The design considers the factor stressor (techno-stressor/non-stressor) and the factor social support (no support/emotional support/instrumental support). Notably, the design should encompass six different treatment groups. However, the techno-stressor and no support group form a single group because the participants are not only exposed to the techno-stressor but also have no opportunity to perceive instrumental or emotional support. Hence, the present experiment contains the following four groups: non-stressor group A (perceive non-techno-stressor and receive no support), no support group B (perceive techno-stressor and no support), instrumental support group C (perceive techno-stressor and receive instrumental support), and emotional support group D (perceive techno-stressor and receive emotional support). The experimental design is illustrated in Figure 3.

		Social support		
		No support	**Instrumental support**	**Emotional support**
Stressor	**Techno-stressor**	**B. no support group** Perceive techno-stressor, receive no support	**C. instrumental support group** Perceive techno-stressor, receive instrumental support	**D. emotional support group** Perceive techno-stressor, receive emotional support
	Non-stressor	**A. non-stressor group** Perceive no techno-stressor, receive no support		

Figure 3: Between-subjects design

To recruit participants, the experiment was promoted in different lectures of our department and advertised on several Facebook groups of individuals living in the city where the experiment took place. To increase participation, every participant received a meal voucher from the local cafeteria. A total of 80 subjects participated in the experiment, which is an appropriate sample size compared with previous SC studies in IS research (Eckhardt et al. 2012; Minas et al. 2014; Riedl et al. 2013; Teubner et al. 2015). The final sample contains 73 subjects because we excluded some participants based on measurement problems and missing values. The majority of the sample are students (69.9%), and the remaining thirty percent were employees (20.5%), self-employed individuals (1.4%), pensioners (1.4%) and 6.9% provided no work status information. Literature suggests that the use of student samples is appropriated (Compeau et al. 2012). As the students participating in the experiment are well-educated concerning the use of IT and have or will use MS SharePoint in future, it is a realistic research sample. The average of age was 28, and most of the subjects were between 19-24 years old. The sample was almost evenly divided between men (52.1%) and women (47.9%). Participants were randomly assigned to one of the four treatment groups. Across the treatment groups, no significant difference in gender and age distribution was identified. The participation was voluntary, and the data collection was completed in one month. The demographics of the overall sample and the four groups are displayed in Table 2.

Table 3: Demographics of the total sample and the four groups

Demographics			A. Non-stressor (perceive no techno-stressor, received no support)	B. No support (perceive techno-stressor, received no support)	C. Instrumental support (perceive techno-stressor, received instrumental support)	D. Emotional support (perceive techno-stressor, received emotional support)
N	73		20	17	18	18
Gender (%)	Men	52.1	52.9	55.0	44.4	55.6
	Women	47.9	47.1	45.0	55.6	44.4
Age (%)	<19	4.2	0.0	10.0	5.6	0.0
	19-24	54.2	64.7	45.0	61.1	47.1
	25-34	25.0	17.6	30.0	16.7	35.3
	35-44	1.4	5.9	0.0	0.0	0.0
	45-54	4.2	0.0	5.0	5.6	5.8
	>54	11.1	11.8	10.0	11.0	11.8

4.2 MANIPULATION: TECHNO-STRESSOR AND SOCIAL SUPPORT

4.2.1 Techno-stressor: simulated computer freeze

Whereas participants in the non-stressor group were not exposed to a techno-stressor, participants in the three techno-stressor groups (no support (B), instrumental support (C), and emotional support (D)) were manipulated by being subjected to techno-unreliability. Several studies focus on techno-stressors associated with IT malfunctions and failures, such as computer freezes, poor response times, or techno-unreliability (Boucsein and Thum 1995; Dwivedi et al. 2015; Riedl et al. 2012, 2013; Trimmel et al. 2003). We chose to investigate a computer freeze, which represents an unreliability of the IT. Computer freezes are seen as a significant techno-stressor and have the advantage that participants have experienced one at some point (Riedl et al. 2012). Also, the computer freeze manipulation is more reliably replicable in the context of a laboratory experiment than other techno-stressors such as work-home conflict or role ambiguity.

For these reasons, we chose the proven techno-stressor techno-unreliability, simulating a one-minute computer freeze during which input via mouse or keyboard was impossible, and accompanied by an immediate visual response on the screen. Our objective was to replicate exactly the way a user perceives the behavior of a system during a lockup using a short script for the MS-based GNU GPL application AutoHotkey and proprietary libraries to lock the mouse and keyboard to the hotkey configuration CTRL+ALT+L, which could be activated remotely. When the system was locked, any input is ignored other than the hotkey for unlocking, CTRL+ALT+U. To guarantee that the script was not disrupted we also blocked standard sequences such as CTRL-ALT-DEL (CAD) or the CTRL-SHIFT-ESC, which would have stopped the script otherwise, by running the operating system in a "kiosk" mode. The computers were running on MS Windows XP and configured to be lockable by remote access.

4.2.2 Social support: emotional and instrumental support

To manipulate the effect of social support, subjects receive instrumental or emotional support. The *instrumental support group* (C) was manipulated by receiving instrumental support from the facilitator, which also represents a well-established social support type (Taylor 2011). When the subjects asked for help, the facilitator explained that they should press CTRL+ALT+U to unfreeze the computer, so these participants were exposed to the techno-stressor for a shorter period.

Since receiving sympathy and understanding from someone or general support for emotional reasons is an established emotional support type (Taylor 2011), the *emotional support group* (D) was manipulated by receiving emotional support from the facilitator. When these participants asked for help, the facilitator talked with the subjects about their feelings, encouraged them and gave them sympathy and understanding for the situation caused by the manipulation by always saying to every subject in that group *"just keep cool, this can happen when you use a PC. I know this situation myself. Just stay calm*". The facilitator also shows nonverbal understanding by nodding to provide warmth and understanding. This was repeated if the participant asked again.

The *no support group* was not manipulated. When the subjects asked for help, the facilitator did not answer and signaled non-verbally that he or she would provide no help or support

4.2.3 Manipulation check

To ensure that the subjects of the experiment were successfully manipulated by the computer freeze, the treatment groups were given the threat appraisal questions based on Liang and Xue (2010) to evaluate whether they perceived the frozen computer as a techno-stressor. The mean value shows that participants whose computer froze felt threatened by the manipulation, as the values of the three treatment groups are all above the mean value of 2.5 (5-point Likert scale ranging from 1 strongly disagree to 5 strongly agree). Furthermore, subjects answered techno-unreliability questions based on Ayyagari et al. (2011). The mean values of the no support (B; M = 3.26), instrumental support (C; M =2.10), emotional support (D; M = 2.52) groups are higher than the values in the control group (A; M = 1.87). The results of a one-way ANOVA test indicate that the perception of the manipulation significantly differs between the techno-stressor group (A) and the no support group (B) ($F(1, 36) = 18.724$, $p = .000$). Based on all results, we can conclude that all treatment groups were aware of the techno-stressor manipulation.

The manipulation of social support was evaluated using the questions about "social support for emotional reasons" to verify emotional support and "support for instrumental reasons" to verify instrumental support (Carver et al. 1989). Post-hoc results of two ANOVAs considering social support for instrumental ($F(2, 50) = 12.611$, $p = .003$; $n2=.335$) and emotional reasons ($F(2, 50) = 10.206$, $p = .003$; $n2=.290$) show that the perception of the manipulation of support significantly differs between the no support (B) and the two treatment groups instrumental support (C) and emotional support (D). For instrumental support, there is a significant difference between the no support condition (B) and the instrumental support condition (C) (MD=-1.62; SE=.323; p = .000) as well as between instrumental support condition (C) and emotional support condition (D) (MD=.810; SE=.323; p = .016). For emotional support, there is a significant difference between the no support condition (B) and the emotional support condition (D) (MD=-1.416; SE=.352; p = .003) as well as between instrumental support condition (C) and emotional support condition (D) (MD=-1.349; SE=.358; p = .003). These findings indicate that the treatment groups were aware of emotional support or instrumental support mechanisms.

4.2.4 Tasks and technology used

In the experiment, participants completed three different tasks on a single worksheet using MS SharePoint 2010. We used the enterprise content management (ECM) system MS SharePoint to simulate a realistic organizational environment. ECM systems are common and used in almost every organization (vom Brocke et al. 2011), so participants were familiar with doing different tasks using such systems. Moreover, participants did not need to be experienced in using MS SharePoint to fulfill the tasks. The results of each task were noted under the task description on the worksheet. Three very simple tasks are developed shown in Table 3. All participants worked on the three tasks in the same sequence, which are described in Table 3.

Table 4: Tasks and work steps

Task 1:	What are the street name and the house number of the company Joe & Bloggs Ltd?
Work steps:	For the first task, the subjects were requested to search for a street name and a house number of a particular company in the customer list managed by the system. In this case, the subjects had to navigate from the main window to the correct list of clients and find the desired company and the requested information.
Task 2:	What is the date of the order placed by the company Sample Ltd?
Work steps:	The second task asked for the date of a specific order from a company which is also stored in a list within the system. Here, the subjects had to navigate to the correct list within MS SharePoint and search for the required company and date of order.
Task: 3	How many orders were placed by Miss Sabrina Sample in 2013?
Work steps:	In the third tasks, the subjects had to navigate to the correct list, search for the specific customer and count the exact number of orders. In this step, participants had to find the right order and customer in a long list containing similar orders and clients, such as Sabrina Sample or Sabrina Sampel, to make this task more complicated.

4.3 EXPERIMENTAL PROCEDURE

The experiment was divided into a pre-experimental, experimental, and post-experimental phase. Beforehand, we conducted a pilot test and improved the experimental procedure based on the results (see Appendix, pilot test). For the experiment, we recruited a sample of subjects who had not participated in the pilot test. The three stages are described in the following.

In the **pre-experimental stage**, participants were assigned randomly to one of the treatment groups and seated at a desk in our laboratory. Subjects were isolated from each other and completed the experiment independently. The experiment was introduced to the subjects as a performance test of a new version of MS SharePoint to reduce the bias in the real study. The facilitator then presented the procedure and the task of the experiment and allowed participants to ask questions about the experiment. Before the experimental stage began, the subjects were fitted with the SC equipment and filled out the first paper-based survey.

In the **experimental stage**, the participants moved to a computer workplace where they logged into MS SharePoint with a username and associated password provided. Subjects had to work on three different tasks described on three different cards lying on the desk in front of them. The order of the task was given such that the subjects had to finish one task before continuing with the next one. For each task, the participants had to find information within MS SharePoint (see section *Task and technology used*). If the subjects revealed an answer, they wrote it on the card below the task description and continued with the next task. However, if the subjects finished one task and continued with the next one, they were not allowed to go back to the previous task and change their answer. In all conditions, there was no time limit for each task such that the participants could take as long as they needed to complete each task. A time limit of each task would have posed an additional stressor within the experimental design and would have distorted the results of the experiment. All subjects worked on task one and two under the same conditions. Hereafter, we distinguished among four groups: non-stressor (A), no support (B), instrumental support (C), and emotional support (D) who all completed the same tasks.

The non-stressor group (A) completed task two and was able to continue with tasks three without any manipulation. These subjects completed task three and moved to the post-experimental stage.

The techno-stressor group (B) completed the first two tasks as all other subject and was then manipulated in the way that the computer froze for one minute. The facilitator manually initiated the manipulation. This manipulation began once the participants had completed the second task by freezing the computer via remote access (see section *Techno-stressor: Simulated computer freeze*). During that time, subjects were not able to provide input via the keyboard or the mouse. The subjects in this group were not manipulated again and received no emotional or instrumental support from the facilitator. Participants had to wait one minute until the techno-stressor ended before they could continue to work on the last task. After finishing task three, they moved to the post-experimental stage.

The instrumental support group (C) also completed the first two tasks before the manipulation was applied. The facilitator remotely initiated the computer freeze such that subjects within this group were not able to provide input via the keyboard or the mouse. However, during the computer freeze, this group was again manipulated when the facilitator provided instrumental support. The second manipulation took place after the subjects asked the facilitator for help. The facilitator told the subject what to do to solve the problem with the frozen computer (see section *Social support: Emotional and instrumental support*). This type of support enabled the participants to solve the problem caused by the techno-stressor and continue to work on the last task after unfreezing the computer and, hence, move to the post-experimental stage.

The emotional support group (D) was also manipulated by the computer freeze after finishing task two (see section techno-stressor: simulated computer freeze). During the one-minute freeze, no input from the keyboard or the mouse were possible. However, this group was manipulated again when the facilitator provided emotional support in the form of sympathy and understanding after the subject asked the facilitator

for support. The facilitator communicated with the subjects and showed them warmth and understanding for the situation (see section *Social support: Emotional and instrumental support*). This type of support did not enable the subjects to solve the problem caused by the techno-stressor, and the techno-stressor continued for one minute before participants were able to continue to work on the third task and hence move to the post-experimental stage.

Finally, after approximately ten minutes the **post-experimental stage** started, the subjects left the computer workplace and were seated at a normal desk, where they filled out the second paper-based survey. This survey contains measurement items to confirm that the manipulations were experienced as well as capture dependent variables such as techno-exhaustion. The experimental procedure for each group is illustrated in Figure 4.

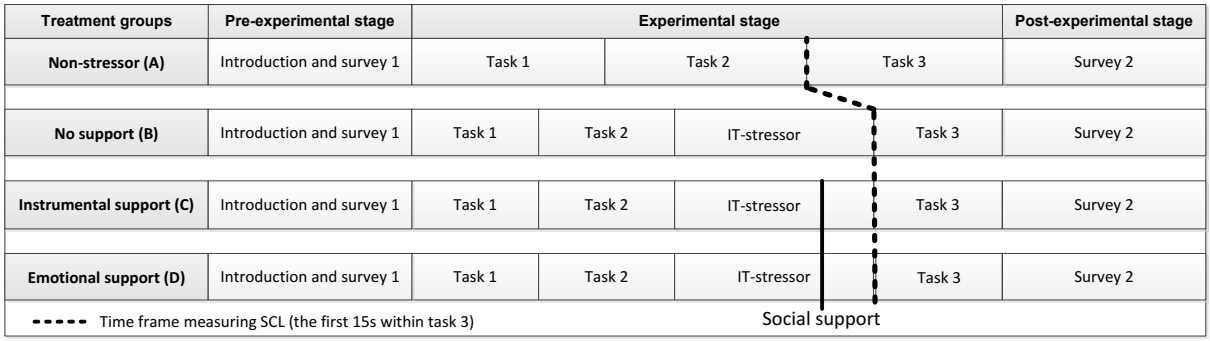

Figure 4: Experimental procedure for each treatment group and point of analysis

4.4 MEASUREMENT

During the experiment, we captured data in the pre- and post-experimental stages as well as during the experimental phases.

The first survey, which was conducted in the pre-experimental stage, collected data on demographics, including age, gender, education status, IT experience (Potosky and Bobko 1998) and IT self-efficacy (Marakas et al. 2007). The second survey, which was conducted in the post-experimental stage, measured perceived threat appraisal (Lee and Larsen 2009; Liang and Xue 2010), support for emotional and instrumental reasons (Carver et al. 1989), techno-unreliability (Ayyagari et al. 2011) and psychological strain (Ayyagari et al. 2011). All measurement items are presented in the Appendix, Table 10. All constructs have been measured on a 5-point Likert scale (strongly disagree to strongly agree).

During the complete experiment, skin conductance (SC) was measured as evidence of physiological arousal. We used an exosomatic SC method, which applies direct current to the skin. Two electrodes were installed on the palmar surface of participants' non-dominant hand to measure the low-level voltage between these electrodes. We measured participants' SC values once per second using a MentalBioScreen K3 device and recorded it in microsiemens (μS). According to Marcolin et al. (2000), is it more appropriated to use a hands-on test to measure end-user performance instead of a self-assessment method, so we measured end-user performance objectively by recording the time needed to process task three (Gattiker and Goodhue 2005).

4.5 DATA ANALYSIS

SC is divided into a tonic and a phasic component (Boucsein 2012). The tonic component is *"the absolute level of […] conductance at a given moment in the absence of a measurable phasic response"* (Dawson et al. 2007, p. 210). In other words, tonic values represent SC over a longer period of time and are referred to as skin conductance level (SCL). The phasic component takes the increases in conductance into consideration, which occurs in the tonic phase typically triggered by different external or internal stimuli. Increases in conductance are labeled as skin conductance responses (SCR; Boucsein 2012). In line with

literature focusing on recovering from physiological strain (Lazarus 1966; Lazarus and Opton 1966), we concentrate on the tonic component of SC.

In the present examination, we decomposed SC into its tonic and phasic components. Furthermore, we determined a specific time point for the data analyses which does not contain any phasic response which might arise from the perception of the techno-stressor. Also, we identified a moment in which all treatment groups worked under the same conditions. As a result, we used the first 15 seconds within task three as the time of analysis, when all participants worked under the same conditions, regardless of whether they had experienced a techno-stressor or received social support. A dotted line represents the data point in the experiment procedure illustrated in Figure 4.

SCL data cannot be analyzed instantly because of differences between the subjects. Lykken and Venables (1971) point out that the SCL of a relaxed subject could be twice as high as the maximum conductance of another subject which is highly stimulated. To account for this variance, each value is set to the individual range from maximum to minimum SCL for each subject, which occurred during the whole experiment. This enabled us to adjust SCL data using the equation of correction for individual differences in range (see Lykken and Venables 1971, p. 667).

Finally, we measured end-user performance by tracking completion times for task three, which all treatment groups completed after the manipulation, i.e., working under the same conditions as the control group. Since all manipulations ended before task three, the time in which users were not able to use the system is not part of the end-user performance (Gattiker and Goodhue 2005).

5 RESEARCH RESULTS

In this section, we first describe the reliability and validity analysis. Then we present our research results, including the effects of IT unreliability on the three strain responses, the direct influence of instrumental and emotional support on strain responses, and the results of a group comparison approach to identify group differences in instrumental support and emotional support.

5.1 RELIABILITY AND VALIDITY ANALYSIS

To provide a valid and reliable measurement model for testing our hypotheses we first assessed the measurement constructs. As all constructs are measured with reflective indicators, we validate the measurement model by focusing on content validity, indicator reliability, construct reliability, and discriminant validity (Bagozzi 1979).

Content validity: To ensure content validity for the perceptive measured variables, we used items that had been used in prior research and discussed each item within our project team. We adjusted the question slightly to fit our experimental setting. For example, we changed the item *"I feel drained from activities that require me to use ICTs"* so that it referred to our experiment and hence worded our item: *"I feel drained because of the IT usage during the experiment."* All items used are presented in Appendix Table 10.

Indicator reliability: This reflects the rate of the variance of an indicator that comes from the latent variables. To ensure that 50 percent or more of the variance is explained by the indicators, each value should be at least 0.707 (Carmines and Zeller 2008). All other items were removed from the model. Table 4 shows that this condition is fulfilled.

Construct reliability: To determine construct quality, we used composite reliability, which should be at least 0.7, and average variance extracted (AVE), which should be at least 0.5 (Fornell and Larcker 1981). Also, the Cronbach's Alpha should be at least 0.7. As shown in Table 4 all criteria are fulfilled.

Discriminant validity: This reflects the extent to which items differ from others (Campell and Fiske 1959). The square root of AVE should be greater than the corresponding construct correlations (Fornell and Larcker

1981). Table 5 shows that the square roots of the values are greater than the corresponding correlations between the constructs.

Table 5: Construct Measures

Construct	Mean	Standard deviation	Item loading	Cronbach 's alpha	AVE	CR	Number of items
Age	28.43	12.03	NA	NA	NA	NA	1
End-user performance	147.19	79.79	NA	NA	NA	NA	1
Gender	.52	.50	NA	NA	NA	NA	1
IT-Experience	3.28	1.19	.842-.938	.93	.82	.96	5
IT self-efficacy	4.00	.98	.800-.897	.84	.68	.90	4
Physiological arousal	.50	.166	NA	NA	NA	NA	1
Support for emotional reasons	2.14	.91	.866-.866	.70	.75	.86	2
Support for instrumental reasons	4.08	1.15	.735-.929	.76	.61	.86	3
Techno-exhaustion	1.29	.41	.707-.861	.77	.63	.87	4
Techno-unreliability	2.42	1.08	.815-.914	.83	.77	.91	3
Threat appraisal	3.03	1.22	.852-.953	.89	.82	.93	3
Note: NA = Not applicable because of single item construct							

Table 6: Inter-Construct correlation

	Construct	1	2	3	4	5	6	7
1	Age	NA						
2	Gender	-.019	NA					
3	IT experience	.173	-.473	.904				
4	IT self-efficacy	-.355	.488	-.762	.827			
5	Techno-exhaustion	-.082	-.046	.211	-.279	.793		
6	End-user performance	.014	-.048	.050	-.071	.009	NA	
7	Physiological arousal	.092	.191	-.029	-.158	-.011	.053	NA
Note: Square root of AVE is listed on the diagonal of bivariate correlations; NA = Not applicable because of single item construct								

5.2 The Influences of Techno-stressors on Behavioral, Psychological and Physiological Strain

Our research model theorizes that techno-stressors reduces end-users' performance and increases techno-exhaustion and physiological arousal (H1a-c). A mean comparison of the non-stressor (A) and the no support condition (B) shows that for end-user performance the mean time needed is shorter for the non-stressor group (A) compared to the no support condition (B). This reveals that subjects in the non-stressor condition (A) performed better than the subjects in the no support condition (B). A comparison of mean techno-exhaustion levels indicates that subjects in the non-stressor condition (A) are less techno-exhausted than the ones in the no support condition (B). With regard to physiological arousal, the findings show that subjects in the non-stressor condition (A) are less aroused than subjects in the no support condition (B), as demonstrated in Table 6.

Table 7 summarizes the results of three ANOVAs, which determine whether or not there are significant differences in end-user performance, techno-exhaustion or physiological arousal levels. We first analyzed the differences between the two conditions non-stressor (A) and no support (B). In the case of end-user performance results of the post-hoc analysis show significant differences between these two conditions ($p=.004$). We also find a significant difference between non-stressor (A) and no support (B) for techno-exhaustion ($p=.044$). The last comparison focuses on physiological arousal. Our findings show that physiological strain significantly differs between the two conditions ($p=.044$). These results support H1a, b, and c.

5.3 The Influence of Social Support on Behavioral, Psychological and Physiological Strain

Our research model distinguishes between instrumental support and emotional support and claims that both increase end-user performance and alleviate techno-exhaustion and physiological arousal. We compared the three treatment groups no support (B), instrumental support (C) and emotional support (D). Our data on end-user performance indicate that subjects in the instrumental support and emotional support conditions performed better than subjects in the no support condition (B). A comparison of instrumental support (C) and emotional support (D) conditions results show that the subjects in the instrumental support condition (C)

performed better than those in the emotional support condition (D). Concerning techno-exhaustion, the mean values of the instrumental support (C) and emotional support conditions (D) are lower than those in the no support condition (B). A comparison between instrumental support (C) and emotional support (D) shows that individuals in the emotional support condition (D) were less exhausted than those in the instrumental support condition (C). Turning to physiological strain, our data demonstrate that subjects in the instrumental support (C) and emotional support conditions (D) are less physiologically aroused than those in the no support condition (B) and subjects in the instrumental support condition (C) are less physiologically aroused than those in the emotional support condition (D). Our results are presented in Table 6.

Table 7: Mean comparison between the social support conditions

		Dependent variables					
		End-user performance		Techno-exhaustion		Physiological arousal	
Treatment groups	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Non-stressor (A)	20	111.60	83.145	1.25	.429	.47	.168
No support (B)	17	184.11	91.154	1.51	.441	.57	.135
Instrumental support (C)	18	128.52	60.451	1.20	.377	.43	.159
Emotional support (D)	18	167.44	60.858	1.18	.319	.53	.177

Note: end-user performance in seconds (high value = bad performance, low value = good performance); Techno-exhaustion measured on 5-point Likert scale (1 = not exhausted – 5 = exhausted); Physiological arousal measured in microsiemens µS (high value = high arousal – low value = low arousal)

To statistically analyze the influence of instrumental and emotional support on end-user performance, techno-exhaustion, and physiological arousal, we conducted three different ANOVAs.

First, end-user performance in the no support (B), instrumental support (C), and emotional support condition (D) is compared. Our findings show a significant effect ($F(3, 69) = 3.687$, $p = .016$; $n2 = .138$). Post hoc comparisons indicate that the mean score for the instrumental support condition (C) is significantly different from the mean value of the no support condition (B). However, the emotional support condition (D) does not significantly differ from the no support condition (B).

Second, we analyze the influences of social support on techno-exhaustion. A significant effect is observable between the four conditions ($F(3, 69) = 2.701$, $p = .052$; $n2 = .105$). A subsequent post hoc comparison shows that the mean score between the no support (B) and the instrumental support (C) as well as the emotional support condition (D) differ significantly.

Third, the impact of social support on physiological arousal is analyzed. The results show a significant effect ($F(3, 69) = 2.520$, $p = .065$; $n2 = .099$). The post hoc analysis demonstrates that the mean score between no support (B) and instrumental support (C) is significant, whereas no significant differences are observable between the no support (B) and emotional support (D) condition. Table 7 summarizes the post hoc results of all ANOVAs. These results support the hypotheses H2a, b, c, and H3b.

Table 8: ANOVAs and post hoc analysis

		Dependent variables								
		End-user performance			**Techno-exhaustion**			**Physiological arousal**		
ANOVA results		F(3, 69) = 3.687, p = .016**; n2 = .138			F(3, 69) = 2.701, p = .052*; n2 = .105			F(3, 69) = 2.520, p = .065*; n2 = .099		
Pairwise comparisons		**End-user performance**			**Techno-exhaustion**			**Physiological arousal**		
Group (i)	**Group (j)**	**MD**	**SD**	**p**	**MD**	**SD**	**p**	**MD**	**SD**	**p**
Non-stressor (A)	No support (B)	-72.51	24.55	.004**	-.26	.13	.044**	-.11	.05	.044**
	Instrumental support (C)	-16.93	24.93	$.499^{NS}$	.04	.13	$.737^{NS}$	.03	.05	$.618^{NS}$
	Emotional support (D)	-55.85	24.55	.004**	.07	.19	$.591^{NS}$	-.06	.05	$.247^{NS}$
No support (B)	Instrumental support (C)	55.58	25.56	.033**	.30	.13	.024**	.13	.05	.016**
	Emotional support (D)	16.67	25.19	$.510^{NS}$	.33	.13	.014**	.04	.05	$.390^{NS}$
Instrumental support (C)	Emotional support (D)	-38.92	25.56	$.132^{NS}$	.03	.13	$.851^{NS}$	-.09	.05	$.112^{NS}$
Note: Social support is the independent variable; p<0.01***; p<0.05**; p<0.1*; $p>0.1^{NS}$; MD= mean difference; SD=standard deviation										

5.4 The Effect of Controls on Strain Responses

To analyze the effect of the control variables, we split the sample depending on high and low values for the IT-experience and IT self-efficacy. High is coded as 1 and summarizes all values equal or above the mean of 2.5. Low is coded as 0 and summarizes all values lower than the mean. Regarding gender, women are coded as 0 and men as 1. Gender has been split into young and old subjects. Young are all subjects who are younger or equal than 39 years and old are all subjects older or equal than 40 years.

To control whether the control variables have a direct effect of the three strain responses we conducted several ANOVAs each for one dependent and control variable. The results of all control variables are reported in Table 8 and indicate that only IT self-efficacy influences techno-exhaustion and physiological arousal. All other influences are insignificant.

Table 9: Influences of the control variables on end-user performance, techno-exhaustion, and physiological arousal

	End-user performance			Techno-exhaustion			Physiological arousal		
Control variable	**Df**	**MSE**	**F**	**Df**	**MSE**	**F**	**Df**	**MSE**	**F**
Gender	1,71	1034.509	$.161^{NS}$	1,71	.025	$.150^{NS}$	1,71	.072	2.690^{NS}
Age	1,70	725.336	$.111^{NS}$	1,70	.056	$.330^{NS}$	1,70	.010	$.343^{NS}$
IT-experience	1,71	3453.548	$.540^{NS}$	1,71	.271	1.627^{NS}	1,71	.000	$.005^{NS}$
IT-self efficacy	1,71	2377.220	$.371^{NS}$	1,71	.476	2.914^{*}	1,71	.6316	6.316**
Note: p<0.01***; p<0.05**; p<0.1*; p>=0.1^{NS}; MSE=mean square of the error									

5.5 The Moderation Effect of Inter-Individual Differences on The Relation Between Social Support and Strain Responses

Inter-individual differences might explain the different effects of instrumental support and emotional support on the strain responses. Hence, we tested whether any of these personal factors (gender, age, IT-experience, IT self-efficacy) moderates the effect of instrumental and emotional support on end-user performance, techno-exhaustion, or physiological arousal.

Because the moderator variables, as well as the independent variables, are discrete, we followed a multisampling approach (Rigdon et al. 1998). We adopted the group comparison approach developed by Chin (2000) and used by Keil et al. (2000) to analyze the moderating effect of the control variables on the relation between social support and the three strain response variables. According to the group comparison approach, the direct effects of the exogenous variable on the endogenous variables is estimated separately for each group of interest (Henseler and Fassott 2010). The moderating effect is then interpreted as the differences in the model parameters between the different data groups and calculated by the formula developed by Chin (2000)[35].

By computing the moderation effects on the relation between instrumental and emotional support and end-user performance, techno-exhaustion, and physiological arousal, we compare the effects of instrumental and emotional support on each strain response variable separately for each control variables, which is depicted in Table 9. We report the t-value and significance level based on the group comparison method described above as well as the mean differences between instrumental support and emotional support for each moderation condition. The main results are summarized in Table 9.

[35] Formula is provided under: http://disc-nt.cba.uh.edu/chin/plsfaq.htm

Table 10: Interaction effects of inter-individual differences

			End-user performance			Techno-exhaustion			Physiological arousal		
			Independent variables (pairwise comparisons)			Independent variables (pairwise comparisons			Independent variables (pairwise comparisons		
			Instrumental support (C)		Emotional support (D)	Instrumental support (C)		Emotional support (D)	Instrumental support (C)		Emotional support (D)
			No support (B)	Emotional support (D)	No support (B)	No support (B)	Emotional support (D)	No support (B)	No support (B)	Emotional support (D)	No support (B)
Gender	MD (i-j)	Male	43.344	62.694	-19.350	.331	.024	.306	.126	.166	-.040
		Female	71.000	19.575	51.425	.281	-.0687	.350	.143	.025	.118
		T	.001^{NS}	.010^{NS}	.008^{NS}	.001^{NS}	.599^{NS}	.009^{NS}	0.500^{NS}	**2.460*****	**5.465*****
Age	MD (i-j)	Young	38.748	31.500	7.248	.235	-.018	.252	.100	.055	.045
		Old	137.667	85.333	52.333	.667	-.000	.667	.299	.289	.009
		T	.007^{NS}	.004^{NS}	.004^{NS}	1.407^{NS}	.715^{NS}	1.387^{NS}	**2.640*****	**3.574*****	.905^{NS}
IT-experience	MD (i-j)	High	4.750	68.975	-64.225	.201	.187	.218	.061	.078	.078
		Low	97.233	32.948	64.284	.217	-.179	.396	.213	.124	.089
		T	.009^{NS}	.009^{NS}	.017^{NS}	.775^{NS}	**2.399*****	1.221^{NS}	**4.096*****	.576^{NS}	**3.619*****
IT-efficacy	MD (i-j)	Male	25.689	41.477	-27.364	.248	-.070	.318	.050	.092	-.013
		Female	132.114	46.257	47.138	.182	.064	.357	.242	.100	.141
		T	.009^{NS}	.009^{NS}	.014^{NS}	.960^{NS}	.822^{NS}	.248^{NS}	**2.413*****	.051^{NS}	**4.852*****

Note: end-user performance in seconds (high value = bad performance – low value = good performance); Techno-exhaustion measured on 5-point Likert scale (1 = not exhausted – 5 = exhausted); Physiological arousal measured in microsiemens µS (high value = high arousal – low value = low arousal); p<0.01***; p<0.05**; p<0.1*; p>=0.1^{NS};

The moderation analysis shows that no significant moderation effect could be found on the relationship between instrumental or emotional support and **end-user performance**.

Concerning **techno-exhaustion**, our results show that the influence of emotional and instrumental support on techno-exhaustion is moderated by *IT experience*, such that techno-exhaustion is lower for highly experienced users who receive instrumental support, whereas users with less experience show lower techno-exhaustion when they receive emotional support.

The moderation analysis regarding the influence of social support on **physiological arousal** reveals several significant results. The influence of social support on physiological arousal is also moderated by *gender* such that the effect of instrumental support and emotional support is roughly similar for women. Men experienced less physiological strain when receiving instrumental support than when receiving emotional support. Furthermore, men who receive emotional support are more physiologically aroused than men who receive no social support. Women show a significant lower physiological arousal level in the emotional support condition than in the no support condition.

Concerning *age*, the results show that physiological arousal is lower for young individuals who receive instrumental support than for individuals who do not receive social support. In addition, physiological arousal is lower for old individuals who receive instrumental support compared to emotional support, whereas instrumental support and emotional support have almost the same effect for young individuals.

The influence of social support on physiological arousal is also moderated by *IT experience,* such that the physiological arousal level is similar for highly experienced individuals who receive instrumental support and for users who receive no social support. The physiological arousal level is lower for low experienced users who receive instrumental support than for users who receive no social support. Additionally, highly experienced individuals who receive emotional support are more physiologically aroused than individuals who receive no social support, whereas physiological arousal level is lower for individuals with less experience who receive emotional support compared to individuals who receive no social support.

Turning to *self-efficacy*, our results show that individuals with high self-efficacy who receive emotional support are more physiological aroused than individuals who receive no social support. Physiological arousal is lower for individuals with low self-efficacy who receives emotional support than individuals receiving no

social support. Furthermore, the physiological arousal level for individuals with high self-efficacy who receive instrumental support and for individuals with high self-efficacy who receive no social support is roughly similar. The physiological arousal level for individuals with low self-efficacy who receive instrumental support is lower than for individuals with low self-efficacy who receive no social support.

6 DISCUSSION AND CONTRIBUTION

Technostress costs organizations a significant amount of money and can cause health problems among employees, such as phobia and depression (McEwen 2006; Riedl 2013). Research indicates that technostress inhibitors, which are organizational mechanisms such as social support or involvement reduce the negative strain responses of users (Ragu-Nathan et al. 2008; Tarafdar et al. 2010). However, past literature exams technostress inhibitors on an aggregated level (e.g., Ragu-Nathan et al. 2008; Tarafdar et al. 2011, 2014, see also Table 1) and neglects the investigation of the mitigating effect of single technostress inhibitors such as social support. As a result, extent literature provides no insights into if and how each technostress inhibitor reduces the strain responses. Moreover, by focusing on social support, it is shown that despite the consistent opinion of psychological research demonstrating various types of social support, i.e. emotional and instrumental support (Cohen and Wills 1985; Taylor 2011), technostress inhibitor research neglects to investigate different types of social support on strain responses. Hence, the present research focuses on one particular technostress inhibitor in terms of social support, tested separately for emotional and instrumental support, and examines their influence on the three strain responses triggered by one techno-stressor to investigate these effect in a controlled environment without distorting effects.

This study analyzes the influence of social support on psychological, physiological and behavioral responses caused by the perception of a techno-stressor, which can protect individuals' health and organizations' IT investments. To ensure a controlled environment, we conducted a laboratory experiment to capture behavioral, psychological and physiological strain and provided instrumental support and emotional support. A statistical analysis of our data shows that the techno-stressor significantly influences behavioral, psychological and physiological strain. Our results also indicate that instrumental support and emotional support differently affect behavioral, psychological and physiological strain. Instrumental support directly affects all three strain responses, whereas emotional support only influences psychological strain. Furthermore, we examined the influences of individual factors on strain responses as well as their moderation effects on the relationship between instrumental and emotional support and the strain responses. Our research responds to Ayyagari et al.'s (2011) call for research into the physiological consequences of stressful IT usage, as well as Riedl's (2013) call for an examination of the biological and objective effects of different technostress countermeasures. The present research contains several theoretical and practical contributions which are presented in the following sections.

6.1 THEORETICAL CONTRIBUTIONS

Technostress research considers the behavioral, psychological (Ragu-Nathan et al. 2008; Tarafdar et al. 2010; Tarafdar et al. 2011; Tarafdar et al. 2014), and physiological strain responses (Riedl et al. 2012, 2013) regarding techno-stressors. However, technostress research neglects to investigate how one techno-stressor influences all three strain responses simultaneously. The present study contributes to technostress literature such as Ragu-Nathan et al. (2008), Tarafdar et al. (2010), and Riedl et al. (2012) which either focus only on one or two strain responses by showing that behavioral and psychological strain are explained to a greater extent than physiological strain. Furthermore, we contribute to technostress literature which also considers technostress inhibitors (Fuglseth and Sørebø 2014; Ragu-Nathan et al. 2008; Tarafdar et al. 2011) by investigating one technostress inhibitor, social support, broken down into instrumental and emotional support rather than examining one general technostress inhibitor . Moreover, we contribute by theorizing and providing empirical evidence that social support has a direct effect on strain responses while struggling with unreliable IT and by revealing different strain responses when receiving instrumental or emotional support. In particular, the effect of instrumental and emotional support on end-user performance, techno-exhaustion, and physiological arousal contains further implication, which are described below.

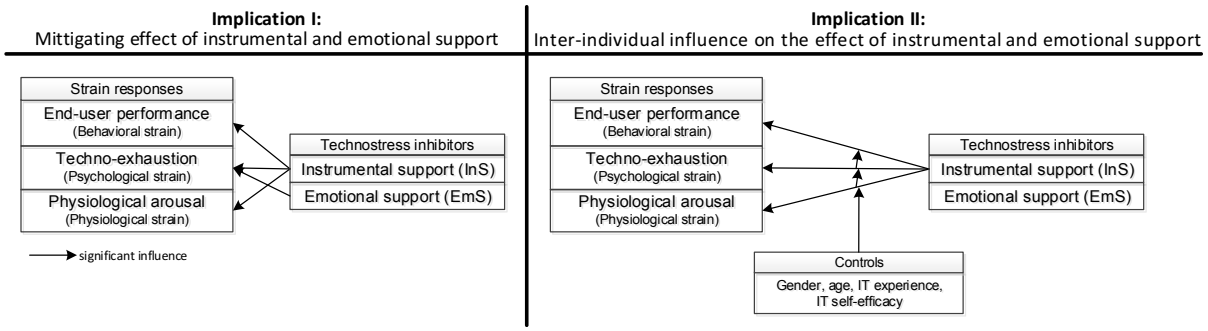

Figure 5: Overview of theoretical implications

6.1.1 Social support increases end-user performance and decreases techno-exhaustion and physiological arousal

Regarding **end-user performance**, our results contribute to technostress literature such as Tarafdar et al. (2011), who show that technostress inhibitor as an aggregated factor increases end-user performance, by treating social support as an independent technostress inhibitor and by splitting it into instrumental and emotional support. In particular, the results show that instrumental support significantly increases end-user performance, whereas emotional support has no effect on end-user performance. In other words, providing warmth and understanding does not increase the performance of the user, whereas the provision of instrumental help increases the performance of the user struggling with unreliable IT. Our results indicate that a differentiation of technostress inhibitors is necessary. Also, the present study extends social support literature investigating traditional social support structures such as online support, help desk support, change management support and peer advice on job performance and reveals differences between the support structures (Sykes 2015) by focusing on different types of social support in terms of instrumental and emotional support. Particularly, our result shows besides the differences in the support structures that there are also differences between different types of social support. In other words, past literature shows that change management support and peer advice increases job performance. We extend these findings by demonstrating that the type of support (i.e., instrumental or emotional support) provided by peers or other persons is important. The results also extend the findings of previous literature which investigates the effect of giving and receiving advice on job performance (Sykes et al. 2014) by indicating the different effects of instrumental and emotional support. Furthermore, we extend investigations which examine the effect of different source of advice (i.e., friends, acquaintances) on deep structure use and job performance (Sykes and Venkatesh 2017) by demonstrating that different effects exist among the two types of social support.

By focusing on **techno-exhaustion**, the present research contributes to technostress literature such as Ragu-Nathan et al. (2008), Tarafdar et al. (2011), and Fuglseth and Sørebø (2014), who demonstrate that technostress inhibitors positively influence psychological strain in terms of satisfaction by focusing on one technostress inhibitor rather than aggregating multiple inhibitors and by focusing specifically on two types of social support: instrumental and emotional support. In particular, we show that instrumental and emotional support significantly reduce techno-exhaustion. Warmth and understanding, as well as help, reduce the perception of tiredness and fatigue while struggling with unreliable IT. Also, our results extend previous research (e.g., Tarafdar et al. 2010) that shows that innovation support increases psychological strain in terms of end-user satisfaction by considering two types of social support (instrumental and emotional support) and demonstrating that both influence psychological strain. Literature which investigates traditional social support structures such as online support, help desk support, change management support, and peer advice on psychological strain such as exhaustion (Sykes 2015) is advised to focus on the different types of social support. To reduce psychological strain, future research might not only focus on the structure of social support such as online support or help desk support but also on the type of the support provided, such as instrumental or emotional support.

With respect to **physiological arousal**, some investigations show that the perception of techno-stressors leads to physiological strain (Galluch et al. 2015; Riedl et al. 2012, 2013; Riedl 2013). However, only a few

have focused on technostress inhibitors such as social support (Weiss 1983). The present study contributes to technostress literature such as Riedl et al. (2012; 2013) by showing that the physiological arousal caused by a computer freeze can be reduced most by providing instrumental support. Furthermore, we extend the findings of Galluch et al. (2015), who demonstrate that method and resource control moderates the relationship between techno-stressors and physiological strain, by demonstrating that social support directly reduces physiological strain. Moreover, by distinguishing between instrumental support and emotional support, we are able to show that physiological strain is significantly influenced by instrumental support, whereas emotional support has no direct effect on it. Also, the finding extends an early study by Weiss et al. (1983), who investigated the effect of social support on physiological strain, by distinguishing between two types of social support: instrumental and emotional support. Specifically, the results indicate that only instrumental support reduces physiological strain.

In summary, our findings contribute to technostress research by focusing on one technostress inhibitor and revealing differences between instrumental and emotional support (see Figure 5, implication I). We show that future research should treat technostress inhibitors independently rather than aggregating them. Also, the study extends the literature by indicating that in addition to support structures and the source of social support, there are also differences between the types of social support. Future research should account for this and consider the effect of structure, source, and type of social support on end-user performance, techno-exhaustion, and physiological arousal.

6.1.2 Inter-individual influence on instrumental and emotional support

Several previous investigations consider the direct effect of individual differences on strain responses, showing that men perceive techno-stressors stronger than women and that older individuals with more education and computer confidence perceive techno-stressors less than younger individuals with less education (Ragu-Nathan et al. 2008; Riedl et al. 2013). However, none of the studies considering technostress inhibitors investigated the effect of inter-individual differences in the relation between technostress inhibitors on strain responses. Regarding social support, the literature suggests that there are differences between men and women (Cohen and Wills 1985; Taylor 2011).

The present paper extends past technostress literature examining the effect of technostress inhibitors either on the techno-stressor or on strain responses (e.g., Fuglseth and Sørebø 2014; Ragu-Nathan et al. 2008; Tarafdar et al. 2014) by investigating the moderation effects of individual differences on the relationship between the technostress inhibitor social support and strain responses (see Figure 5, implication II). Our results show that individual differences only moderates the effect of social support on techno-exhaustion and physiological arousal. The effect of social support on techno-exhaustion is moderated by *IT experience*, such that highly experienced users should receive instrumental support and less experienced users should receive emotional support.

The effect of social support on physiological arousal is moderated by *gender, age, IT experience, and IT-efficacy*. Regarding gender, our findings align well with previous research results (Cohen and Wills 1985). As in previous studies (Cohen and Wills 1985), our results indicate that men should receive instrumental rather than emotional support to reduce physiological arousal. In particular, men who receive emotional support are more physiologically aroused than men who receive no social support. This is in line with other research revealing that gender influences user behavior (Venkatesh and Morris 2000).

Our results indicate that it is not always beneficial to provide social support to reduce strain responses. The decision whether to provide social support should be made based on the level of IT experience and self-efficacy because providing inappropriate support might cause more strain in certain users than providing no social support. For example, individuals with high self-efficacy who receive emotional support are more physiological aroused than individuals who receive no social support.

In summary, as most of technostress research considers technostress inhibitors as an aggregated construct

and the present study distinguishes between two types of social support, instrumental support, and emotional support, and compares their effect, we contribute to technostress literature by showing differences between the effect of instrumental and emotional support on the strain responses. Furthermore, most technostress literature which encompasses technostress inhibitors neglects the moderation effect of individual differences. We extend these past examinations by indicating that the effect of social support on psychological and physiological strain is moderated by individual differences (see Table 5 Implication II). For example, our results show that the appropriateness of providing instrumental or emotional support is moderated by gender, age, IT experience, and IT self-efficacy such that an inappropriate provision of social support can lead to higher psychological and physiological strain levels.

6.2 Practical Contributions

The implications of social support research for practice are substantial. The consequences of techno-stressors have significant costs for organizations, so examining the extent to which social support could reduce these costs is highly relevant to practitioners (Tarafdar et al. 2015a).

This study shows that social support mitigates techno-exhaustion and physiological arousal and increases end-user performance. Specifically, we show that instrumental support is generally more efficient than emotional support in terms of increasing end-user performance and reducing psychological and physiological strain. Our findings indicate that organizations striving to increase end-user performance and alleviate technology-induced psychological and physiological strain should consider improving their help desk services and providing group support to ensure that the support provided is solution-oriented and avoids delays in solving the problem. Based on our results, managers should establish standardized processes which prescribe contacting technical support when an IT problem is experienced rather than asking for understanding and emotional support from colleagues. Turning to colleagues for emotional support not only prevents them from focusing on their task, but the emotional support received is less effective in improving performance levels than solution-oriented support in resolving the problem. The key variable here is not individual social support, but rather receiving instrumental support in solving the root problem instead of receiving emotional understanding from others.

Also, our results show that the effect of social support on techno-exhaustion and physiological arousal is influenced by individual factors such as gender, age, IT experience, and IT self-efficacy. Organizations should be careful when providing instrumental or emotional support because the effect of providing social support depends on individual differences. For example, individuals with high IT self-efficacy who receive emotional support are more physiological aroused than individuals who receive no social support. Hence, organizations should ensure that the support provided by the help desk varies depending on personal factors such as gender, age, IT experience, or IT self-efficacy.

Furthermore, our findings on how instrumental support and emotional support influence techno-exhaustion, physiological arousal and end-user performance are also necessary for effective computing. There are some indications that practitioners are striving to build information systems which automatically identify strain responses towards a techno-stressor (Adams et al. 2014; Riedl et al. 2012), for example, based on biological states such as skin conductance, to reduce the negative consequences of techno-stressors. Consequently, understanding the differences between instrumental support and emotional support and their effect on techno-exhaustion, end-user performance, and especially physiological arousal may contribute to the development of an “intelligent” system which automatically mitigates techno-exhaustion and physiological arousal and increases end-user performance (Fernando et al. 2012).

7 LIMITATIONS AND FUTURE RESEARCH

The present research is limited in several ways. First, our experimental design only considers one techno-stressor associated with IT malfunctions, techno-unreliability, which lowers the generalizability and transferability of the results to other techno-stressors such as organizational techno-stressors investigated by prior literature (Ayyagari et al. 2011; Maier et al. 2015c; Tarafdar et al. 2010; see also Appendix Table 11). Second, our experimental design is limited in its ability to create a typical work environment, such as pressure, multitasking, and interruptions. This was necessary because we wanted to focus on only one stimulus caused by the technology. Future research might investigate the effect of different technical and organizational techno-stressors on strain responses. Regarding social support, in line with past literature (Beaudry and Pinsonneault 2010), we only consider instrumental and emotional support and neglect information support and companionship. Future research might consider the effect of all types of social support on strain responses.

Also, the facilitator was present during the whole experiment to provide support to the subject. It is possible that the presence of the facilitator during the experimental phase influenced the social support abilities or the SC of the subjects. The majority within our sample are students. However, as the students participating at the experiment are well-educated concerning the use of IT and have or will use MS SharePoint in future, it is a realistic research sample and appropriated for the present study (Compeau et al. 2012).

Furthermore, we focused on a specific technology and did not consider a diversity of technology uses. The effects of instrumental support and emotional support should also be investigated with other technologies, including mandatory and voluntary technologies, and the effects of social support when using these various types of technology should be compared. In addition, as strain reduces IS usage intention (Maier et al. 2015c; Williams et al. 2009) future research might examine the effect of social support on this relationship.

With regard to the strain response measurement, we only used one objective measurement, so the results are biased by mono-operationalization (Dimoka et al. 2012). Our investigation does not consider the phenomenon of eustress such that the increasing effect of techno-stressors and the resulting U-shaped response of performance or arousal are not considered. As there is a disagreement in psychological literature about whether psychological and physiological strain influences each other (Hellhammer and Schubert 2012), the present research does not investigate the influences of these strain responses. Hence, future research should focus on the interplay between behavioral, psychological and physiological strain in a situation while working with unreliable IT.

8 CONCLUSION

The present research examines how technostress inhibitors reduce behavioral, psychological and physiological strain responses caused by techno-stressors. We concentrate on one precise technostress inhibitor, social support, and distinguish between two types of social support, instrumental and emotional support. Our results show that social support significantly influences all three strain responses. Furthermore, our findings identify differences between instrumental support and emotional support, indicating that instrumental support is more efficient than emotional support in counteracting the three strain responses. Moreover, we shed light on the effect of instrumental support and emotional support on strain responses by investigating the moderation effect of several individual factors.

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10 APPENDIX

10.1 OVERVIEW OF TECHNO-STRESSORS

Table 11: Overview of techno-stressors and their effects

Authors (ordered by years)	Techno-stressors	Type of techno-stressor	Dependent variables
Tarafdar et al. (2007)	Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Associated with organizational IT usage	Productivity, role stress (role conflict, role overload)
Ragu-Nathan et al. (2008)	Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Associated with organizational IT usage	Job satisfaction, organizational commitment continuance commitment
Tarafdar et al. (2010)	Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Associated with organizational IT usage	End-user satisfaction, end-user performance
Tarafdar et al. (2011)	Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Associated with organizational IT usage	Job satisfaction, organizational commitment, role conflict, role overload, employee innovation, employee productivity, end-user satisfaction
Ayyagari et al. (2011)	Work-home conflict, invasion of privacy, work overload, role ambiguity, job insecurity	Associated with organizational IT usage	Emotional exhaustion
Riedl et al (2012)	System breakdown	Associated with IT malfunctions	Physiological strain (cortisol)
Riedl et al. (2013)	System breakdown	Associated with IT malfunctions	Physiological strain (skin conductance)
Tarafdar et al. (2014)	Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Associated with organizational IT usage	Sales performance, technology enabled innovation
Fuglseth and Sørebø (2014)	Techno-stressors$_1$ (techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty)	Associated with organizational IT usage	Satisfaction with IT use, intention to extend the use of IT
Maier et al. (2014a)	Social Overload	Associated with private IT usage	SNS exhaustion, SNS satisfaction, SNS discontinuous usage intention
Maier et al. (2015c)	SNS-stress creators$_1$ (complexity, uncertainty, invasion, disclosure, pattern, social overload) Switching-stress creators$_1$ (transition costs, sunk costs, replacement overload)	Associated with private IT usage	SNS exhaustion, Switching exhaustion, Discontinuous usage intention, discontinuous usage behavior
Note: 1 = second order construct			

10.2 MEASUREMENT ITEMS

Table 12: Measurement items

Constructs	Items	References
IT-experience	I can explain…how an e-mail works.	(Potosky and Bobko 1998) 5-point Likert (very bad to very good)
	I can explain…how an operating system works.	
	I can explain…how a databases works.	
	I can explain…how a local area network works.	
	I can explain…how a computer works.	
IT self-efficacy	I have the ability to install new software applications on a computer.	(Marakas et al. 2007) 5-point Likert (very bad to very good)
	I have the ability to set up a new computer.	
	I have the ability to remove information from a computer that I no longer need.	
	I have the ability to use a computer to display or present information in a desired manner.	
Techno-unreliability	The performance and functionalities of the IT during the experiment was dependable.*	(Ayyagari et al. 2011) 5-point Likert (strongly agree to strongly disagree)
	The capability of the IT during the experiment was reliable.*	
	IT was free from software errors, quality problems and technical failures.*	
Threat appraisal	The computer freeze threatened the successful processing of the tasks.	(Liang and Xue 2010) 5-point Likert (strongly disagree to strongly agree)
	Problem caused by the computer freeze threatened the successful processing of the task.	
	The successful processing of the tasks was uncertain because of the freezing.	
Support for instrumental reasons	I asked the instructor for help with the frozen computer.	(Carver et al. 1989) 5-point Likert (strongly disagree to strongly agree)
	I got advice from the instructor what to do about the frozen computer.	
	I talked to the instructor, who was able do something about the frozen computer.	
Social support for emotional reasons	I discussed my feelings about the frozen computer with the instructor.	(Carver et al. 1989) 5-point Likert (strongly disagree to strongly agree)
	I got sympathy and understanding for the situation in which the computer froze from instructor.	
Techno-exhaustion	I feel drained because of the IT usage during the experiment.	(Ayyagari et al. 2011) 5-point Likert (strongly disagree to strongly agree)
	I feel tired because of the IT usage during the experiment.	
	During the experiment, working with IT was a burden for me.	
	I feel burned out by working with the IT during the experiment.	
Note: All other items are objectively measured; * Items are reverse coded		

10.3 PILOT TEST

A pilot test was conducted to identify the critical items of the manipulation, to make sure that the tasks were understandable even for subjects who have not used the ECM system before, and to clarify how the social support mechanisms could be provided properly. Furthermore, it was used to ensure that all measuring instruments could be installed in time and to test the whole experimental procedure. The pilot test was conducted using five subjects drawn from the same population as the subjects from the following experiment, and who had been interviewed subsequently. The manipulation time was increased from 30 seconds to 1 minute, because some subjects sought help after only 25 seconds, so the manipulation was almost over before the participants started to cope. Additionally, three out of five subjects were not able to solve task four, so we created an easier task. The whole worksheet with all the tasks was also substituted by single worksheets for each task so that the subjects were not able to see all the tasks at the beginning of the experiment and had to follow the correct order of the tasks. The behavior of the facilitator responding to EFC efforts was changed, so the facilitator offered general sympathy and understanding regarding the situation. In general, various responses and questions from the subjects led us to limit the behavior of the facilitator more strictly to ensure that all subjects were treated equally. Also, the point in time when the measurement items were attached was changed to avoid irritating the subjects during the experiment. The pre-test also showed that we needed to control external factors, so all cell phones were turned off, all windows were closed, and nobody was permitted to enter the room during the experiment.

4. Chapter
Longitudinal approach of coping with the dark side of IT use

Paper X

HOW DOES PERFORMANCE CHANGE WHEN USERS ENCOUNTER REPEATED IT EVENTS?

AN INVESTIGATION OF HABITUATION AND SENSITIZATION OF AROUSAL, EXHAUSTION, AND TASK PERFORMANCE

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How Does Performance Change when Users Encounter Repeated IT Events?

An Investigation of Habituation and Sensitisation of Arousal, Exhaustion, and Task Performance

Abstract

Past literature shows that task performance decreases due to encounters with single IT events and the resulting user responses. However, users do not encounter a single IT event only once; instead, they encounter an IT event repeatedly over time. For example, the literature indicates that IT events such as computer breakdowns occur not just once, but with a probability of 1 chance in 3.3 they will occur a second time. The dual-process theory demonstrates that individuals show two different response patterns when encountering a repeated stimulus: one decremental, called habituation; and one incremental, called sensitisation. The present paper aims to investigate how a repeated IT event and its resulting user responses influence task performance over time, either improving or worsening it. A multivariate latent growth model (LGM) was developed, which considers the time-dependent effect of physiological and psychological responses on task performance when encountering repeated IT events. A laboratory experiment with 100 subjects was performed using a multiple-method approach in which four different methodologies were used to validate the research model. The findings contribute to the literature by revealing user responses regarding a repeated IT event; identifying the relationship of habituation and sensitisation to task performance; and demonstrating that the effects of habituated and sensitised user responses predict task performance.

Keywords: Habituation, Sensitisation, Dual process theory, IT event, Task performance, Skin conductance, Continuance state sampling

1 Introduction

Technology users spend 28% of their workday on information technology (IT) events, such as IT-related interruptions that might lead to lower task performance. Users need approximately 20 minutes to continue with their original task after an interruption (Mark et al. 2008; Spira and Feintuch 2005).

Task performance is one of the primary outcomes of information system (IS) use and has been a long-standing phenomenon of interest in IS research (DeLone and McLean 1992, 2003; Goodhue and Thompson 1995). From a theoretical perspective, the literature shows that task performance decreases due to an encounter with a single IT event and the resulting user responses (e.g., Addas and Pinsonneault 2018; Ortiz de Guinea and Webster 2013; Tams et al. 2014). In particular, studies demonstrate that single IT events, such as computer breakdowns, interrupt user work environment (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005; Ortiz de Guinea and Webster 2013). The experience of such isolated IT events engenders a wide range of user responses (e.g., physiological, psychological) and reduces task performance (e.g., Addas and Pinsonneault 2018; Ortiz de Guinea and Webster 2013; Tams et al. 2014).

However, users are not interrupted only once by single IT events; rather, users encounter repeated interruptions, and frequently by the same event. For example, the literature indicates that IT events such as computer breakdowns occur more than once. Computer systems that have crashed once have a probability of 1 chance in 3.3 of crashing a second time (Nightingale et al. 2011). Hence, not only do users encounter IT events not once but repeatedly; user responses and their influence on task performance also change with each repetition. The dual-process theory (Groves and Thompson 1970) demonstrates that individuals show two

different response patterns while encountering a repeated stimulus, such as a repeated computer breakdown. One decremental pattern, called habituation,[36] means that the responses decrease with each encounter; the other pattern is incremental, called sensitisation, means that the response increases with each encounter (Groves and Thompson 1970). Previous approaches have not captured the dynamic development of the trajectory of task performance resulting from repeated encounters with an IT event and the resulting user responses. In particular, most previous IS literature concerning IT events concentrates only on the single encounter (e.g., Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005; Bhattacherjee et al. 2017; Ortiz de Guinea and Webster 2013) and neglects the more realistic situation in which an IT event occurs not only once, but might arise several times in a row. The extent of the consequences of repeated IT events might be immense for organisations, because user responses and task performance change for better or worse with each repetition. This leads to articulating the research question prompting the present study:

How do a repeated IT event and ensuing user responses influence users' task performance over time?

Providing an answer to that question builds upon the dual-process theory and assumes that users also experience habituation or sensitisation from encounters with a repeated IT event. Thereby, the authors theorize that the encounter with a repeated IT event results in decreasing physiological arousal because users become habituated to its occurrence; whereas psychological exhaustion increases because a repeated IT event sensitises users. Moreover, task performance improves as users habituate to a repeated IT event, and thus user responses of habituation and sensitisation can predict changes in task performance.

The authors conducted a laboratory experiment with 100 subjects, using a multiple-method approach by implementing four different methodologies to validate the research model. The data was analysed by making a longitudinal examination of the trajectories of user physiological arousal, psychological exhaustion, and task performance in response to encountering a repeated IT event. The study contributes to the literature by revealing user responses to a repeated IT event, identifying habituation and sensitisation effects on user responses and task performance, and demonstrating that the effects of habituated and sensitised user responses predict task performance.

The remainder of this paper is structured as follows. The theoretical background encompasses the related work on performance, single IT events, and responses. The dual-process theory is explained, and the research gap addressed by this paper is demonstrated. Then, a research model is developed, and the methodology, data analysis, and results are presented. Finally, a discussion section is reserved for showing the theoretical and practical contributions of this research and future research possibilities.

2 THEORETICAL

This section provides an overview of literature focusing on user encounters with single IT events, resulting responses, and effects on performance. The dual-process theory and a brief overview of the IS literature applying it are reviewed. Finally, the current research gap is described, prior to demonstrating how this research addresses it.

2.1 PERFORMANCE, SINGLE IT EVENTS, AND RESPONSES

Past literature indicates that the perception of a single discrepant IT event[37] (hereafter "single IT event") and resulting responses reduce task performance. IT events occur when technology does not behave as expected, or when a user is unable to use the technology appropriately on a work-related task (Ortiz de Guinea 2016; Ortiz de Guinea and Webster 2013). Single IT events involve a problem, a misunderstanding,

[36] Anderson et al. (2016) note that despite the same Latin root, the construct of habituation differs from the construct of habit. Habit is defined as "learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or endstates" (Verplanken and Aarts 1999, p. 104). In contrast, habituation is defined as a "response decrement that results from repeated stimulation" (Rankin et al. 2009, p. 136). Thus, the former refers to an automatic behaviour, whereas the latter is non-associated learning where responses are reduced in reaction to repeated stimulus.

[37] Different types of IT events exist. Besides the discrepant IT event investigated in this paper, there are also expected IT events that are ordinary events characterized by a match between the expectations of the user and the performance of the IT, as well as discovery IT events that are unexpected positive events characterized by the discovery of new functionality of the technology (Ortiz de Guinea and Webster 2013).

or a difficulty with the IT in use—e.g., computer breakdowns (Ortiz de Guinea 2016; Ortiz de Guinea and Webster 2013). Much of the examination investigating the effect of single IT events on task performance considers only the single encounter and neglects cases of repeated IT events.

The literature shows that users in these single-event situations perform different adaptation mechanisms that encompass behavioural and emotional responses. An evaluation of the single IT event requiring management should lead to higher individual performance (Beaudry and Pinsonneault 2005). In the same vein, models of technology adaptation behaviours (Bala and Venkatesh 2015) demonstrate that users perform different technology-adaptation behaviours in response to single IT events, which in turn influence job performance. Ortiz de Guinea and Webster (2013) demonstrate that short-term task performance is indirectly influenced by a single IT event. Users respond psychologically in terms of computer-related thoughts and emotions, and physiologically in terms of arousal, both of which affect task performance. In the context of technostress, research demonstrates that the perception of single IT events (e.g., technostressors) reduce productivity (Tarafdar et al. 2007) and sales performance (Tarafdar et al. 2014). Research on email demonstrates that interruptions containing information irrelevant to the task indirectly reduce task performance, whereas interruptions containing relevant information have an indirect positive effect (Addas and Pinsonneault 2018). Other examinations show that physiological and psychological responses to any stimulus negatively influence task performance (e.g., Chilton et al. 2005), and Tams et al. (2014) focus on reduced task performance following physiological and psychological responses to interruptions.

In sum, past literature investigates only single IT events that involve a problem or difficulties with the IT in use, and shows that users respond multifariously to single IT events (e.g., users respond psychologically in terms of emotions, physiologically in terms of arousal), thus influencing task performance.

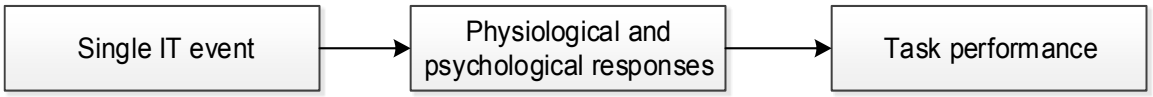

Figure 1: Single IT event – response – task performance

2.2 DUAL-PROCESS THEORY

The dual-process theory (Groves and Thompson 1970) claims that individuals show two different patterns of response to a repeated stimulus: a decremental response called *habituation* and an incremental response called sensitisation (Epstein et al. 2009; Groves and Thompson 1970). Habituation and sensitisation are inferred constructs, the simplest forms of learning. Explanation of both response patterns and a brief overview of IS literature applying the theory follow.

Habituation is defined as a *"response decrement that results from repeated stimulation"* (Rankin et al. 2009, p. 136). It is a learning behaviour that decreases a response resulting from a repeated stimulus (Thompson and Spencer 1966). In other words, habituation allows humans to filter out irrelevant stimuli and focus on important ones (Rankin et al. 2009). It occurs when a stimulus is repeated following the initial response to a novel stimulus. When the same stimulus is repeatedly presented, the individual's response decreases as the user becomes habituated to it (Grissom and Bhatnagar 2009; Thompson and Spencer 1966). Habituation develops in the stimulus-response (S-R) neural pathway (Thompson 2009). When a stimulus is repeatedly perceived, the nervous system creates a model of the expected stimulus and compares further presentations of the stimulus to the model. If the stimulus complies with the model, then the responses decrease (Sokolov 1963).

Sensitisation is a response increment that results from repeated stimulation (Groves and Thompson 1970). Sensitisation develops in a separate-state system and not in the S-R neural pathway (Thompson 2009). Individuals are sensitised to a stimulus whether the stimulus is perceived as a positive value or as a strong or aversive stimulus (Hinde 1966). The encounter with a stimulus might lead to perception of greater vulnerability, and hence to an increase in responses (Garbarino 2008). Prime examples are hospitalization or

vaccination, to which responses (e.g., anxiety) increase with each encounter because the first encounter sensitises one to future vulnerability.

Application of the Dual-Process Theory in IS Literature. The dual-process theory has been applied in two main research streams within IS research, namely, online marketing and security. In the context of online marketing, Sun et al. (2013) propose that in banner processing, the influences of structural and semantic salience of attention is moderated by the habituation level. Furthermore, they claim that behavioural frequency, structural stability, and semantic stability depict antecedents of the habituation level. In addition, management literature indicates that the willingness to pay for goods involves the impact of repeated consumption and variations in habituation and sensitisation patterns (Wathieu 2004). In the context of security, a current literature review emphasizes the investigation of habituation by using methods from the field of NeuroIS (Anderson et al. 2016b). Several recent investigations concentrate on habituation and sensitisation. Results demonstrate that users are not necessarily lazy regarding security messages, but rather become habituated to them (Anderson et al. 2014; Anderson et al. 2016a). Habituation to security messages has been proved by using functional magnetic resonance imaging (fMRI) and mouse movement technique. Previous literature differentiates between static and polymorphic warnings that change appearance, revealing that polymorphic warnings evoke sensitisation patterns (Anderson et al. 2016c). In addition, these effects also have been confirmed in a longitudinal laboratory, as well as in a field experiment. Findings based on fMRI and eye-tracking demonstrate that users habituate to security warnings over a five-day work week. Moreover, they also display a partial recovery between workdays. The polymorphic warnings also show a sensitisation pattern over a period of three weeks (Vance et al. 2017; Vance et al. 2018).

Taking together, according to the dual-process theory, two different response patterns to a repeated stimulus—namely habituation and sensitisation—occur in the context of banner ads and security massages, studies of which appear in the IS literature and demonstrate both response patterns.

2.3 RESEARCH GAP

Encounters with single IT events influence resulting user responses, and therefore task performance. However, users rarely encounter only a single IT event and will more likely encounter the IT event repeatedly. For example, systems that have broken down once have a high likelihood of breaking down a second time (Nightingale et al. 2011). Past literature focuses on the encounter with a single IT event, neglecting to address how users respond and behave toward encounters with a repeated IT event, and how such responses and their effects on task performance change as the number of encounters increases.

In the context of repeated stimuli, previous literature based on the dual-process theory (Groves and Thompson 1970) indicates a two-response pattern, comprising habituation (i.e., decrementing responses to each encounter) and sensitisation (i.e., incrementing responses to each encounter). The dimensions of the consequences of a repeated IT event might be immense for organisations, because user responses and task performance change for either better or worse with each repetition. Hence, the present paper concentrates on the encounter with a repeated IT event and theorizes that users show habituation as well as sensitisation patterns of response, which in turn affect task performance.

Past literature demonstrates that single IT events lead to multifarious responses, such as physiological arousal (Ortiz de Guinea and Webster 2013; Riedl et al. 2012, 2013). The present paper focuses on **physiological arousal** (i.e., bodily responses to stimuli such as cardiovascular, biochemical and gastrointestinal symptoms) (Cooper et al. 2001), the subject of previous investigations (Chilton et al. 2005; Ortiz de Guinea and Webster 2013; Riedl et al. 2012; Riedl 2013; Tams et al. 2014). Previous literature also addresses psychological responses to single IT events in terms of emotional responses (Beaudry and Pinsonneault 2010; Ortiz de Guinea and Webster 2013; Stein et al. 2015). This paper concentrates on **psychological exhaustion**, understood as emotional reactions to the encountered stimuli (Ayyagari et al. 2011; Maier et al. 2015a), and defined as the feeling of tension and depletion of one's emotional resources (Maslach et al. 2001; Moore 2000). In the context of IT events, the literature concentrates on impact on task

performance (Addas and Pinsonneault 2018; Ortiz de Guinea and Webster 2013; Tams et al. 2014; Tarafdar et al. 2014). Hence, the present research focuses on **task performance** as an outcome variable. In IS research, task performance has been intensively examined as an outcome over the last decades (e.g., Avital and Te'eni 2009; Dennis et al. 2001; Serrano and Karahanna 2016). Task performance studies consider behaviours fulfilled to complete a job (Meister 1986). According to the literature (Ortiz de Guinea and Webster 2013), task performance understood as outcomes is measured in terms of effectiveness (Campbell 1990; Sonnentag and Frese 2005). In other words, performance is the extent to which the results of the task meet the goals of the task (Campbell 1990). Following this definition emphasises the short-term character of task performance, which the research also stresses (Burton-Jones and Straub 2006). Consequently, focusing on short-term task performance encompasses the effectiveness of an immediately performed task, and neglects long-term performance over a more extended working phase (e.g., day, week). The relation between repeated IT events, responses, and task performance is shown in Figure 2.

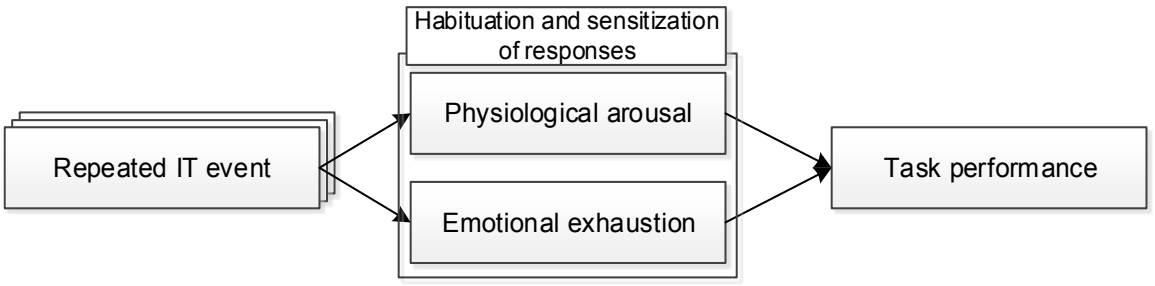

Figure 2: Focus of the present research

3 MODEL DEVELOPMENT

Based on the dual process theory, the development of this study's hypotheses focuses on response habituation and sensitisation to encounters with a repeated IT event. The development of this study's research model theorizes habituation effects on responses of physiological arousal and sensitisation effects on responses of psychological exhaustion. Second, the effect of a repeated IT event on behaviour in terms of task performance is assumed and defined. Third, the influences of habituated responses of physiological arousal and sensitised responses of psychological exhaustion on task performance are highlighted. The research model is shown in Figure 3.

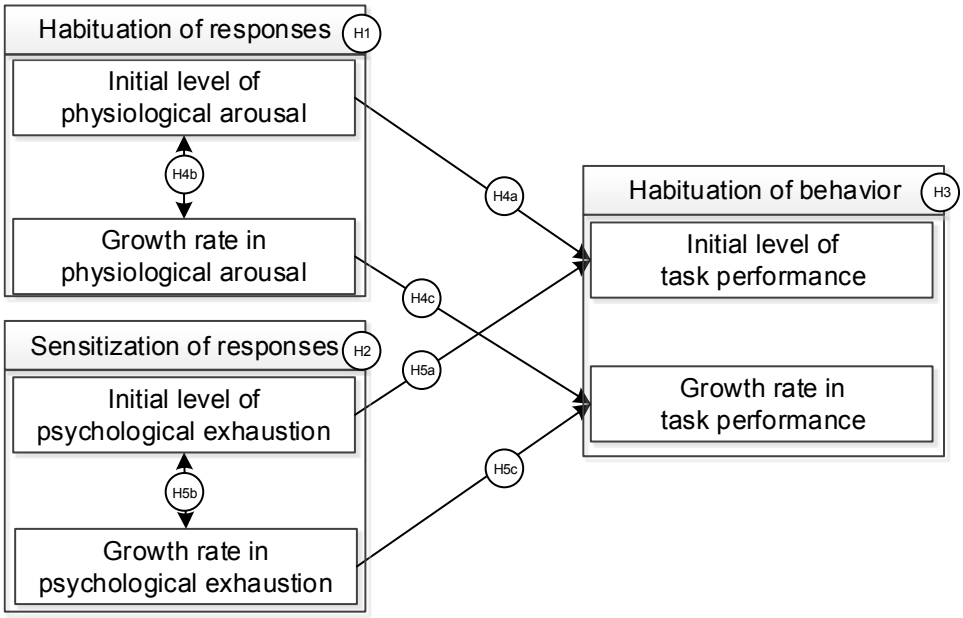

Figure 3: Research model

3.1 Habituation of Physiological Arousal to a Repeated IT Event Encounter

IS literature indicates that single IT events (e.g., computer breakdowns) lead to physiological arousal such as high skin conductance, increased cortisol levels or elevated heart rate (Ortiz de Guinea and Webster 2013; Riedl et al. 2012, 2013). However, in response to a repeated IT event, habituation theory assumes that physiological responses such as pupillary responses, sweating or hormonal reactions undergo habituation. More specifically, cellular or molecular responses or neuronal activity are subject to habituation (Rankin et al. 2009). Results show that a "given stimulus elicits an HPA [hypothalamic-pituitary-adrenal] response, repeated exposure to that stimulus will elicit a progressively reduced response" (Grissom and Bhatnagar 2009, p. 4). Several examinations show the habituation of physiological responses, such as the arousal level when giving repeated speeches (Eckman and Shean 1997). In this context, past literature also demonstrates that physiological responses (e.g., fMRI, eye tracking) habituate to a repeated stimulus such as security warnings (Anderson et al. 2016c; Vance et al. 2014; Vance et al. 2018). Based on the dual-process theory and past literature, physiological arousal in response to a repeated IT event is thought to decrease because users filter out irrelevant IT events and focus on important ones (Rankin et al. 2009). The nervous system creates a model of the IT event to remember, comparing further presentations of the repeated IT event to the model, and if the repeated IT event corresponds with the model, then physiological arousal decreases (Sokolov 1963). Imagine a situation in which the computer breaks down six times in a row and your physiological arousal might be reduced by each repeated computer breakdown because you get used to the situation. This leads to the first hypothesis:

> *H1: Through encounters with a repeated IT event, users habituate such that their physiological arousal responses decrease over time, reflected by a falling growth rate.*

3.2 Sensitisation of Psychological Exhaustion to a Repeated IT Event Encounter

Past literature indicates that single IT events result in a psychological response of emotional exhaustion (Boucsein and Thum 1995, 1997). In addition, research suggests that single IT events (e.g., interruptions) are associated with increased emotional and cognitive load (Addas and Pinsonneault 2018). However, single IT events (hence, first encounters) do not lead to immunity to future responses (Garbarino 2008) of emotional exhaustion. The encounter with a stimulus such as a repeated IT event might lead to perception of greater vulnerability, and hence to an increase in responses (Garbarino 2008). In the context of the dual-process

theory, the effect is sensitisation (Groves and Thompson 1970), by which the brain begins to adapt to the process of repeated stimuli (i.e., a repeated IT event) in a way that makes it increasingly vulnerable to the repeated IT event (Garbarino 2008). Emotional exhaustion is associated with significant illnesses such as burnout (Maslach et al. 2001; Moore 2000). Users feel drained and tired while using the IT (Ayyagari et al. 2011; Moore 2000). Hence, it is believed that emotional exhaustion increases with each encounter with the IT event because each encounter sensitises users to their vulnerability. A computer breakdown that occurs six times in a row might well led to increasing emotional exhaustion with each repeated breakdown, since each encounter reduces emotional resources and the user feels tired and exhausted. This leads to the second hypothesis:

H2: Through the encounter with a repeated IT event, users are sensitised such that responses of psychological exhaustion increase over time, reflected by a rising growth rate.

3.3 Habituation of Task Performance to a Repeated IT Event Encounter

Past literature indicates that a single IT event leads to a deterioration of task performance (Ortiz de Guinea and Webster 2013; Tarafdar et al. 2010; Tarafdar et al. 2014). In general, performance literature (Addas and Pinsonneault 2018) indicates that users who are interrupted (e.g., encounter with a single IT event) will likely show decreased performance, reflected in higher error rates (Basoglu et al. 2009), lower memory accuracy (Dodhia and Dismukes 2009), lower output quality (Gupta et al. 2013), longer primary task resumption lags and longer task completion times (Bailey and Konstan 2006). However, the psychological literature demonstrates that task performance measured by reaction times is better after repeat encounters with a specific event, compared with a single encounter with the event (Rodriguez Merzagora et al. 2014). One rationale might be the habituation of the user to the repeated events, as habituation also has a behavioural effect and repeated stimuli lead to decremented behavioural outcomes (Vance et al. 2018). According to the dual-process theory, behavioural response decreases as a result of a repeated stimulus (Rankin et al. 2009). In particular, the habituation literature assumes that when a stimulus is repeatedly perceived, the nervous system creates a model of the expected repetition. Further presentations of the repeated event are compared to the model, and if the repeated event complies with the model, then the behavioural responses decrease (Sokolov 1963; Thompson 2009). Performance literature indicates a similar process by assuming that mental models guide users and reduce the error rate, as well as the effort and time required to complete the task, when information displays the user's mental model (Avital and Te'eni 2009). Based on this assumption, it is plausible to theorize that users habituate to the encounter with a repeated IT event by showing better performance with each encounter (i.e., decrease in the effect on task performance). For example, if computer breaks down six times in a row, task performance might decrease after the first encounter, but increase with repeated encounters. This leads to the third hypothesis:

H3: Through the encounter with a repeated IT event, users are habituated such that the effect on behaviour in terms of task performance reduces over time, reflected by a diminishing growth rate.

3.4 Predicting Task Performance due to Physiological Arousal

In the context of a repeated IT event, users with higher initial physiological arousal will show worse task performance (i.e., higher task-performance time). Several investigations indicate an adverse effect on task performance caused by physiological arousal (Chang et al. 2009; Chilton et al. 2005; Lang et al. 2007; Tams et al. 2014). Past literature indicates that single IT events, such as computer breakdowns, result in high physiological arousal (Ortiz de Guinea and Webster 2013; Riedl et al. 2012, 2013). The Yerkes and Dodson (1908) law of physiological arousal suggests that performance decreases when arousal is high (Kreutzer et al. 2011, p. 2737). In addition, attentional mechanisms can explain the influences of physiological arousal on task performance. For example, high arousal levels have been found to disrupt information processing (Sanbonmatsu and Kardes 1988). Increased arousal leads to a restriction of attention, inhibiting performance as attention concentrates on the stimulus, neglecting the task (Easterbrook 1959). In particular, the feedback from the autonomic nervous system activity is highly salient, thus competing with other cues for limited attentional capacity. The attentional demands of the internal cues that are characteristic of a high arousal state

leave less capacity available for performing tasks (Mandler 2003). Based on these findings, initial levels of task performance will be positively (worsened) influenced by initial levels of physiological arousal.

Habituation literature suggests that the initial response strength (e.g., physiological arousal level caused by single IT events) is directly related to stimulus strength (Thompson and Spencer 1966). In addition, one main characteristic of habituation is that the less intense the stimulus, such as a repeated IT event, the faster the behavioural response decrements (Rankin et al. 2009). Taken together, less intense repeated IT events lead to low initial responses and more rapid behaviour-response decrement. Hence, we assume that a user with low initial levels of physiological arousal will experience stronger decreases in the growth rate of physiological arousal due to a repeated IT event, compared to users with higher initial levels of physiological arousal.

Users showing a higher negative growth rate in physiological arousal due to a repeated IT event (hence, habituating faster to the repeated IT event) will also show faster improvement in task performance. Users with greater negative growth rate habituate faster to the repeated IT event and hence have a decremental level of physiological arousal that enables them to draw their attention to the task and have available capacity for work on the task. Consequently, the performance of users improves such that they display faster processing time. Hence, users who have a higher negative growth rate in physiological arousal due to the repeated encounters of an IT event will experience a higher negative growth rate in task performance. This leads to three aspects of the fourth hypothesis:

H4a: Users with higher initial physiological arousal will experience worse (higher) initial task performance than users with lower initial physiological arousal.

H4b: Users with lower initial physiological arousal will exhibit a faster growth in physiological arousal than users with higher initial physiological arousal.

H4c: Users with higher negative growth rate in physiological arousal will experience a faster increase in task performance than users with lower growth rate in physiological arousal.

3.5 Predicting Task Performance due to Psychological Exhaustion

Users with higher initial psychological exhaustion will show worse task performance (higher task performance time). Extant literature indicates that psychological exhaustion and performance are negatively correlated (Chilton et al. 2005; Cropanzano et al. 2003; Wright and Cropanzano 1998a). Users who are emotionally exhausted are tired and fatigued, such that they have fewer emotional resources (Maslach et al. 2001; Moore 2000) and are emotionally overextended and exhausted by work (Wright and Bonett 1997), which reduces task performance. Moreover, as emotional exhaustion is most likely to occur in situations where one's resources are inadequate to meet work demands (Hobfoll 1988), and when users have insufficient mental resources (Wilke et al. 1985), initial levels of task performance will be negatively influenced by initial levels of psychological exhaustion.

Emotional exhaustion sensitises the user to repeated IT events, supporting the assumption that. users with high initial psychological exhaustion (i.e., high exhaustion level from encounters with single IT events) will show a strong deterioration of task performance. Past literature indicates that sensitisation is related to strong and significant stimuli (Hinde 1966), represented in the first response of psychological exhaustion. The extent and duration of sensitisation are directly associated with stimulus intensity. To a greater extent, sensitisation is directly related to stimulus frequency. At low intensities, there may be little or no sensitisation (Groves and Thompson 1970). Hence, users with higher initial psychological exhaustion will show stronger deterioration (i.e., growth rate) in task performance over time, compared to users with lower initial levels of psychological exhaustion.

Users are sensitised by psychological exhaustion because it is related to a serious illness such as burnout (Maslach et al. 2001; Moore 2000; Wright and Bonett 1997; Wright and Cropanzano 1998b). The first encounter does not lead to immunity to future encounters (Garbarino 2008); instead, they sensitise the user

to future vulnerability (Groves and Thompson 1970). The brain begins to adapt to the process of repeated IT events in a way that makes it increasingly vulnerable to repetition (Garbarino 2008), costing more mental resources and causing user task performance to deteriorate. Hence, users who have a higher positive growth rate in psychological exhaustion due to repeated IT events will experience a higher positive growth rate of time on task performance (deterioration).

H5a: Users with higher initial psychological exhaustion will experience worse (higher) initial task performance than users with lower initial psychological exhaustion.

H5b: Users with higher initial psychological exhaustion will exhibit a faster growth in psychological exhaustion than users with lower initial psychological exhaustion.

H5c: Users with higher positive growth rate in psychological exhaustion will experience a greater increase (deterioration) in task performance than users with a lower growth rate in psychological exhaustion.

4 METHODOLOGY

This section first describes the study sample and experimental design encompassing the experimental task and the manipulation. Second, the multi-method approach is explained; finally, the experimental procedure is outlined.

4.1 STUDY SAMPLE

The participants were university students and staff members, and the laboratory study was conducted over a four-week period at the end of 2016. Overall, 107 participants for the laboratory study were recruited, and the answers of 7 participants were dropped because of problems with the objective measurement or inappropriate behaviour during the experiment. Table 1 shows the characteristics of the participants. The sample was almost split equally between men and women, and the majority of the participants were between 19 and 34 years old.

Table 1: Study participants

Demographics						
N	100		Apprenticeship	6.7	School student	1.0
Gender (%)	Men	51.0	Post-secondary education	33.7	University student	77.9
	Women	49.0	Undergraduate	37.5	Employees	21.2
Age (%)	<19	1.0	Graduate	19.3		
	19-24	21.0	Others	2.8		
	25-34	74.2				
	35-44	3.8				

4.2 EXPERIMENTAL DESIGN

The experiment followed a two-factorial subject-within design, encompassing the factors *IT event* (IT event, non-IT event) and *encounter* (no encounter to encounter 6). Following a subject-within design, all participants encounter all treatments. The experiment contained one control group and six treatments. During the first treatment, the participants do not perceive an IT event and consequently are not able to habituate to the IT event. This treatment is needed to capture a baseline in an unmanipulated situation. Six IT-event encounters follow, in which the subjects always encounter the same IT event (see section manipulation) to manipulate a repeated IT event. Table 2 summarizes the experimental design.

Table 2: Experimental design

		Encounter						
		No encounter	**Encounter 1**	**Encounter 2**	**Encounter 3**	**Encounter 4**	**Encounter 5**	**Encounter 6**
IT event	**IT event**		Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6
	Non-IT event	Baseline						

4.2.1 Tasks and technology used

To emulate a realistic organisational situation, an enterprise content management (ECM; Laumer et al. 2013) system such as MS SharePoint was used. In a text-based scenario, a participant slips into the role of an intern with several different tasks to complete for his supervisor, all solvable by using MS SharePoint. During the experiment, each participant must work on seven different tasks. All tasks were made simple to solve, to eliminate task complexity and to avoid the requirement of having any SharePoint experience. In addition, the tasks have the same approximate level of difficulty (see Table 3). In the scenario, the subjects must work on tasks such as the following example: The intern is asked to search for a contact person in the HR department within the system. In this case, the subjects must navigate from the main window to the correct list of employees and find the desired contact person in the HR department. Table 3 describes all experimental tasks.

Table 3: Description of the experimental tasks

#	Task description	Task difficulty
1	I need the item number of product “package A2” quickly. Please open MS-SharePoint and look for the information!	6.5
2	Mr. Fisher needs the telephone number of the customer “John Doe.” Please search for it on SharePoint.	6.5
3	I am looking for the name of the street in [Sampletown] at which the company [Samplecompany] is located. Please check it on SharePoint and let me know.	6.5
4	Can you tell me how many purchase orders customer K1001 has submitted?	6.4
5	There is a note with customer number K1018 on it. Can you tell me his name?	6.4
6	I am preparing the payroll, but I cannot log into the system, unfortunately. Would you be so kind and tell me the name of the employee M100?	6.3
7	I am generating a project overview. Can you tell me how many projects the employee M100 is assigned to? I just want to double-check.	6.1
Note: easy (7) to difficult (1); items are presented in Appendix B		

4.2.2 Manipulation: repeated IT event

A computer breakdown was chosen to function as the repeated IT event (Riedl et al. 2012), and researchers simulated a 20-second system freeze during which input by mouse or keyboard was impossible. This freeze could be remotely activated by the facilitator. Appendix B shows the experimental setting, indicating that the facilitator and the subject were sitting in the same room, separated by a partition wall such that mirrored screens enabled the facilitator to follow the activity of the subject. To manipulate the repetition level, the subjects were exposed repeatedly to the same stimulus—computer breakdown—as in prior investigations (e.g., Rankin et al. 2009), while trying to keep the working environment stable. Subjects were exposed to the IT event six times, an appropriate number of stimuli to examine habituation and sensitisation, for which Dawson et al. (2007) prescribe two to eight stimuli.

4.3 A Multiple-Method Approach

In line with the work of Cry and Head (2009), a multiple-method approach with four methodologies was used to evaluate the hypotheses: continuance state sampling, time measurement, skin conductance and surveys.

4.3.1 Continuance state sampling

In line with Ortiz de Guinea et al. (2013), an experience sampling method (ESM; Larson and Csikszentmihalyi 2014) called continuance state sampling (CSS; Sembill et al. 2008) was performed. The objective of this method is to capture the emotional state of the participants in everyday situations. In this method, the questions to measure emotional state are based on a specific scenario. Participants are asked to report their feelings at a specific moment rather than measure their feelings later in a post-experimental survey. The measurement can be initiated by a signal such as a beeping tone, an event such as a computer

breakdown, or a time interval. In the present study, a text-based scenario was used, in which the subjects were questioned about emotional feelings in terms of emotional exhaustion after each task and manipulation. This enabled measuring users' exhaustion level during the experimental task activities (Csikszentmihalyi and LeFevre 1989). Therefore, based on Ayyagari et al. (2011), the emotional exhaustion level was captured after each encounter with the IT event. Appendix B, Table 8 shows the items.

4.3.2 Task performance

Task performance consists of behaviours carried out to complete a job (Meister 1986). When studying task performance, the measures must reflect the task under consideration. For the purpose of this empirical investigation, performance was assessed as an outcome because the individual user had complete control of her own task, and output did not depend on other people (Burton-Jones and Straub 2006). In line with Cody et al. (2015), the outcome of the task and completion time for all seven tasks were drawn from video analysis. The completion time of each task was measured in seconds. Participants' ability to complete the tasks with no errors or errors was determined as an outcome. Incorrect task outcomes were evaluated with a time penalty added to time required to complete the task. Errors resulted in a time penalty of one standard deviation added to the time, the standard deviation having been derived from the times of those participants who completed the task (Cody et al. 2015).

4.3.3 Skin conductance

Skin conductance (SC) captures human responses by analysing the electrical phenomena in the skin (Boucsein 2012; Dawson et al. 2007). SC was measured as evidence of physiological arousal. An exosomatic SC method that applies direct current to the skin was used. Two electrodes were installed on the palmar surface of participants' non-dominant hand to measure the low-level voltage between the electrodes. Participants' SC values were measured once per second using a MentalBioScreen K3 device and recorded in microsiemens (µS). SC was divided into a tonic and a phasic component (Boucsein 2012). The tonic component is *"the absolute level of […] conductance at a given moment in the absence of a measurable phasic response"* (Dawson et al. 2007, p. 210). In other words, tonic values represent SC over a longer period of time and are referred to as skin-conductance level (SCL). The phasic component takes the increases in conductance into consideration, which occurs in the tonic phase, typically triggered by different external or internal stimuli. Increases in conductance are labelled as skin-conductance responses (SCR; Boucsein 2012). In the present examination, SC was decomposed into its tonic and phasic components. In line with past IS literature (Riedl et al. 2013; Teubner et al. 2015), the researchers drew on SCR to measure arousal after each manipulation, and in line with Teubner et al. (2015), drawing on the amplitude of an SCR (SCR.amp), which refers to the height of a single response (Boucsein 2012). SCR.amp acts thereby as the proxy for the extent of instant arousal and reflects short bursts of sympathetic activity (Dawson et al., 2011). As SCR.amps are frequently skewed, a transformation algorithm was performed, as suggested by past literature (e.g., Dawson et al. 2007; Teubner et al. 2015), by transforming all the SCR.amp values by log(x+1). SCR.amp was measured after each repeated IT event and an SCR.latency of three seconds between each repeated IT event and response onset was considered, as recommended in the literature (Dawson et al. 2011).

4.3.4 Surveys

During the experiment, data was captured in the pre- and post-experimental stages. The first survey, conducted in the pre-experimental stage, collected data on demographics including age, gender, IT experience (Potosky and Bobko 1998), IT self-efficacy (Marakas et al. 2007) and computer breakdown self-efficacy (self-developed based on Marakas et al. 2007). The second survey, conducted in the post-experimental stage, measured perceived-threat appraisal (Lee and Larsen 2009; Liang and Xue 2010) and techno-unreliability (Ayyagari et al. 2011). Appendix B, Table 8 shows all measurement items.

4.4 Experimental Procedure

The experiment was divided into a pre-experimental, an experimental and a post-experimental phase. In the **pre-experimental stage**, participants arrived at the laboratory and were assigned to a desk. Subjects were

isolated from each other and completed the experiment independently. After the subjects were seated, they got a short introduction to the experiment to follow. Before the experimental stage began, the subjects were fitted with the SC equipment and filled out the first survey (see A Multiple-Method Approach).

In the **experimental stage**, the subjects were confronted with a text-based scenario in which the subjects were to imagine themselves as a new intern in a fictitious company called IT-share AG. At the beginning of this stage, the subjects were welcomed as a new intern of the company and the intern program was explained. The supervisor demonstrated that the company worked mostly with MS SharePoint and explained that the task for the day was to get used to this software. The supervisor explained that each intern had access to several lists and libraries within the system, and told them that they had to support the supervisor by identifying information from MS SharePoint (see Appendix A). In addition, the supervisor explained that the interns were frequently questioned during these tasks to improve the quality of the intern program (see Appendix A).

After the introduction, the subjects were confronted with their first task in the form of a short message from the supervisor, asking the subjects for some information out of the MS SharePoint system (see Tasks and Technology Used). Before the first task, no manipulation occurred, to obtain a baseline of subject responses. Before Task Two began, the subjects encountered the first manipulation, which froze the computer so that no inputs by keyboard or mouse were possible. The freeze continued for 20 seconds, after which the subjects were able to continue working on the second task (see Manipulation). Subsequently, the subjects worked on Tasks Three to Seven, in which the subjects encountered before each task a manipulation that froze the computer as before.

During all seven tasks, SCR was measured shortly after the manipulation and the working time and the task results were captured as a proxy for task performance. After the subjects accomplished each task, the CSS method was used to capture the psychological responses of the subjects and the behavioural intentions (see Multiple Method Approaches).

In the **post-experimental stage,** the subjects completed the experiment by filling out the second survey, which contained several control variables (see Multiple Method Approaches). Figure 4 shows the experimental procedure.

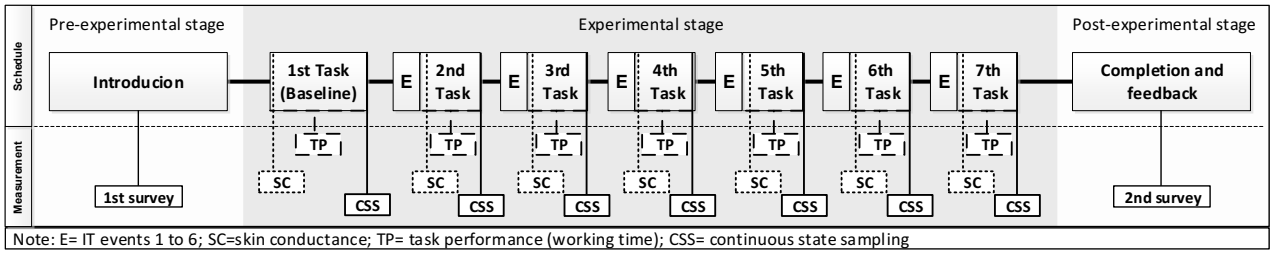

Figure 4: Experimental procedure

5 DATA ANALYSIS

This section reports steps taken to ensure that the measures are valid and reliable, and to describe the check on whether the subjects were aware of the manipulation. Lastly, the results of the present study are reviewed and the hypotheses validated.

5.1 VALIDITY AND RELIABILITY

The self-report measurement items were controlled for validity and reliability.

Content Validity. Only items that had been used in prior research were used for this survey, and they are described in the measurement section and listed in Appendix B, Table 8.

Indicator Reliability. Indicator reliability reflects the relation of the variance of one indicator that comes from the corresponding latent variables. To explain at least 50% of the variance of a latent variable by the indicators, values should be greater than 0.707 (Carmines and Zeller 2008). To fulfil this condition, this survey included only items with values higher than 0.707, as shown in Appendix B, Table 8 and Table 9.

Construct Reliability. The construct reliability reflects criteria to determine the quality at the construct level. Therefore, composite reliability (CR) should be higher than 0.7 and average variance extracted (AVE) should be higher than 0.5 (Fornell and Larcker 1981). Table 9 in Appendix B demonstrates that the CR criteria, as well as the AVE criteria, are fulfilled.

Manipulation Validity. To ensure manipulation validity (Straub et al. 2004), the post-experimental survey included several manipulation-check questions that displayed the encounter with the computer breakdowns. Each subject was asked how many computer breakdowns had been encountered during the experimental stage. The results demonstrate that the subjects were aware of all computer breakdowns (Mdn= 6). In addition, IT unreliability was measured based on Ayyagari et al. (2011), to check whether the computer freeze was perceived as a repeated IT event and whether it posed a threat to the subjects based on the question by Liang et al. (2010). Findings show that the System had been classified as unreliable (M= 1.8; 5= agree to 1= disagree) and that the repeated IT events are perceived as a threat (M= 2.8; 5= agree to 1= disagree; all measurement items are presented in Appendix B, Table 8). Moreover, a one-way repeated measure ANOVA demonstrates that psychological exhaustion significantly differs between the baseline and the treatment-one condition (Wilk's Lambda = 0.919, F(1, 99)= 8.634, p = 0.004). Regarding physiological arousal, similar results were revealed (Wilk's Lambda = 0.725, F(1,198)= 34.478, p = 0.000). Overall, the results indicate a successful manipulation.

5.2 RESULTS

This section first presents the descriptive statistics of user responses and behaviour within the baseline and each encounter. Afterward, the habituation and sensitisation effects on physiological arousal, psychological exhaustion and task performance enfolding over time are demonstrated. Finally, the effects of user responses on behaviour are shown.

Table 4 demonstrates the descriptive statistics of user responses, behaviours and control variables. Physiological arousal shows an increase between the baseline and encounter 1 and the following decrease over time. Psychological exhaustion also indicates an increase between the baseline and encounter 1, and in this case, psychological exhaustion increases over time. Task performance is lower (better) in the baseline compared to encounter 1 and improves over time (faster performance time).

Table 4: Mean and standard deviation

		User responses				Behaviours		Control variables		
		Physiological arousal		Psychological exhaustion		Task performance				
		Mean	SD	Mean	SD	Mean	SD		Mean	SD
Baseline		0.11	0.15	1.40	0.80	4.03	0.51	IT experience	3.38	0.93
Encounter 1		0.25	0.23	1.56	0.94	4.24	0.35	IT self-efficacy	3.90	1.00
Encounter 2		0.19	0.21	1.78	1.03	3.89	0.42	Computer breakdown experience	4.10	0.59
Encounter 3		0.18	0.19	1.81	1.06	4.39	0.30			
Encounter 4		0.14	0.18	1.92	1.15	3.89	0.44			
Encounter 5		0.12	0.15	2.11	1.23	3.79	0.30			
Encounter 6		0.14	0.18	2.15	0.80	4.03	0.38			

Note: psychological exhaustion measured on 5-point Likert scale (1 = not exhausted – 5 = exhausted); Physiological arousal measured in log(microsiemens µS+1) (high value = high arousal – low value = low arousal); task performance in seconds (high value = bad performance, low value = good performance); all control variables are measured on a 5-point Likert scale (1 = disagree – 5 = agree)

The study hypothesises that user responses as well as behaviours change in response to a repeated IT event, requiring a data-analytic approach that allows measuring such changes. Several approaches exist that assess changes in a variable over time, such as change scores, ANOVA and MANOVA with repeated measures. However, these approaches are limited in power and in investigating inter-individual changes

(Benlian 2015). Latent Growth Modeling (LGM) has recently been proposed as a powerful and integrative approach for assessing latent variable changes. LGM overcomes many of the limitations of the traditional approaches mentioned above (Lance et al. 2002) and has been applied in recent IS examinations (Bala and Venkatesh 2013; Benlian 2015; Proudfoot et al. 2016; Zheng et al. 2014). Not only does LGM help measure the change in a latent variable over time; it also validates causal models to predict changes and evaluate the impact of changes on outcome variables within a single structural model (Williamson et al. 2002). In particular, LGM integrates intercepts and slopes of constructions to capture the initial status of individuals (intercept) and of constructs (at the first time point), and to develop a trajectory (slope) for each individual over time. Each individual has its own intercept and slope, and considerable inter-individual variation is expected in both the intercept and the slope (see Figure 5).

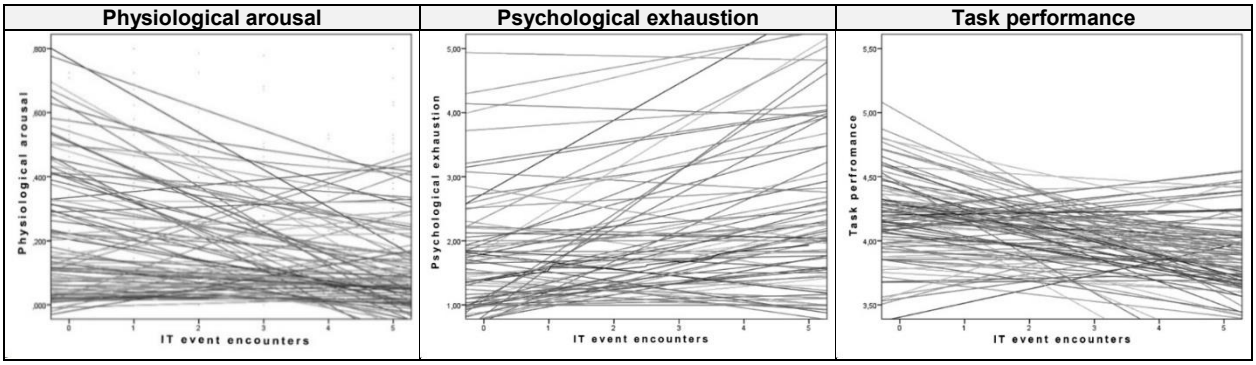

Figure 5: Course of user responses and behaviour

To conduct the LGM analysis, the three-step approach by Bala and Venkatesh (2013) was followed. The *first step* encompasses the test of measurement invariance, which validates whether the same latent variable has been measured over time. As physiological arousal and task performance are objective measurements as well as single measurement items, they are not subjected to measurement invariance. Hence, only emotional exhaustion was tested, indicating that measurement invariance is established (see Appendix B). In the *second step*, the goal was to find out the nature and extent of change in users' responses (e.g., physiological arousal and psychological exhaustion) as well as behaviour (e.g., task performance) while encountering a repeated IT event. To find the best model, four different models were tested, namely a no-growth model, a linear-growth model, a quadratic-growth model and a free-form growth model, to determine the functional form of change (e.g., whether there were increasing or decreasing trajectories of changes) in these latent constructs. In step three, the predictors were added by modeling a multivariate LGM, which validates the influences of user responses on behaviour over time. Next, step two continued with the attempt to find the best model to represent the change of user responses and behaviour while encountering a repeated IT event.

5.2.1 The habituation and sensitisation effect of responses and behaviour

To find the magnitude of change (e.g., whether there are increasing or decreasing trajectories of changes) in physiological arousal, psychological exhaustion and task performance, four different models were tested: a no-growth model, a linear-growth model, a quadratic-growth model and a free-form model. The nested models were compared using chi-square difference tests. The chi-square difference test is implemented by calculating the significance level for the difference in model chi-square values and the degrees of freedom for a pair of nested models (see Table 5).

Physiological arousal											
Model	Change function	Residual structure	X^2	df	NNFI	CFI	RMSEA	SRMR	Model comparison	ΔX^2	Δdf
PA1a	No growth	Heteroscedastic	85.746***	19	0.716	0.641	0.188	0.110			
PA1b	No growth	Homoscedastic	115.149***	24	0.693	0.509	0.196	0.1145	PA1a vs. PA1b	29.403***	5
PA2a	Linear growth	Heteroscedastic	33.245**	16	0.913	0.907	0.104	0.0629	PA1a vs. PA2a	52.501***	8
PA2b	Linear growth	Homoscedastic	52.500***	21	0.879	0.830	0.123	0.0814	PA2a vs. PA2b	19.255***	5
									PA1b vs. PA2b	62.649***	3
PA3a	Quadratic growth	Heteroscedastic	42.226***	16	0.868	0.859	0.129	0.0599	PA1a vs. PA3a	43.520***	3
PA3b	Quadratic growth	Homoscedastic	68.072***	21	0.819	0.747	0.150	0.0761	PA3a vs. PA3b	25.846***	5
									PA1b vs. PA3b	47.077***	3
PA4a	Optimal growth$^{\phi}$	Heteroscedastic	21.311*	12	0.937	0.950	0.089	0.0787	PA1a vs. PA4a	64.435***	7
									PA2a vs. PA4a	11.934*	4
									PA3a vs. PA4a	20.915***	4
PA4b	Optimal growth$^{\phi}$	Homoscedastic	41.675**	17	0.883	0.867	0.121	0.0966	PA4b vs. PA4a	20.344***	5
									PA1a vs. PA4a	73.474***	2
									PA2a vs. PA4a	10.825*	4
									PA3a vs. PA4a	26.397***	5
Psychological exhaustion											
Model	Change function	Residual structure	X^2	df	NNFI	CFI	RMSEA	SRMR	Model comparison	ΔX^2	Δdf
PE1a	No growth	Heteroscedastic	318.113***	19	0.770	0.709	0.399	0.0492			
PE1b	No growth	Homoscedastic	438.103***	24	0.748	0.597	0.417	0.0885	PE1a vs. PE1b	119.99***	5
PE2a	Linear growth	Heteroscedastic	58.542***	16	0.961	0.959	0.164	0.0095	PE1a vs. PE2a	259.571***	3
PE2b	Linear growth	Homoscedastic	99.014***	21	0.946	0.924	0.194	0.0253	PE2a vs. PE2b	40.472	5
									PE1b vs. PE2b	339.089***	3
PE3a	Quadratic growth	Heteroscedastic	104.289***	16	0.919	0.914	0.236	0.0285	PE1a vs. PE3a	213.824***	3
PE3b	Quadratic growth	Homoscedastic	183.988***	21	0.887	0.841	0.280	0.0542	PE3a vs. PE3b	79.699	5
									PE1b vs. PE3b	254.115***	3
PE4a	Optimal growth$^{\phi}$	Heteroscedastic	53.628***	12	0.949	0.959	0.187	0.0125	PE1a vs. PE4a	264.485***	7
									PE2a vs. PE4a	4.914^{NS}	4
									PE3a vs. PE4a	50.661***	4
PE4b	Optimal growth$^{\phi}$	Homoscedastic	89.368***	17	0.938	0.930	0.207	0.0203	PE4b vs. PE4a	35.74***	5
									PE1a vs. PE4a	348.735***	7
									PE2a vs. PE4a	9.646^{NS}	4
									PE3a vs. PE4a	94.62***	4
Task performance											
Model	Change function	Residual structure	X^2	df	NNFI	CFI	RMSEA	SRMR	Model comparison	ΔX^2	Δdf
TP1a $^{\phi\phi}$	No growth	Heteroscedastic	234.150***	19	-	-	-	-	-	-	-
TP1b $^{\phi\phi}$	No growth	Homoscedastic	244.491***	24	-	-	-	-	-	-	-
TP2a $^{\phi\phi}$	Linear growth	Heteroscedastic	189.202***	16	-	-	-	-	-	-	-
TP2b $^{\phi\phi}$	Linear growth	Homoscedastic	210.961***	21	-	-	-	-	-	-	-
TP3a $^{\phi\phi}$	Quadratic growth	Heteroscedastic	200.978***	16	-	-	-	-	-	-	-
TP3b $^{\phi\phi}$	Quadratic growth	Homoscedastic	217.233***	21	-	-	-	-	-	-	-
TP4a	Optimal growth$^{\phi}$	Heteroscedastic	13.745^{NS}	12	0.946	0.957	0.038	0.0677	-	-	-
TP4b	Optimal growth$^{\phi}$	Homoscedastic	58.125***	17	0.141	0.026	0.152	0:0886	TP4b vs. TP4a	44.38***	5

Note: *p < 0.05. **p < 0.01. ***p < 0.005; $^{\phi}$ As Bollen & Curran. (2005) recommend setting the factor loadings for the free-form model by fixing λ1 = 0 and λ4 = 1. while freely estimating all of the loadings between the first and last time points. $^{\phi\phi}$ Models failing to converge to an admissible solution.

Table 5: Fit statistics for unconditional LGM

Findings shown in Table 5 demonstrate that the free-form growth model for physiological arousal (Model PA4a) with a heteroscedastic residual structure (i.e., free error variances over time) has the best overall fit and was significantly better than the no-growth model (Model PA1a), the linear-growth model (Model PA2a) and the quadratic-growth model (Model PA3a) based on a chi-square difference test. Regarding psychological exhaustion also, the free-form model (Model PE4a) with a heteroscedastic residual structure (i.e., free error variances over time) has the best overall fit and was significantly better than the no-growth model (Model PE1a), the linear-growth model (Model PE2a) and the quadratic-growth model (Model PE3a). Moreover, the free-form growth model with a heteroscedastic residual structure (i.e., free error variances over time) also has the best overall fit in the case of task performance.

Analysing the presence of significant intra-individual differences in starting point and slope for changes in **physiological arousal**, the trajectory values of the free-form models are examined. The intercept is 0.251 and significant. The slope value -0.099 indicates a significant ($p<0.001$) decrease in physiological arousal in each time period. The variances for the intercept and slope are also significant ($p<0.05$) indicating that users' growth trajectories exhibited significant individual differences across the samples (i.e., they differed from the mean initial physiological arousal level and the mean physiological arousal growth rate), which supports H1. The covariances between the intercepts and the slopes are negative significant (-0.020; $p<0.01$), indicating that users with high initial levels of physiological arousal experienced a lower growth rate (i.e., slopes) in physiological arousal over time, and vice versa. Looking at **psychological exhaustion,** the intercepts are 1.624 and significant. The slope value 0.503 indicates a significant ($p<0.001$) increase in physiological arousal in each time period. The variances for the intercept and slope are also significant ($p<0.001$), indicating that users' growth trajectories exhibited significant individual differences across the

samples (i.e., they differed from the mean initial psychological exhaustion level and the mean psychological exhaustion growth rate), which supports H2. The covariances between the intercept and the slopes are not significant. Regarding **task performance,** the intercept is 4.239 and significant. The slope values -0.211 indicate a significant ($p<0.001$) increase in task performance in each time period. The variances for the intercept and slope are also significant ($p<0.001$), indicating that users' growth trajectories exhibited significant individual differences across the samples (i.e., they differed from the mean initial task performance level and the mean task performance growth rate), which supports H3. The covariances between the intercepts and the slopes are not significant. Results are summarized in Figure 6.

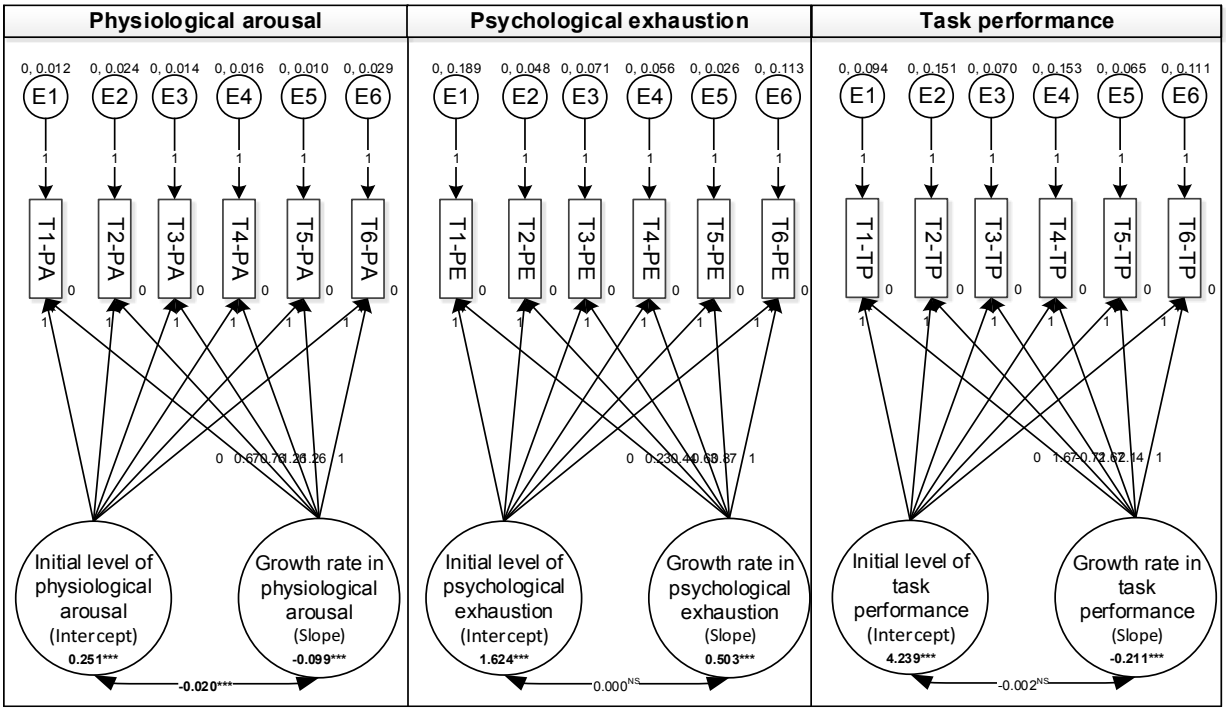

Figure 6: LGM results for physiological arousal, psychological exhaustion and task performance

5.2.2 Physiological arousals and psychological exhaustions impact on task performance

The fit statistics for the multivariate growth model (i.e., models that link growth in several different focal variables simultaneously, here physiological arousal, psychological exhaustion and task performance) are fairly good (χ_2/d.f. = 246.862, $p<0.001$, CFI = 0.918, RMSEA = 0.086, and SRMR = 0.099).

As shown in Figure 7, the means for the intercepts and the slopes of the free-form growth model in **physiological arousal** are statistically significant (mean intercept = 0.251, $p<0.001$, mean slope = -0.095, $p<0.001$), suggesting that physiological arousal grew non-linearly over time. Similarly, the variances for physiological arousal growth trajectory parameters were also significant ($p<0.023$), suggesting that they were different for each individual. The covariance between the intercepts and the slopes is negative and significant (-0.022, $p<0.004$), suggesting that users with lower initial physiological arousal experienced a faster decrease rate of physiological arousal over time than users with higher initial physiological arousal, which supports H4b. The means for the intercepts and the slopes of the free-form growth model for **psychological exhaustion** are statistically significant (mean intercept = 1.630, $p<0.001$, mean slope = 0.494, $p<0.001$), suggesting that psychological exhaustion grew non-linearly over time. Similarly, the variances for psychological exhaustion growth trajectory parameters are also significant ($p<0.001$), suggesting that they were different for each individual. The covariance between the intercepts and the slopes was not significant (-0.002, $p<0.982$). The means for the intercepts and the slopes of the free-form growth model in **task performance** are statistically significant (mean intercept = 4.222, $p<0.001$, mean slope = -0.231, $p<0.001$), suggesting that task performance grew non-linearly over time. Similarly, the variances for psychological exhaustion growth trajectory parameters were also significant ($p<0.001$), suggesting that they were different for each individual.

For the multivariate growth relationships between physiological arousal and task performance, the paths from the intercept of physiological arousal to the intercept of task performance are significant (β = 0.173, p<0.05), suggesting that users with high initial physiological arousal have worse (higher) initial levels of task performance, supporting H4a. However, the paths between the slope of physiological arousal and the slope of task performance are not significant (β = 0.022, p>0.05), so H4b cannot be supported. Regarding the relationship between psychological exhaustion and task performance, the path from the intercept of psychological exhaustion to the intercept of task performance is not significant (β = -0.013, p>0.05), and so cannot support H5a. Moreover, the path between the slope of psychological exhaustion and the slope of task performance is significant (β = 0.039, p<0.01), such that H5b can be supported.

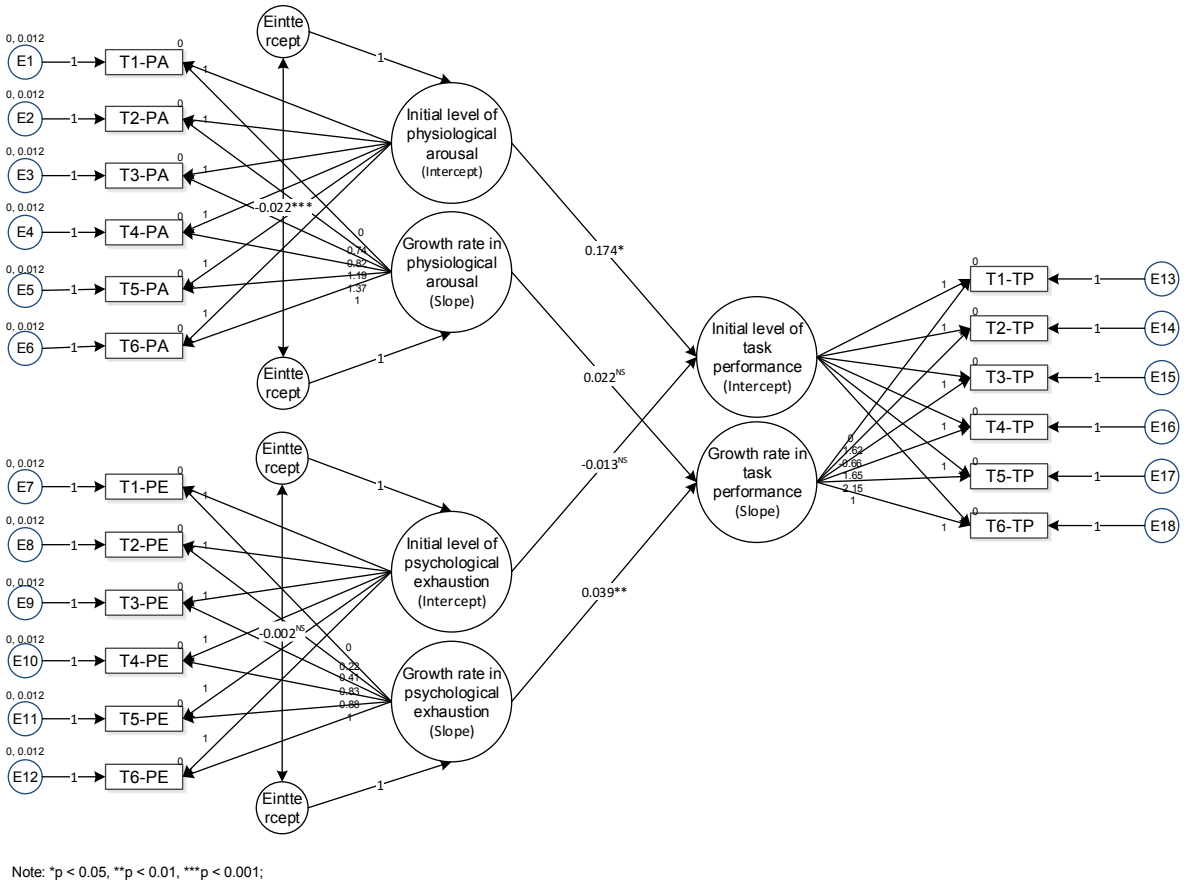

Figure 7: Multivariate LGM

5.2.3 Control variables

The researchers also tested whether inter-individual differences affect physiological arousal, psychological exhaustion and task performance. Results show that gender and IT self-efficacy influences psychological exhaustion and task performance. Computer experience influences psychological exhaustion and no effects are found from age or computer-breakdown experience (see Appendix C Table 12).

6 DISCUSSION, CONTRIBUTION AND LIMITATIONS

The fundamental goal of the present paper is to enrich the knowledge about the change of task performance when users are confronted with a repeated IT event, and the user responses that follow. Past literature indicates that task performance is influenced by single IT events and the resulting user responses. However, the literature neglects the more realistic situation in which users encounter an IT event not only once, but several times in a row. The task performance of users and the resulting user responses might change with each repetition. Given the shortcoming of existing literature that concentrates only on a single IT event and neglects a repeated IT event, the present paper develops a research model based on the dual-process theory and claims that users habituate (shown in decrementing physiological arousal) and sensitise (shown in incrementing psychological responses), both of which predict users' performance level. The research model was validated by applying a multi-method approach. Table 6 summarizes the results, which

demonstrate that users are habituated to a repeated IT event regarding physiological arousal and sensitised regarding psychological exhaustion. Task performance also decrements, which shows a habituation effect during the repeated encounter with IT events. Moreover, users with higher initial physiological arousal also have a worse initial performance level, and users with lower initial arousal level habituate faster than users with a high initial arousal level. Also, the data demonstrate that users with high positive growth rates in psychological exhaustion have a stronger deterioration of task performance. Our results make several theoretical, practical and methodological contributions, described in the following sections.

Hypotheses	
H1: Through the encounter of a repeated IT event users habituate such that its responses in terms of physiological arousal decrease over time with a diminishing growth rate.	Supported
H2: Through the encounter of a repeated IT event users sensitise such that its responses in terms of psychological exhaustion increase over time with a rising growth rate.	Supported
H3: Through the encounter of a repeated IT event users habituate such that its behaviour in terms of task performance reduces over time with a diminishing growth rate.	Supported
H4a: Users with higher initial physiological arousal will experience worse (higher) initial task performance than users with lower initial physiological arousal.	Supported
H4b: Users with lower initial physiological arousal will exhibit a faster growth in physiological arousal than users with higher initial physiological arousal.	Supported
H4c: Users with a higher negative growth rate in physiological arousal will experience a faster increase in task performance than users with a lower growth rate in physiological arousal.	Not supported
H5a: Users with higher initial psychological exhaustion will experience worse (higher) initial task performance than users with lower initial psychological exhaustion.	Not supported
H5b: Users with higher initial psychological exhaustion will exhibit a faster growth in psychological exhaustion than users with lower initial psychological exhaustion.	Not supported
H5c: Users with a higher positive growth rate in psychological exhaustion will experience an increase (deterioration) in task performance than users with a lower growth rate in psychological exhaustion.	Supported

Table 6: Summary of results

6.1 THEORETICAL CONTRIBUTION

The present study contains several theoretical contributions to the field of information systems. First, the paper extends the literature by revealing user responses to a repeated IT event. Second, it investigates the trajectory of task performance and the influence of physiological arousal and psychological exhaustion; and third, it demonstrates habituation and sensitisation of user response.

6.1.1 User Responses to a Repeated IT Event

Before the present research, the influence of IT events on task performance was only investigated by considering a single IT event and responses to it. Neglected were more realistic experiences of repeated IT events over time. Hence, as previous literature neglects that consideration of repeated events (e.g., Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005; Ortiz de Guinea 2016; Ortiz de Guinea and Webster 2013), the paper contributes to advancing that knowledge by providing empirical evidence that the theoretically assumed changes in responses and task performance following a repeated IT event over time are valid. The literature that indicates that IT events are perceived once, when a somewhat more realistic situation is that IT events such as computer breakdowns or IS implementations take a period of time, is substantial (Nightingale et al. 2011; Sykes et al. 2009; Sykes et al. 2014; Sykes 2015; Sykes and Venkatesh 2017). The paper contributes to the literature by providing knowledge that allows researchers to understand not only how users respond to a single encounter, but how the trajectory of responses and task performance developed with repeated encounters over time. These can help future research to advance the theoretical foundation as to how task performance changes when considering the more realistic situation of repeated IT events.

6.1.2 The Trajectory of Task Performance and the Influence of Physiological Arousal and Psychological Exhaustion

This new understanding contributes to the literature by demonstrating that habituation also has a behavioural effect (Vance et al. 2018) in terms of positive development of task performance when encountering repeated IT events. Previous literature shows that the single encounter with IT events leads either directly or indirectly to deterioration of task performance (Addas and Pinsonneault 2018; Ortiz de Guinea and Webster 2013). The present paper extends those results by revealing that task performance improves with the encounter with a repeated IT event over time. In other words, users become habituated to

the repeated IT event, such that their task performance improves. Consequently, the paper provides an evidence-based contribution to the discussion of how task performance develops over time. Future research concentrating on IT events (e.g., interruptions, stressors) and task performance should not only investigate the encounter with one IT event, but instead should consider the perception of repeated IT events, because task performance might change with each encounter.

Moreover, the present research extends the prior literature by theoretically and empirically demonstrating that the time-dependent effect of physiological arousal and psychological exhaustion predicts the changes in task performance. For example, Chilton et al. (2005) show that physiological and psychological responses negatively influence task performance, and Tams et al. (2014) demonstrate that physiological and psychological responses impair task performance in the encounter with a single IT event. The present study extends these results by demonstrating that users with higher initial physiological arousal will experience worse initial task performance and users with lower initial physiological arousal will exhibit a faster growth in physiological arousal. Regarding psychological exhaustion, the results show that users with a higher positive growth rate in psychological exhaustion will experience a deterioration in task performance. In other words, the present paper extends prior research by demonstrating how the initial state and the development over time of physiological and psychological responses influence task performance.

6.1.3 Habituation and Sensitisation of User Responses

The present paper contributes to research by theoretically and empirically demonstrating that users habituate, shown by decrementing physiological arousal responses, and sensitise, shown by incrementing psychological exhaustion responses to a repeated IT event.

On the one hand, prior research is extended by showing how users *habituate* to a repeated IT event. The repeated nature of the encounter with an IT event enabled the capture of user responses over the course of six IT events. This extends the prior work, such as Ortiz de Guinea et al. (2013), who demonstrate that users' responses to a single IT event contain responses such as physiological arousal, by providing insights into the intra-individual changes of physiological arousal. The present paper explains the trajectories of physiological arousal when users encounter a repeated IT event over time. Moreover, regarding physiological arousal, the present study demonstrates that users habituate to a repeated IT event, such that the physiological response decreases, and extend the past literature that focused only on the first encounter with a single IT event, such as a computer breakdown (Riedl et al. 2012, 2013).

On the other hand, the paper extends our knowledge by demonstrating that users *sensitise* in terms of psychological exhaustion. The examination enhances prior work that focused on psychological exhaustion (e.g., Ayyagari et al. 2011; Boucsein and Thum 1995, 1997; Maier et al. 2015c) by theoretically and empirically demonstrating the sensitised nature of psychological exhaustion, shown by an increment in psychological exhaustion due to the repeated encounter with an IT event. The previous literature demonstrates that the encounter with a single IT event leads to tiredness and fatigue (e.g., Ayyagari et al. 2011; Maier et al. 2015c), extended here by showing that the perception of psychological exhaustion increases significantly with each repetition of the IT event. Hence, the experience of a repeated IT event leads to greater vulnerability in terms of tiredness or depletion, such that the responses increase with each encounter.

Altogether, the present paper offers an empirically based contribution to the discussion of how user response changes when encountering repeated IT events, by demonstrating that physiological arousal decrements (habituation), whereas psychological exhaustion continually increments (sensitisation) with the encounter with a repeated IT event. This investigation is especially significant for future research investigating adaptation behaviour (Beaudry and Pinsonneault 2005), as it helps to explain how to reduce user responses, as the trajectories of psychological and physiological responses develop in opposite directions, calling for different adaptation strategies.

These findings also relate to the use of patterns developed by Ortiz de Guinea et al. (2013). They reveal automatic and adaptive use patterns and demonstrate that users switch from an automatic to an adaptive IS use pattern because of the encounter with a single IT event. Automatic use patterns are characterised by low physiological and psychological responses, whereas high physiological and psychological responses characterize adaptive IS use patterns. The present paper contributes to the literature by providing strong empirical confirmation that the characteristics of IS use patterns change when encountering a repeated IT event. In particular, the extent of physiological arousal reduces with each encounter (habituation), whereas the extent of psychological exhaustion increases with each encounter (sensitisation). Hence, the results question whether users switch from an automatic to an adaptive IS use pattern when encountering a repeated IT event, as the trajectories of responses develop in opposite directions. Future adoption research should consider the development of the response trajectories and shed more light on the IS use patterns when confronted with a repeated IT event.

The discussion of the results provides more answers to the question of whether physiological and psychological measures are complements or alternatives. The present paper contributes to existing knowledge by revealing that physiological and psychological responses to a repeated IT event develop in the opposite direction over time. In particular, this study extends the research concentrating on psychological and physiological measures, such as the work of Tams et al. (2014), who demonstrate that physiological measures are complements to psychological ones, rather than alternatives, by yielding initial evidence that the trajectories of psychological and physiological measures develop differently during the repeated encounter of an IT event. Besides the complementary nature of physiological measures with respect to existing methods and their improvement in prediction of outcomes, discovered by Tams et al. (2014), the present research contributes to the discussion of whether physiological measures are an alternative to psychometrics, implying that the two methods assess the same dimension of an underlying IS construct by empirically demonstrating that physiological and psychological measures develop in opposite directions when encountering a repeated IT event. Consequently, physiological measures enable us to measure bodily responses that develop differently than psychological responses and demonstrate that physiological measures do not measure the same dimension as psychometrics. Hence, the present paper enriches IS research by obtaining a more complementary or holistic understanding of IS phenomena, such as the encounter with a repeated IT event.

6.2 Practical Contribution

Organisations must care about a human health resource and how their employees perform. The present paper demonstrates for managers how users respond (physiological and psychological responses) and behave in terms of their task performance, while repeatedly encountering an IT event.

The present results help organisations to understand how user physiological and psychological responses develop over time. Based on the results, managers should focus on psychological responses of users, rather than on physiological responses, as the present research demonstrates that users habituate to a repeated IT event regarding their physiological responses, whereas they are sensitised regarding their psychological response as the event is repeated. Hence, managers should support coping mechanisms and provide support that aims to reduce the psychological responses of their employees.

Moreover, managers learn from the present research that short-term task performance increases again while perceiving a repeated IT event. The results show that the initial state of physiological arousal reduces the initial state of task performance and emotional exhaustion reduces instead of improving task performance. To increase short-term task performance, the organisation might try to support employees trying to reduce their physiological responses immediately, and over time might try to reduce the psychological exhaustion so as to increase task performance.

6.3 Limitations and Future Research

As with all research, the present investigation was subject to several limitations. It follows past literature (Dawson et al. 2011) by choosing six repetitions of the IT event to create an environment in which users are able to habituate and sensitise to the repeated IT event. User responses might develop differently when the IT event is repeated more often. Also, the encounter with six repeated IT events gives few insights into the long- time effects of habituation and sensitisation, and whether user responses will be stable as shown or develop differently over a longer time period. Hence, future research might investigate the effects considering more repeated encounters with an IT event and investigate the long-time effects of habituation and sensitisation. In addition, the laboratory experiment created a controlled environment that enabled concentration on the user responses to one specific IT event, excluding or controlling the influence of other factors and manipulating the situation in the desired way to measure cause and effect appropriately. However, current research (Vance et al. 2018) notes that especially habituation is related to the frequency of stimuli received, such that users might show different patterns of habituation within a 30-minute laboratory experiment than they would show over a period of one day or without a constant number of repetitions. Hence, future research might conduct a similar study using a field experiment to shed light on whether the results are significantly different. Moreover, to measure physiological arousal, only one objective measurement of skin conductance was used. However, literature suggests using more bodily measures at the same time to reduce mono-operationalization biases (Dimoka et al. 2012). Therefore, using additional objective measurements that have already been used in habituation research such as EEG, fMRI, or eye tracking (e.g., Anderson et al. 2016c; Vance et al. 2014; Vance et al. 2018) would complement the current research stream on IT events. Past literature on IT events demonstrates that there are different kinds of such events. For example, Ortiz de Guinea et al. (2013) introduces three types: expected IT events, discrepant IT events and discovery IT events. Also, within the research stream of technostress, more IT events (stressors) are investigated, which focuses more on IT events that result from IT use, such as work overload or work-home conflict (Ayyagari et al. 2011; Tarafdar et al. 2010). Hence, as this paper only focuses on discrepant IT events in terms of a computer breakdown, it is unclear how and if users show different patterns of habituation and sensitisation when encountering different kinds of repeated IT events. Future research might, therefore, concentrate on other kinds of IT events.

7 Conclusion

As users encounter IT events in practice, not only once but repeatedly, it becomes critical to understand how users respond and behave toward such repeated IT events. Our study develops a longitudinal research model investigating the trajectories of user responses, in terms of physiological arousal and psychological exhaustion, as well as the behaviours of task performance. Users habituate in terms of decrements in physiological arousal, sensitise in terms of increments in psychological exhaustion, and habituate in terms of decrements in task performance. Moreover, the influences of physiological arousal and psychological exhaustion on task performance are identified. The present paper contributes to the literature by revealing user responses regarding a repeated IT event, investigation of habituation and sensitisation effects, user responses and task performance and analysing the effect of habituated and sensitised user responses on task performance.

8 References

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9 APPENDIX A

9.1 TEXT-BASED SCENARIO

Table 7: Text-based scenario and laboratory design

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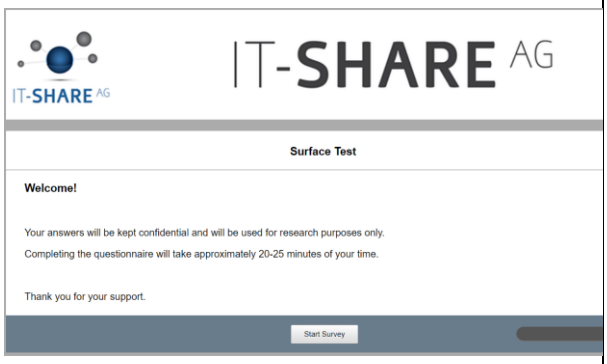
<td> 
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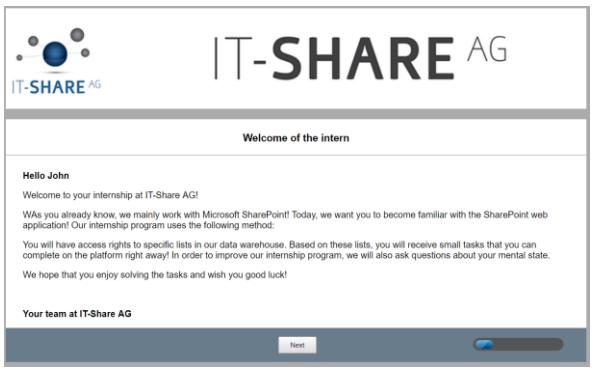
<td>S 
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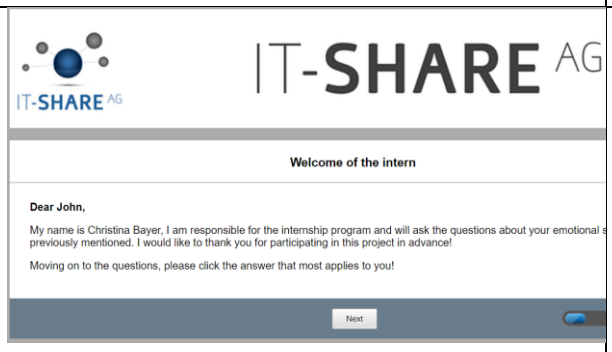
<td> 
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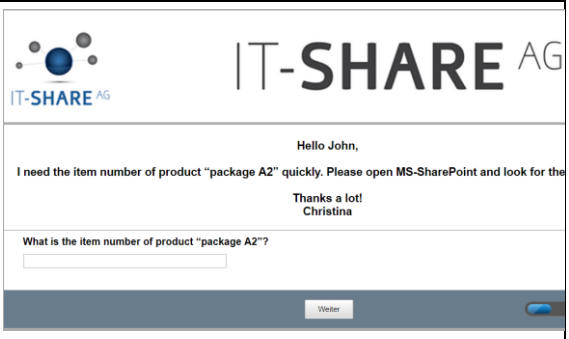
<td> 
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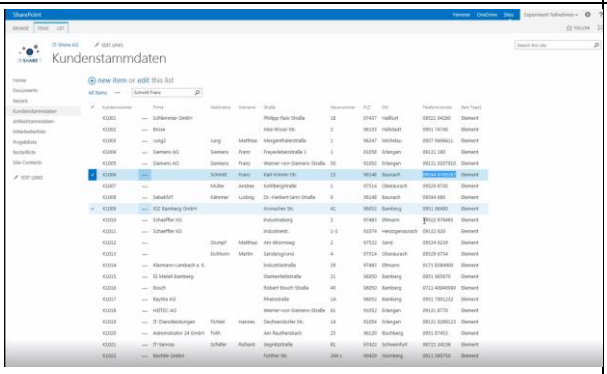
<td> 
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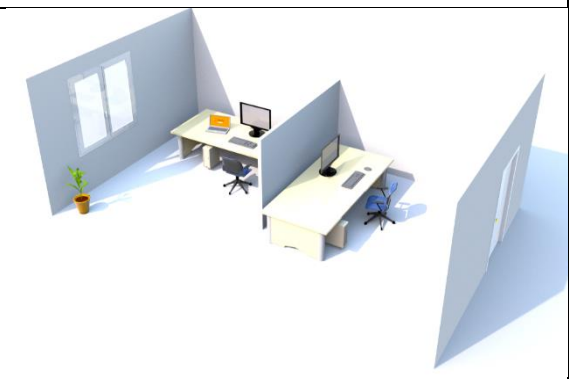
<td>  </td>
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10 APPENDIX B

10.1 MEASUREMENT ITEMS

Table 8: Measurement items

Construct	Items	Loadings	Reliability
Task difficulty (self-developed)	I perceived task 1 as ... (difficult to easy)	0.950	7-point Likert scale (1 = difficult to 7 = easy) AVE: 0.826 CR: 0.971 Cronbach's α= 0.960
	I perceived task 2 as ... (difficult to easy)	0.952	
	I perceived task 3 as ... (difficult to easy)	0.940	
	I perceived task 4 as ... (difficult to easy)	0.959	
	I perceived task 5 as ... (difficult to easy)	0.855	
	I perceived task 6 as ... (difficult to easy)	0.893	
	I perceived task 7 as ... (difficult to easy)	0.802	
Emotional exhaustion (Ayyagari et al. 2011)	I feel drained because of the IT usage during the experiment.	See Table 9	5-point Likert scale (1 = disagree to 5 = agree) AVE: see Table 9 CR: see Table 9 Cronbach's α= see Table 9
	I feel tired because of the IT usage during the experiment.		
	During the experiment, working with IT was a burden for me.		
	I feel burned out by working with the IT during the experiment.		
Computer self-efficacy (Marakas et al. 2007)	I have the ability to install new software applications on a computer.	0.774	5-point Likert scale (1 = disagree to 5 = agree) AVE: 0.729 CR: 0.915 Cronbach's α= 0.870
	I have the ability to set up a new computer.	0.860	
	I have the ability to describe how a computer works.	0.897	
	I have the ability to solve operational problems with a computer.	0.880	
IT experience (adapted from Anderson and Agarwal 2010)	How long have you been dealing with information technologies (IT)?	NA	5-point Likert scale (5 = < 1 years to 1= > 15 years) AVE: NA CR: NA Cronbach's α= NA
Computer breakdown self-efficacy (self-developed following Marakas et al. 2007)	I have often experienced that a computer did not respond.	0.784	5-point Likert scale (1 = disagree to 5 = agree) AVE: 0.599 CR: 0.817 Cronbach's α= 0.664
	Situations, where a computer hangs and does not respond, are known to me.	0.818	
	I have never experienced that a computer hangs.*	0.717	
Unreliability (Ayyagari et al. 2011)	The performance and functionalities of the IT during the experiment was dependable.*	0.839	5-point Likert scale (1 = disagree to 5 = agree) AVE: 0.772 CR: 0.910 Cronbach's α= 0.849
	The capability of the IT during the experiment was reliable.*	0.901	
	IT was free from software errors, quality problems, and technical failures.*	0.894	
Threat (adapted from Liang and Xue 2010	For me, freezing the screen was a difficult situation.	0.736	5-point Likert scale (1 = disagree to 5 = agree) AVE: 0.729 CR: 0.915 Cronbach's α= 0.830
	The computer freeze threatened the successful processing of the tasks.	0.847	
	Problem caused by the computer freeze threatened the successful processing of the task.	0.876	
	The successful processing of the tasks was uncertain because of the freezing.	0.734	
Amount of computer breakdowns (self-developed)	Within the experiment, you experienced a certain number of computer breakdowns during which input via mouse or keyboard were impossible. Please enter here the number of perceived computer breakdowns.	NA	Text field AVE: NA CR: NA Cronbach's α= NA
Note: All other items are objectively measured; * Items are reverse coded			

10.2 VALIDITY OF PSYCHOLOGICAL EXHAUSTION

Table 9: Validity and reliability of psychological exhaustion

	Psychological exhaustion			
Treatment groups	**CR**	**AVE**	**Reliability**	**Loadings**
Baseline	0.946	0.815	0.920	0.820-0.946
Treatment 1	0.947	0.819	0.917	0.808-0.945
Treatment 2	0.933	0.776	0.903	0.854-0.917
Treatment 3	0.959	0.853	0.937	0.859-0.958
Treatment 4	0.950	0.826	0.925	0.856-0.949
Treatment 5	0.951	0.828	0.928	0.850-0.940
Treatment 6	0.957	0.849	0.939	0.851-0.951

Note. CR= composite reliability; AVE= average variance extracted; Reliability = Cronbachs alpha

10.3 MEASUREMENT OF INVARIANCE

To test for configural invariance, the paper follows the procedures outlined by Chan (1998) and used by Bala and Venkatesh (2013). In particular, to establish configural and metric invariance across time two nested models are compared. Within the first model the factors corresponded to the measurement occasions. In other words, T0 items loaded only on the T0 factors and the intercept is fixed to factor loadings, error variances, factor means, and factor variances are freely estimated. An acceptable fit of Model 1 would indicate the unidimensional factor structure over time. Hence, configural invariance would be established (Chan 1998). Model 2 is equal to Model 1 except that the factor loadings are equal across measurement occasions. Consequently, factor loading at T0 = factor loading T1 = factor loading T2. As Model 2 is nested within Model 1, the difference in chi-square is used to test if there is any statistically significant change (i.e., reduction) in model fit from Model 1 to Model 2. If Model 2 did not differ significantly from Model 1 metric invariance has been established because a significant worsening in fit would indicate inequivalence of factor loadings over time.

As shown in Table 10, Model 2 did not differ significantly from Model 1 such that metric invariance has been established because a significant worsening in fit would indicate inequivalence of factor loadings over time.

Table 10: Tests of measurement invariance for psychological exhaustion

Models	X^2	df	NNFI	CFI	RMSEA	SRMR	Model comparison	ΔX^2	Δdf
Model 1: Free factor loadings, error variances, factor means, factor variances	**1020.1**	**237**	**0.754**	**0.798**	**0.183**	**0.072**			
Model 2: Equal factor, loadings, free error variances,factor means, factor variances	**1039.2**	**251**	**0.750**	**0.797**	**0.178**	**0.067**	**1 vs. 2**	**19.1^{NS}**	**14**

10.4 INTER-CONSTRUCT CORRELATION

Table 11: Inter-construct correlation

	Constructs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	Emotional exhaustion (baseline)																																
2	Physiological arousal (baseline)	-0.142																															
3	Task performance (baseline)	0.431	-0.082																														
5	Emotional exhaustion (1)	0.726	0.074	0.294	0.372																												
6	Physiological arousal (1)	-0.089	0.385	0.044	-0.073	0.026																											
7	Task performance (1)	-0.064	0.026	0.118	0.154	0.089	0.101																										
9	Emotional exhaustion (2)	0.598	0.114	0.220	0.297	0.841	0.007	0.082	0.309																								
10	Physiological arousal (2)	0.014	0.259	0.189	-0.010	-0.020	0.554	0.064	-0.058	0.080																							
11	Task performance (2)	0.056	0.090	0.064	0.046	0.109	0.047	0.338	0.042	0.081	0.068																						
13	Emotional exhaustion (3)	0.539	0.108	0.216	0.198	0.785	0.078	0.099	0.254	0.928	0.043	0.143	0.427																				
14	Physiological arousal (3)	-0.135	0.448	0.174	-0.016	0.008	0.657	0.188	0.068	0.023	0.549	0.198	0.149	0.060																			
15	Task performance (3)	-0.209	0.244	-0.022	-0.232	-0.210	0.118	0.073	-0.100	-0.197	0.051	0.070	-0.121	-0.125	0.196																		
17	Emotional exhaustion (4)	0.473	0.093	0.171	0.209	0.708	0.017	0.080	0.292	0.888	-0.046	0.073	0.424	0.932	-0.016	-0.133	0.488																
18	Physiological arousal (4)	0.116	0.326	0.135	0.013	0.287	0.408	0.005	-0.040	0.331	0.417	0.030	0.096	0.265	0.527	-0.003	0.076	0.173															
19	Task performance (4)	-0.023	-0.024	0.154	-0.014	-0.006	0.219	0.218	0.067	0.013	0.144	0.026	-0.013	0.048	0.076	0.160	0.009	0.054	0.034	1.000													
21	Emotional exhaustion (5)	0.473	0.053	0.203	0.170	0.690	0.000	0.079	0.241	0.832	-0.022	0.095	0.392	0.904	-0.033	-0.126	0.473	0.953	0.175	0.073	0.487	0.910											
22	Physiological arousal (5)	0.117	0.326	0.273	-0.115	0.193	0.403	0.011	-0.067	0.160	0.409	0.018	-0.006	0.115	0.598	0.049	-0.071	0.074	0.581	0.111	-0.083	0.065	1.000										
23	Task performance (5)	-0.063	-0.001	0.005	-0.203	0.058	0.109	0.081	-0.065	0.045	-0.104	0.084	0.038	0.172	0.134	0.117	0.038	0.184	0.042	0.105	0.023	0.255	0.045	1.000									
25	Emotional exhaustion (6)	0.425	0.033	0.171	0.111	0.589	-0.007	0.081	0.165	0.739	-0.051	0.059	0.311	0.836	-0.057	-0.081	0.419	0.889	0.114	0.014	0.458	0.948	0.015	0.238	0.497	0.921							
26	Physiological arousal (6)	-0.171	0.326	-0.062	-0.104	-0.197	0.485	0.053	0.034	-0.209	0.288	0.001	-0.065	0.225	0.331	0.064	-0.080	-0.211	0.231	0.114	-0.030	-0.208	0.165	-0.022	-0.078	0.204	1.000						
27	Task performance (6)	-0.072	-0.060	0.004	0.129	0.131	0.051	0.146	-0.027	0.081	0.023	0.165	-0.019	0.018	0.031	0.393	-0.040	0.001	-0.155	0.086	-0.020	0.011	0.015	0.281	0.008	-0.021	0.026	1.000					
29	Age	-0.121	0.050	-0.024	0.015	0.068	0.028	0.056	0.070	0.171	0.102	0.128	0.007	-0.180	0.157	-0.019	0.008	-0.178	0.048	-0.069	0.041	0.149	0.099	-0.044	0.013	0.152	0.061	0.082	-0.095	1.000			
30	Gender	0.067	-0.339	0.127	-0.157	0.103	0.229	0.047	0.180	0.097	0.254	0.176	0.186	0.067	0.236	0.040	0.240	0.017	0.284	0.073	0.217	0.002	0.252	0.017	0.172	0.011	0.156	0.005	0.214	0.087	1.000		
31	Computer experience	0.110	-0.138	0.106	-0.098	0.077	0.065	0.029	0.078	0.101	0.055	0.180	0.113	0.122	0.078	0.030	0.175	0.163	0.055	0.125	0.201	0.183	0.052	0.006	0.231	0.277	0.009	0.054	0.271	0.291	0.218	1.000	
32	IT self-efficacy	-0.198	0.187	-0.309	0.099	-0.045	0.137	0.166	0.157	0.064	0.031	0.027	0.100	0.067	0.102	0.057	0.238	0.062	0.108	0.071	0.181	0.043	0.022	0.040	0.202	0.070	0.015	0.158	0.191	0.009	0.558	0.275	1.000
33	Computer breakdown experience	0.066	0.210	0.103	0.111	0.013	0.060	0.072	0.126	0.034	0.060	0.051	0.118	0.041	0.018	0.142	0.095	0.020	0.089	0.040	0.146	0.051	0.062	0.180	0.165	0.033	0.018	0.143	0.202	0.148	0.025	0.030	0.094

11 APPENDIX C: CONTROL VARIABLES

Table 12: The influences of the control variables on physiological arousal, psychological exhaustion, and task performance

Dependent variables	Control variables				
	Age	Gender	Computer experience	IT self-efficacy	Computer breakdown experience
Physiological arousal					
Intercept	-0.016^{NS}	-0.077^{NS}	-0.005^{NS}	0.030^{NS}	-0.034^{NS}
Slope	0.019^{NS}	0.011^{NS}	0.006^{NS}	-0.031^{NS}	0.036^{NS}
Psychological exhaustion					
Intercept	-0.124^{NS}	0.286^{NS}	-0.217***	0.076^{NS}	0.049^{NS}
Slope	-0.036^{NS}	-0.582***	-0.019^{NS}	-0.175*	-0.040^{NS}
Task performance					
Intercept	0.007^{NS}	-0.144***	-0.007^{NS}	-0.069***	0.011^{NS}
Slope	0.009^{NS}	0.009	-0.006^{NS}	0.016^{NS}	-0.040^{NS}
Notes *p < 0.05, **p < 0.01, ***p < 0.001					

Paper XI

IS REAPPRAISAL AND TECHNOLOGY ADAPTATION

A LONGITUDINAL STUDY DURING AN IS IMPLEMENTATION

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IS REAPPRAISAL AND TECHNOLOGY ADAPTATION

A LONGITUDINAL STUDY DURING AN IS IMPLEMENTATION

Abstract

Employees have to adapt to newly implemented information systems (IS) because organizations continuingly implement new IS to gain efficiency and effectiveness. However, the process of technology adaptation behavior is not stable as suggested by previous literature. It is instead dynamic such that employees reevaluate the new implemented IS over time, which is called reappraisal. As firms continue to implement IS, an understanding of reappraisal and the influence of technology adaptation behavior is vital to ensure successful implementations. Therefore, the present paper investigates reappraisal, and the influences of four different technology adaptation behaviors during the implementation phase of an IS. We conducted a longitudinal study in a university library and used hierarchical linear modeling (HLM) to validate our research model. Our findings reveal that employees reappraise the newly implemented IS over time and demonstrate that technology adaption behaviors influence such reappraisal. We thereby contribute to research by extending the adaptation behavior literature and add a new piece of the puzzle to understand how employees adapt towards newly implemented IS over time.

Keywords: Reappraisal, Technology adaptation, Opportunity, Threat, Controllability

1 INTRODUCTION

Organizations continuingly implement new information systems (IS) to gain efficiency and effectiveness (Bala and Venkatesh 2015; Morris and Venkatesh 2010; Sykes 2015). Gartner (2018) reports that the global spending on IS will reach US 391 billion dollars in 2018, which indicate that organizations invest more and more money in IS implementations. Such IS implementations force employees to adapt to these new implemented IS by performing technology adaptation behaviors (Bala and Venkatesh 2015, p. 1). Hence, technology adaptation behaviors are essential for the successful implementation of an IS and hence a key to achieving growth in organizational efficiency and effectiveness (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005). In particular, to adapt to newly implemented IS employees first appraise the new IS and second perform a technology adaptive behavior (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005).

However, previous IS literature treats appraisal and technology adaptation behaviors towards IS implementation as a static process (Bala and Venkatesh 2015), whereby psychological literature shows that instead it depicts a continuance process of appraisal-adaptation-reappraisal unfolding over time (Folkman 1982; Lazarus and Folkman 1984). For example, IS implementations in part require several months if not years until they are completed (Morris and Venkatesh 2010; Sykes 2015; Sykes and Venkatesh 2017). Hence, employees do not appraise the new IS once and decide whether to reject or accept the new IS, but rather reappraise and continuously adapt during the implementation phase. Past IS literature investigates the appraisal-adaptation relationship (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005) and neglects reappraisal. Reappraisal takes the temporal development of the evaluation process into consideration. It differs from cognitive appraisal as it follows and modifies an earlier cognitive appraisal, which might be the primary one in which the newly implemented IS has been appraised for the first time. Reappraisal depicts a process where employees reevaluate the situation based on new information from the environment or the individuals' behavior (Folkman 1982; Lazarus and Folkman 1984) such as a technology adaptation behaviors. For example, employees appraise the newly implemented IS as highly threatening (appraisal) and therefore perform technology adaptation behavior such as using new features (technology adaptation behavior). The technology adaptation behavior changes the situation such that reappraisals are made which

in turn might bring the employee to perceive the new IS as more or less threatening (reappraisal).

As the technology adaptation behaviors of employees are essential for the successful implementation of an IS and hence a key to achieving growth in efficiency and effectiveness, it is essential to understand how employees adapt to IS implementations over time. As the appraisal and the subsequent technology adaptation behavior are not static, as investigated in the IS literature thus far (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005), but somewhat dynamic as employees adapt and reappraise the new IS repeatedly, reappraisal of the new IS is crucial to understand adaptation of IS implementations. The investigation of IS usage over time "*help[s] us better understand the fluid relationships that exist between an adoption model's constructs and a variety of mutually influential set of behaviors users typically engage in, such as their adaptation, learning, and hands-on usage behaviors […]"* (Benbasat and Barki 2007, p. 215). To shed more light on reappraisal and technology adaptation behaviors, the present paper aims to answer the following research question:

How do technology adaptation behaviors influence reappraisal?

The paper thereby follows the call by Bala and Venkatesh (2015) who propose conducting a field study in which researchers examine reappraisal during the implementation phase of an IS as well as investigating predictors of such changes by applying hierarchical linear modeling (HLM). We contribute to research by extending the adaptation behavior literature and add a new piece of the puzzle to understand how employees adapt towards newly implemented IS over time. The present research contributes by revealing that technology adaptation is not a static process of appraisal and adaptation, but rather a dynamic process of appraisal, adaptation, and reappraisal which is predicted by technology adaptation behaviors.

To explain these contributions in more detail, the remainder of this paper is as follows. In the theoretical background section, we explain the technology adaptation behaviors including reappraisal and give a brief overview of related work on IT adaptation. Afterward, we develop the research model and present the methodology and research results. Eventually, the theoretical and practical contributions, as well as limitations and future research directions are outlined.

2 THEORETICAL BACKGROUND

In this section, we explain technology adaptation behavior, including reappraisal which considers the temporal development of cognitive appraisal, and give a short overview of previous work on IT adaptation.

2.1 TECHNOLOGY ADAPTATION BEHAVIORS

More recent attention has focused on technology adaptation behaviors (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005). Previouse literatuer demonstrates that cognitive appraisals and technology adaptation behaviors are a key linking mechanism between newly implemented IS and job outcomes (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005). Fundamental adaptation theories suggest that employees cognitively appraise a newly implemented IS, which in turn determines different technology adaptation behaviors (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005). Moreover, the adaptation process is highly iterative and changes over time. Technology adaptation behaviors influence the cognitive appraisal process of employees, which leads to a reappraisal of the situation. For example, employees appraise the newly implemented IS and in turn make different adaptation efforts which change the technology or the environment so that employees reappraise the newly implemented IS (Beaudry and Pinsonneault 2005). The process of cognitive appraisal, technology adaptation behavior, and reappraisal is shown in Figure 1 and specified in the following.

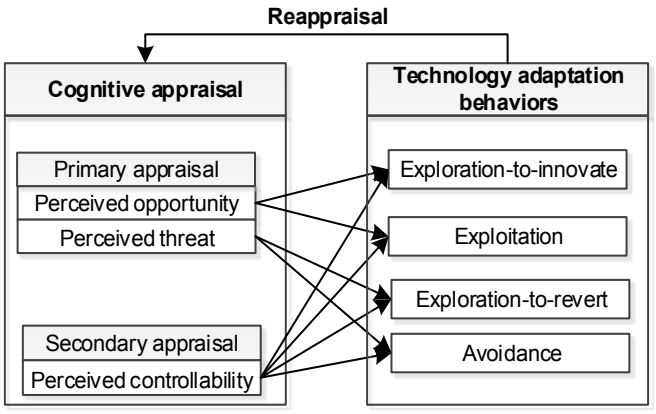

Figure 1: Cognitive appraisal technology adaptation behavior relationship based on Bala and Venkatesh (2015) and Beaudry and Pinsonneault (2005)

Cognitive appraisal. Cognitive appraisal is conceptualized as both a primary appraisal encompassing perceived opportunity and threat and as a secondary appraisal considering perceived controllability. During the primary appraisal, employees evaluate the *perceived opportunity* of the newly implemented IS. Thereby, employees evaluate the degree to which they think that the new IS offers them a chance for success (Bala and Venkatesh 2015). Although employees may perceive a chance for success in several aspects of their work following an IS implementation, such as personal growth, gain, reward, mastery, or job performance, they are likely to develop a holistic assessment of opportunity when they first encounter an IS in their work environment (Beaudry and Pinsonneault 2005). Also, employees evaluate the *perceived threat* of the newly implemented IS. Employees evaluate the degree to which they think that the new IS harms his or her well-being, personal gain, or growth (Bala and Venkatesh 2015). For example, employees may think that the IS is downgrading their performance and status in the organization because their roles in business processes may change after its implementation. During the secondary appraisal, employees evaluate the *perceived controllability* of the newly implemented IS. Here, employees evaluate the extent of their ability and resources to deal with the new IS (Bala and Venkatesh 2015). Perceived behavioral control, self-efficacy, and facilitating conditions have significant conceptual similarities (Venkatesh et al. 2003).

Technology adaptation behaviors. Technology adaptation behaviors are specific behaviors that employees perform to cope with a newly implemented IS (Bala and Venkatesh 2015). Different adaptation concepts exist (see Table 1). In the present study we focus on the model of technology adaptation because it is one of few models which investigates the cognitive appraisal – adaptation behavior relationship (see Table 1). The model thereby identifies four different technology adaptation behavior – exploration-to-innovate, exploitation, exploration-to-revert, and avoidance – which are determined by the cognitive appraisal process. All four technology adaptation behaviors are explained in the following.

Exploration-to-innovate (EXPLRI) is the extent to which an employee is attempting to find, extend, and modify IS features to accomplish their tasks innovatively. Exploration-to-innovate is conceptually similar to feature extension, feature exploration, and infusion or emergent use of IS (Jasperson et al. 2005; Thatcher et al. 2011). For example, employees might discover the new IS and find a new way to do their work tasks.

Exploitation (EXPLT) is the extent to which an employee uses a set of recommended IS features to perform their portfolio of tasks. This behavior is similar to previously investigated behaviors such as exploitive system use (Burton-Jones and Straub 2006), feature adoption (Jasperson et al. 2005), and routine use of an IS (Thatcher et al. 2011). For example, employees who perform exploitation behavior use a set of IS features which they have learned from others (e.g., peers, supervisors, help desk). They use these features on a regular basis to accomplish their work tasks.

Exploration-to-revert (EXPLRV) occurs when an employee tries to find, develop, and modify IS features based on their work processes or habits related to the old processes and IS (Bala and Venkatesh 2015). This

behavior is similar to workarounds (Laumer et al. 2017) where instead of learning what is new employees return to what they had done in the past. One example is that employees pull data from the new system and use the old system to perform their analyses.

Avoidance (AVOID) is the extent to which an employee tries not to use the new IS to perform their work tasks (Bala and Venkatesh 2015). For example, employees try to avoid usage of the new IS as much as they can or find ways to complete most of their task without using the new IS.

Reappraisal. Reappraisal[38] is a reevaluation process where individuals appraise the situation regarding opportunity, threat, and controllability again based on new information from the environment or the individuals' reaction (Beaudry and Pinsonneault 2005; Lazarus and Folkman 1984). It differs from a cognitive appraisal specifically in that it follows and modifies an earlier cognitive appraisal (Lazarus and Folkman 1984). Thereby, reappraisal considers the temporal development and indicates that individuals repeatedly reappraise their circumstances (Folkman 1982). For example, individuals cognitively appraise a situation for the first time and perform different adaptation behaviors which change the situation so that the individual has new information and reappraises the situation differently. For instance, imagine a situation in which an employee appraises a new IS as being a high threat, low opportunity, and low controllability. These appraisals of the new IS might lead the employee to perform an exploitation behavior so that he gets help from his coworkers who explain to them how to use the new IS to accomplish his work tasks. Based on this adaptation behavior, the employee reappraises the new IS so that the individual might than reappraise the new IS as a lower threat, higher opportunity, and higher controllability.

2.2 Related work on IT adaptation

Different IT adaptation concepts have been investigated in IS literature (for an exhaustive literature review see Schmitz et al. (2016) or Sun et al. (2012); an overview is also given in Table 1). The well-known coping model of user adaptation (CMUA) states that the evaluation of the discrepant IT event starts with a primary appraisal, in which users assess the discrepant IT event as either a threat or opportunity. The assessment of the discrepant IT event follows an evaluation of the amount of control and resources users have to estimate the adaptation possibilities. Four different adaptation behaviors are differentiated (benefits maximizing, benefits satisfying, self-preservation, and disturbance handling) which are determined by primary and secondary appraisals. Each adaptation behavior is assumed to result in three different outcomes: restoring emotional stability, minimizing the perceived threats of the technology, and improving user effectiveness and efficiency. Moreover, the adaptation process is highly iterative and changes over time. The adaptation behaviors and the outcomes influence the appraisal process of individuals which leads to a reappraisal of the situation (Beaudry and Pinsonneault 2005). However, the CMUA has been conceptually developed so that the following examination validates its statistical robustness. Their results show that the four strategies of adaptation (benefits maximizing, benefits satisficing, self-preservation, and disturbance handling) are empirically distinct from each other and the appraisal process leads to the theorized adaptation strategies (Elie-Dit-Cosaque and Straub 2011). The application of the CMUA in the context of emotions shows that adaptation behaviors such as venting, seeking social support, and distancing mediate the relationship between negative emotions (anger, anxiety) and IT use, whereas adaptation behaviors such as task adaptation and seeking instrumental support mediate the relationship between positive emotions (happiness, excitement) and IT use (Beaudry and Pinsonneault 2010).

In addition, the literature on IT adaptation behavior has specified several IT adaptation behaviors. One study focuses on task-technology adaptation behavior, which is defined as any behavior directed at changing or modifying an IT (Barki et al. 2007). Further IT adaptation behaviors are, for example, individual feature adoption, which is the acceptance of the users to use the system to complete their work task, and individual

[38] It should be noted that despite having the same name, the phenomenon of reappraisal is very different from the coping strategies called reappraisal. The first is the temporal development of cognitive appraisal, which is explained in the present manuscript. The second is a defensive reappraisal, which depicts a specific coping strategy consists of any effort made to reinterpret the past more positively (Lazarus and Folkman 1984).

feature extension, which represents the adaptation behavior whereby users discover how to apply features that go beyond the use delineated by designers (Jasperson et al. 2005). In the same vein, Ahuja and Thatcher (2005) investigate how users try to innovate with IT. This behavior reflects the user's goal of finding novel uses for IT. Further investigations concentrate on the differentiation between task and technology, and investigate exploitive and exploratory task adaptation and differentiate these behaviors from the exploitive and exploratory technology adaptation (Schmitz et al. 2016). Sun et al. (2012) examines four different IT adaptation behaviors of trying new features, feature repurposing, substituting features, and feature combining. Trying new features is the explanation of the scope of feature a user is currently using. Feature repurposing is understood as applying features in a new way. Adaptive systems use is a user's revision of which, and in what way, functionalities of the system are used. Substituting features is a behavior which replaces old features with other similar functions of the system. Feature combining uses features together for the first time. A recent investigation predicts usage behavior in mandated situations where users have no freedom to decide whether or not to use the IS. They concentrate on an implementation of an IS and propose, based on the appraisal process, four different behavioral responses such as engaged, compliant, reluctant, or deviant. For example, they argue that users appraising the IS as a threat have a low-control response in a deviant way by using workarounds, whereas users appraising the IS as an opportunity have a high-control response in an engaging way by experimenting with the IS (Bhattacherjee et al. 2017).

Authors	Appraisal	Adaptation behavior		Reappraisal
Beaudry and Pinsonneault 2005	✓	✓	Benefits maximizing Benefits satisfying Self-preservation Disturbance handling	✓
Elie-Dit-Cosaque and Straub 2011.	✓	✓	Benefits maximizing Benefits satisfying Self-preservation Disturbance handling	✕
Beaudry and Pinsonneault 2010	✕	✓	Venting Seeking social support Distancing Task adaptation Seeking instrumental support	✕
Bhattacherjee et al. 2017	✓	✓	Engaged Compliant Reluctant Deviant	✕
Jasperson et al. 2005	✕	✓	Feature adoption Feature extension	✕
Schmitz et al. 2016	✕	✓	Exploitive task adaptation Exploratory task adaptation Exploitive technology adaptation Exploratory technology adaptation	✕
Barki et al. 2007	✕	✓	Task-technology adaptation	✕
Sun 2012	✕	✓	Trying new features Feature repurposing Substituting features Feature combining	✕
Ahuja and Thatcher 2005	✕	✓	Trying to innovate with IT	✕
Bala and Venkatesh 2015	✓	✓	Exploration-to-innovate Exploitation Exploration-to-revert Avoidance	✕
Note: ✓ has been considered; ✕ has not been considered				

Table 1: Overview of IT adaption literature

As depicted in Table 1, previous IS literature currently does not know how employees adapt towards a newly implemented IS over time by considering the whole process of appraisal-adaptation-reappraisal. We focus here on the adaptation-reappraisal relationship because the adaptation towards a new implemented IS takes place over a period of time and cannot be fully understood by examining static adaptation behavior. IS implementations partly require several months if not years until they are completed (Morris and Venkatesh 2010; Sykes 2015; Sykes and Venkatesh 2017). As the IT adaptation literature mostly investigates only the adaptation itself or the appraisal-adpation relationship and neglects the reappraisal, technology adaptation literature is currently limited by the dynamic and time-dependencies of reappraisal. To address these shortcomings, the present paper aims to extend the IT adaptation literature by investigating the whole process of appraisal-adaptation-reappraisal.

3 HYPOTHESES DEVELOPMENT

Figure 2 presents the research model we use to extend technology adaptation literature. As mentioned above, the present paper focuses on the adaptation-reappraisal relationship as it concentrates on the temporal changes of appraisal and the prediction of technology adaptation behaviors (e.g., exploration-to-innovate, exploitation, exploration-to-revert, and avoidance; Bala and Venkatesh 2015) of such reappraisals. Next, we first focus on perceived opportunity, second on perceived threat, and lastly on perceived controllability. For each, we theorize the reappraisal during the implementation phase predicted in Figure 2 as the influence of time on perceived opportunity, threat, and controllability. Also, we theorize the prediction of the reappraisal through technology adaptation behaviors, which are identified by past research as the main adaption behavior in response to newly implemented IS (Bala and Venkatesh 2015).

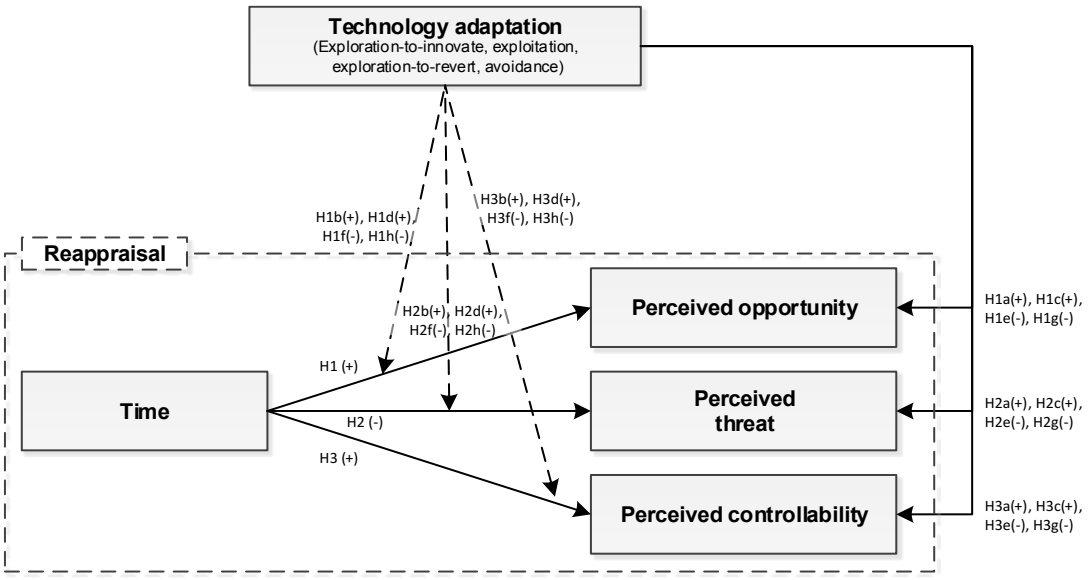

Figure 2. Research model (in line with Otondo et al. (2009))

3.1 PERCEIVED OPPORTUNITY

3.1.1 Reappraisal of the new IS regarding perceived opportunity

We hypothesize that employees will reappraise the new IS during the implementation phase so that perceived opportunity will change. As mentioned above, reappraisal is a cognitive appraisal that follows an earlier cognitive appraisal and modifies it (Folkman 1982). In essence, reappraisal encompasses the temporal development of the evaluation process of perceived opportunity. Lazarus and Folkman (Lazarus and Folkman 1984) state that employees reappraise a situation based on new information from the environment or the individuals' reaction (Folkman 1982). Hence, we argue that employees do not appraise the perceived opportunity regarding a new implemented IS once. We theorize that they reappraise the new IS regarding perceived opportunity during the implementation of an IS because they get new information and react to the new IS. Employees can reappraise the new IS more positively by getting used to it (Jasperson et al. 2005) and encounter the features of the new system so that employees realize what chances for success the IS offers. Consequently, we assume that:

H*1: Employees reappraise the new IS over time so that perceived opportunity will change at increasing growth rates during the implementation phase.*

3.1.2 Predicting the reappraisal of the new IS regarding perceived opportunity due to technology adaptation behaviors

Focusing on the initial status of opportunity, we assume that employees rated high for ***exploration-to-innovate*** have a higher perceived opportunity than employees with a low rating for exploration-to-innovate. Past literature indicates that exploration-to-innovate and perceptions of opportunity are positively related

(Bala and Venkatesh 2015). One explanation is that employees exhibiting this behavior extend the usage of features and explore the new IS, they understand the new IS better and find new ways of accomplishing their task. Consequently, employees can use the IS more effectively.

Regarding the slope, we assume that employees with high rating in exploitation-to-innovate have a higher growth rate for reappraisal of the new IS regarding perceived opportunity. Employees using the new IS accomplish their work task more efficiently and realize that the new IS offers them a chance for success so that they reappraise the new IS with higher perceived opportunity. Exploration-to-innovate reflects a benefit maximizing strategy, and therefore employees are willing to take full advantage of the opportunities offered by the new IS (Beaudry and Pinsonneault 2005) so that they think they can increase job performance and, therefore, reappraise the system with more opportunity. Hence, employees reappraise the new IS in a positive light and perceive more opportunities. Therefore, we assume that:

H1a: Employees with a higher initial performance of exploration-to-innovate will have a higher initial perceived opportunity than employees with a lower initial performance of exploration-to-innovate.

H1b: Employees high in exploration-to-innovate will have a higher growth rate in reappraising the new IS regarding perceived opportunity.

We assume that the employees with high initial performance of ***exploration*** have a higher initial perceived opportunity than employees with lower initial performance of exploitation. Employees performing this behavior learn new IS features (Jasperson et al. 2005) and hence learn to use the new IS to accomplish their work tasks which in turn increases the perception of opportunity because employees are more effective, grow personally, and gain more reward (Bala and Venkatesh 2015).

Regarding the effect on the slope, we assume that employees with a high rating in exploration have a higher growth rate in reappraisal of the new IS regarding perceived opportunity. When employees use a set of IS features effectively to do their tasks, the perception of the chances the new IS discloses for success in the workplace increases over time. In other words, when employees can perform their tasks by learning a set of features, they reappraise the new IS in a favorable light and perceive more opportunities. Hence, we assume:

H1c: Employees with higher initial performance of exploitation will have a higher initial perceived opportunity than employees with a lower initial performance of exploitation.

H1d: Employees rated high in exploitation will have a higher growth rate in reappraising the new IS regarding perceived opportunity.

Regarding the initial status, we assume that employees with a higher initial performance of ***exploration-to-revert*** have a lower initial perceived opportunity than employees with a lower initial performance of exploration-to-revert. A previous examination reveals a negative relation between exploration-to-revert and perceptions of opportunity (Bala and Venkatesh 2015). In particular, as employees performing this behavior do not change their working processes and instead try to change and manipulate the new IS to maintain familiar processes (Laumer et al. 2017), the perception that the new IS offers new chances and opportunities for success in the workplace is low.

Concerning the slope, we assume that employees higher in exploration-to-revert have a lower growth rate reappraisal of the new IS regarding perceived opportunity. Over time employees do not learn new ways to accomplish their task and instead try to remain in old habits (Polites and Karahanna 2012, 2013). In addition, employees exhibiting this behavior do not use the new IS in the prescribed manner, so the chance of success decreases. Moreover, exploration-to-revert leads to issues in the organization as employees do not use the new IS appropriately, so employees are not able to execute business processes successfully (Bala and Venkatesh 2015) which also reduces the chance of experiencing the benefits the new IS offers. Therefore, employees reappraise the new IS in a more negative light and perceive fewer opportunities. Therefore, we assume that:

H1e: Employees with a higher initial performance of exploration-to-revert will have a lower initial perceived opportunity than employees with a lower initial performance of exploration-to-revert.

H1f: Employees rated high in exploration-to-revert will have a lower growth rate in reappraising the new IS regarding perceived opportunity.

Regarding the initial status of ***avoidance***, we assume that employees with a higher initial performance of avoidance have a lower initial perceived opportunity than employees with a lower initial performance of avoidance. Results from past research indicate that avoidance and perceptions of opportunity are negatively related (Bala and Venkatesh 2015). Employees avoiding the new IS as much as possible by using, for example, workarounds perceive fewer opportunities as they do not learn what the new IS might offer.

Regarding the slope, we assume that employees with high avoidance have a lower growth rate in reappraisal of the new IS regarding perceived opportunity. Employees who avoid using the new IS also reduce their level of belief that the new IS offers them a chance for success because the employees do not learn how to use the new IS and hence do not perceive the opportunities the system offers. Also, if employees abandon the new IS and complain about the adverse effects of the new IS rather than seeing any chance of personal growth or rewards, employees reappraise the new IS in a negative light and perceive fewer opportunities during the implantation phase. Hence, we assume:

H1g: Employees with a higher initial performance of avoidance will have a lower initial perceived opportunity than employees with a lower initial performance of avoidance.

H1h: Employees rated high in avoidance will have a lower growth rate in reappraising the new IS regarding perceived opportunity.

3.2 Perceived Threat

3.2.1 Reappraisal of the new IS regarding perceived threat

As mentioned above, reappraisal is a temporal development and modification of an early appraisal (Folkman 1982; Lazarus and Folkman 1984). We assume that the appraisal of the IS in terms of perceived threat changes during the implementation phase. Based on the employee behaviors and external information employees can reappraise the new IS more positively as well as more negatively during the implementation. For example, on the one side employees can get used to the new IS and develop new habits in their work routines (Limayem et al. 2007) so that the new IS is not as threatening as expected. Hence, their perceived threat decreases over time, so we assume that:

H2: Employees reappraise the new IS over time so that perceived threats will change with decreasing growth rates during the implementation phase.

3.2.2 Predicting the reappraisal of the new IS regarding perceived threat due to technology adaptation behaviors

Regarding the initial status of ***exploration-to-innovate***, we assume that employees with a higher initial performance of exploration-to-innovate have a lower initial perceived threat than employees with a lower initial performance of exploration-to-innovate. Employees who demonstrate this behavior will be proactively involved in discovering and expanding features for their personal gain and growth. Also, a past examination revealed a negative relation between exploration-to-innovate and perceived threat (Bala and Venkatesh 2015). Previous research has shown that some employees make considerable efforts to explore the IS to discover new functions and ways to creatively and innovatively carry out their work processes (Beaudry and Pinsonneault 2005).

Regarding the slope, we assume that employees rated high in exploration-to-innovate have a lower growth rate in reappraisal of the new IS regarding perceived threat. Employees who discover the new IS and hence develop new routines in using the new IS reduce the idea that the new IS degrades their performance as employees and are able to experience how the use of the new IS increases their effectiveness. Employees who actively explore the IS reappraise the new IS as less threating because they do not think the IS negatively

affects their performance as expected. Therefore, we assume that:

H2a: Employees with a higher initial performance of exploration-to-innovate will have a higher initial perceived threat than employees with a lower initial performance of exploration-to-innovate.

H2b: Employees high in exploration-to-innovate will have a higher growth rate in reappraising the new IS regarding perceived threat.

Regarding the initial status of ***exploitation***, we assume that employees with higher initial performance of exploitation have a lower initial perceived threat than employees with lower initial performance of exploitation. Employees who perform an exploitation behavior apply a benefits-satisficing strategy which encompasses problem- and emotion-focused aspects (Beaudry and Pinsonneault 2005), which both are assumed to reduce perceived threat (Liang and Xue 2009). In addition, literature indicates that exploitation and perceptions of threat are negatively related (Bala and Venkatesh 2015).

Regarding the slope, we assume that employees rated high in exploitation have a lower growth rate in reappraisal of the new IS regarding perceived threat. Based on the time-dependent learning nature of the exploitation behavior due to training sessions, employees develop expertise in using relevant features and hence know how to use the new IS, which reduces the perception that the new IS will harm employee's performance. Also, the support from co-workers or the help desk strengthens employee perceptions that the newly implemented IS will not have an impact on their well-being (Yan and Tan 2014). Therefore, employees reappraise the new IS as less threatening during the implementation phase, as by applying this adaption behavior employees have a somewhat positive experience when using the new IS so that initial perceived expectations of threat disappear. Hence, we assume:

H2c: Employees with a higher initial performance of exploitation will have a higher initial perceived threat than employees with a lower initial performance of exploitation.

H2d: Employees high in exploitation will have a higher growth rate in reappraising the new IS regarding perceived threat.

Regarding the initial status of **e*xploration-to-revert***, we assume that employees with a higher initial performance of exploration-to-revert have a higher initial perceived threat than employees with lower initial performance of exploration-to-revert. The exploration-to-revert behavior includes, among others, workarounds (Laumer et al. 2017), whereby employees performing these behaviors do not use the new IS in an appropriate manner. This might also lead to health (i.e., more people calling in sick) or work-related (i.e., less job satisfaction) consequences (Laumer et al. 2012).

Regarding the slope, we assume that employees rated high in exploration-to-revert have a higher growth rate in reappraising the new IS regarding perceived threat. Over time exploration-to-revert leads to problems in an organization which are based on the unappropriated use of the new IS. Consequently, employees are not able to successfully perform their work, and they experience even more fatal consequences than initially expected. These issues predict an even worse threat to employees which they project onto the new IS. Hence, employees reappraise the new IS as being more threatening as they increasingly experience negative aspects of the new IS by applying exploration-to-revert as an adaption behavior. Hence, we assume that:

H2e: Employees with a higher initial performance of exploration-to-revert will have a higher initial perceived threat than employees with lower initial performance of exploration-to-revert.

H2f: Employees rated high in exploration-to-revert will have a higher growth rate in reappraising the new IS regarding perceived threat.

Regarding the initial status of ***avoidance***, we assume that employees with a higher initial performance of avoidance have a higher initial perceived threat than employees with a lower initial performance of avoidance. Employees who avoid the new IS completely have a high threat perception in the first place (Bala and Venkatesh 2015) which increases because they believe they can accomplish their work tasks more effectively without using the new IS. They believe that they do not need the new IS and do not want to use

the system (Lapointe and Rivard 2005).

Regarding the slope, we assume that employees rated high in avoidance have a higher growth rate in reappraiing the new IS regarding perceived threat. The more employees avoid or abandon the new IS over time, the more employees perceive that they do not want to use the system and think they are more effective without it (cf. Laumer et al. 2017), and consequently its perceived threat increases. Hence, employees reappraise the new IS as more threatening when applying avoidance as a technology adaption behavior, so that we assume:

H2g: Employees with a higher initial performance of avoidance will have a higher initial perceived threat than employees with a lower initial performance of avoidance.

H2h: Employees rated high in avoidance will have a higher growth rate in reappraisal of the new IS regarding perceived threat.

3.3 Perceived Controllability

3.3.1 Reappraisal of the new IS regarding perceived controllability

Based on reappraisal research (Folkman 1982; Lazarus and Folkman 1984), we assume that perceived controllability is also not appraised just once but reappraised during the implementation of a new IS, as it takes years until the implementation is completed (Morris and Venkatesh 2010; Sykes 2015; Sykes and Venkatesh 2017). Employees reappraise the new IS in terms of perceived controllability based on the abilities and resources which are needed to deal with the new IS. When the use of the new IS entails a learning behavior, and the organization provides resources so that an employee can get used to using the new IS, employees increasingly perceive that they have the abilities to deal with the new IS appropriately. Hence, their perceived controllability will increase. Hence, we assume that:

H3: Employees reappraise the new IS over time so that perceived controllability changes with increasing growth rates during the implementation phase.

3.3.2 Predicting the reappraisal of the new IS regarding perceived controllability due to technology adaptation behaviors

Regarding the initial status of ***exploration-to-innovate***, we assume that employees with a higher initial performance of exploration-to-innovate have a higher initial perceived controllability than employees with a lower initial performance of exploration-to-innovate. By applying this adaption behavior, employees strive to find and use various IS features to accomplish their tasks and realize the opportunities the IS provides (Beaudry and Pinsonneault 2005). Hence, employees with the knowledge and resources to use IS effectively (i.e., perceived controllability) are more likely to use this knowledge, and their resources to leverage IS to make the most possible from the IS (Venkatesh et al. 2012).

Regarding the slope, we assume that employees rated high in exploration-to-innovate have a higher growth rate in reappraising the new IS regarding perceived controllability. The exploration of the system and the problem-focused manner of the technology adaptation behavior increase knowledge and resources, so that the perceived controllability increases over time. Therefore, employees reappraise the new IS as they have more perceived controllability. Therefore, we assume that:

H3a: Employees with a higher initial performance of exploration-to-innovate will have a higher initial perceived controllability than employees with a lower initial performance of exploration-to-innovate.

H3b: Employees rated high in exploration-to-innovate will have a higher growth rate in reappraising the new IS regarding perceived controllability.

Regarding the initial status of ***exploitation***, we assume that employees with a higher initial performance of exploitation have a higher initial perceived controllability than employees with a lower initial performance of exploitation. According to Bala and Venkatesh (2015), exploitation is conceptually similar to deep structure use (Jasperson et al. 2005) and routine use of IS (Thatcher et al. 2011), which both implicate a high

degree of controllability. For example, deep structure use and routine use of IS entail that employees behave less reflectively and more intuitively, which in turn requires high controllability (e.g., Turel and Qahri-Saremi 2017).

Regarding the slope, we assume that employees rated high in exploitation have a higher growth rate in reappraising new IS regarding perceived controllability. The time-dependent learning nature of exploitation demonstrates that the abilities and the resources to deal with the new IS increases when performing exploitation. For example, as employees adopt a set of features due to support from others, the self-efficacy and the competencies to use the new IS increase (Taylor 2011), so that employees reappraise the perceived controllability as higher. Therefore, we assume:

H3c: Employees with a higher initial performance of exploitation will have a higher initial perceived controllability than employees with a lower initial performance of exploitation.

H3d: Employees high in exploitation will have a higher growth rate in reappraising the new IS regarding perceived controllability.

Regarding the initial status of ***exploration-to-revert***, we assume that employees with a higher initial performance of exploration-to-revert have a lower initial perceived controllability than employees with lower initial performance of exploration-to-revert. Employees performing exploration-to-revert have a high perceived controllability in the first place (Bala and Venkatesh 2015). As employees performing this behavior serarch only for features to support their old ways of doing things they do not fully take control of the new system.

Regarding the slope, we assume that employees rated high in exploration-to-revert have a higher growth rate in reappraising the new IS regarding perceived controllability. Over time, employees do not learn how to use the new IS and the new processes, but instead try to maintain what they have done in the past, so that the abilities and resources to deal with the new IS decrease. Also, exploration-to-revert entails that employees do not use the new IS appropriately leading to organizational problems which decrease the ability to deal with the new IS. Therefore, employees reappraise the new IS as they have less perceived controllability over time. Therefore, we assume:

H3e: Employees with a higher initial performance of exploitation will have a higher initial perceived controllability than employees with a lower initial performance of exploration-to-innovate.

H3f: Employees rated high in exploitation will have a higher growth rate in reappraising the new IS regarding perceived controllability.

Regarding the initial status of ***avoidance***, we assume that employees with a higher initial performance of avoidance have a higher initial perceived controllability than employees with a lower initial performance of avoidance. Employees performing avoidance behavior have low controllability in the first place (Bala and Venkatesh 2015). As employees try to avoid the using the system they do not obtain controlability over the new IS.

Regarding the slope, we assume that employees rated high in avoidance have a higher growth rate in reappraising the new IS regarding perceived controllability. If employees perform this behavior, they do not use the new IS at all and consequently do not learn how to use the system and so do not develop abilities which would help them deal with the new IS. As avoidance entails that employees perform their work task without using the new IS, no experience can be developed. Therefore, employees reappraise the new IS as they have less perceived controllability over time.

H3g: Employees with a higher initial performance of exploitation will have a higher initial perceived controllability than employees with lower initial performance of exploration-to-innovate.

H3h: Employees high in exploitation will have a higher growth rate in reappraising the new IS regarding perceived controllability.

4 RESEARCH METHODOLOGY: DESIGN AND MEASUREMENT

To test our hypotheses, we use a longitudinal method because we measured the variables at three points in time. In this section, we first demonstrate the research site and give information about the sample. Afterwards we explain the data collection process.

4.1 RESEARCH SITE AND PARTICIPANTS

To validate our research model, we conducted a longitudinal field study in the university library implementing an enterprise content management (ECM) system (vom Brocke et al. 2011). ECM systems are a modern approach to information management systems and are defined as *"a dynamic combination of strategies, methods, and tools used to capture, manage, store, preserve, and deliver information supporting key organizational processes through its entire lifecycle"* (Association for Information and Image Management 2018). The ECM system is implemented in incremental steps whereby employees are only able to use systems and the newly implemented ECM system. Thereby, the use of the new ECM system is recommended but not mandatory as the employees are able to use legacy systems or might be able to accomplish their tasks without using an IS.

The university library is structured in four different departments and operates six sub-libraries spread throughout the whole city. The library provided us with a list of all employees who were identified as a user of the ECM system. These employees are from multiple departments, such as the directorate, information technology, acquisitions and cataloging, and the user department. As we conducted an online survey, each employee was personally invited to participate in all of the three measurement waves so that the data of each measurement wave could be connected with each other. We thereby followed the rules of the Federal Data Protection Act whereby all personal information of the participants is kept strictly confidential and is only to be used for scientific purposes.

The university library has 90 permanent employees which we invited to our study. Given the study duration was one month with three points of measurement, it was not feasible to have all the invited employees participate throughout the study. Overall, we were able to receive across the three waves an entire response rate of 66.6 percent. As we use HLM, which is especially suitable for a small sample size (Raudenbush and Bryk 2002), the response rate is appropriate for validating that research model. The majority of the participants is between 45 and 64 and have worked more than ten years at the library. Approximately one third are women (see Table 2).

Demographics			**Age (%)**		**Marital status (%)**		**Education (%)**		**Work arragment (%)**		**Tenure (%)**	
Gender (%)	Men	68.3	15-24	7.3	Single	20.0	High school	5.0	Full time	65.9	<2	10.3
	Women	31.7	25-34	14.6	Married	42.5	Apprenticeship	20.0	Part time	34.1	3-4 years	7.7
			35-44	22.0	Divorced	2.5	Undergraduate, graduate, PhD	75.0			5-6 years	12.8
			45-54	14.6	Registered partnership	20.0					7-8 years	10.3
			55-64	39.0	Widowed	2.5					9-10 years	0.0
			> 65	2.4	Others	12.5					More than 10 years	59.0

Table 2.Study participants

4.2 DATA COLLECTION PROCESS

We started the study two months after the initial implementation of the system to ensure that all the participants had already used the system and were able to report cognitions and behaviors. Before the study, we requested that the director of the university library send an initial email to all participating employees in which he introduced the questionnaire and prepared the participants for the three measurement waves. In the first wave (t0) we captured reappraisal, technology adaptation behaviors, and several demographics using the measurement model provided by Bala and Venkatesh (2015) (see Table 7 Appendix). We were able to capture reappraisal in the first wave (t0) as the participants had already used the new IS prior to our

measurement, so they had developed the initial cognitive behavior beforehand. After the first wave, participants worked an additional two weeks with the ECM system. In the second wave (t1), we captured the reappraisal and technology adaptation behaviors using the same measurement model as in first wave (to). Subsequently, a two-week use phase followed and in wave three (t2) we again captured the constructs of interest. The data collection process is shown in Table 3.

Activity before measures	Measures	Activity between measures	Measures	Activity between measures	Measures
System use for two months	Reappraisal Technology adaptation behaviors Demographics	System use for two weeks	Reappraisal Technology adaptation behaviors	System use for two weeks	Reappraisal Technology adaptation behaviors
t0		t1		t2	

Table 3: Data collection procedure

5 RESEARCH RESULTS

We used hierarchical linear modeling (HLM) (also termed multilevel modeling or mixed models) to model the reappraisal as a linear function of time and the interaction of the four predictors with time in a mixed effects longitudinal modeling framework (Singer and Willett 2003). HLM was used because the outcome variables (perceived opportunity, threat, and controllability) are measured over time and thus the measures over time (t0, t1, t2) are nested within each individual. We applied HLM as such analyses techniques consider the longitudinal structure of our research model (Klein and Kozlowski 2000; Raudenbush and Bryk 2002). In addition, HLM allows for unbalanced data and does not require independence of observation on different levels. This technique allows us to control for level specific unobserved heterogeneity by including random-effect and fixed-effect (Wooldridge 2002). For the analysis, we used SPSS 24.0 (IBM Corp. Released 2016). Before accessing the results, we made sure that the research model was valid and reliable. To this end we performed a confirmatory composite analysis (CCA), which is the sibling of the factor-based confirmatory factor analyses (Henseler et al. 2016b), and checked for invariances, content validity, indicator reliability, construct reliability and also made sure that the intraclass correlation was appropriated for the use of HLM.

5.1 MEASUREMENT MODEL

To provide a valid and reliable measurement model for testing our hypotheses we first assessed the measurement model used.

Confirmatory composite analysis (CCA): Measurement invariance tests are a prerequisite to HLM (Bala and Venkatesh 2013) because the results are compared across time. To assess measurement invariance, we drew on the measurement invariance of composite models (MICOM) procedure by Henseler et al. (2016b). The MICOM involves three steps: (1) configural invariance (i.e., equal parameterization and way of estimation), (2) compositional invariance (i.e., equal indicator weights), and (3) the equality of composite mean values and variances. All forms of invariance were strongly supported for all variables. The detailed results of invariance test are presented in Appendix Table 6.

Content validity. To ensure content validity, we used items that have been used in prior research articles (see Appendix Table 7) and discussed each item within our project team. We built upon the research model by Bala and Venkatesh (2015) and adapted the questions of cognitive appraisal and technology adaptation behaviors.

Indicator reliability. This reflects the rate of the variance of an indicator that comes from the latent variables. To ensure that 50 percent or more of the variance is explained by the indicators, each value should be at least 0.707 (Carmines and Zeller 2008). All other items have been removed from the model. Table 7 in the Appendix shows that this condition is fulfilled.

Construct reliability. To determine construct quality, we used composite reliability, which should be at least 0.7, and average variance extracted (AVE), which has to be at least 0.5 (Fornell and Larcker 1981). Both criteria were fulfilled (see Table 4). Also, the Cronbach's Alpha of all constructs in the main model was higher than 0.7 (see Appendix Table 7).

Intraclass correlation (ICC). As we used HLM, in line with past literature (Ko and Dennis 2011) we controlled whether its conductance was warranted by using the ICC, which represents the differences of the dependent variables across employees and the significance of the intercept. The results show that the ICC for each dependent variables (opportunity = 89.8%; threat = 84.3%; controllability = 48.3%) was appropriate and the intercept of each variables was significant (see Table 5). Hence, we can conclude for all three variables that the performance of HLM was warranted.

	Constructs	Mean	SD	CR	AVE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Perceived opportunity (t0)	4.41	1.31	.924	.755																				
2	Perceived opportunity (t1)	4.31	1.52	.944	.840	.937																			
3	Perceived opportunity (t2)	4.31	1.52	.905	.858	.926	.894																		
4	Perceived threat (t0)	2.45	1.46	.943	.805	-.560	-.648	-.622																	
5	Perceived threat (t1)	2.21	1.42	.944	.808	-.579	-.641	-.531	.767																
6	Perceived threat (t2)	2.07	1.21	.905	.712	-.538	-.607	-.475	.814	.881															
7	Perceived controllability (t0)	4.81	1.40	.962	.863	.770	.780	.767	-.734	-.665	-.659														
8	Perceived controllability (t1)	4.32	2.70	.958	.852	.729	.847	.745	-.809	-.676	-.681	.855													
9	Perceived controllability (t2)	5.08	1.20	.959	.852	.580	.673	.629	-.685	-.732	-.632	.818	.834												
10	Exploration-to-innovate (t0)	3.68	1.92	.964	.870	.769	.796	.775	-.676	-.624	-.575	.550	.679	.554											
11	Exploration-to-innovate (t1)	3.81	1.61	.964	.872	.757	.730	.794	-.574	-.581	-.488	.524	.612	.525	.835										
12	Exploration-to-innovate (t2)	3.47	1.55	.983	.936	.826	.831	.860	-.654	-.632	-.563	.577	.699	.608	.873	.889									
13	Exploitation (t0)	4.63	1.84	.969	.886	.583	.644	.619	-.835	-.782	-.734	.592	.690	.670	.723	.591	.749								
14	Exploitation (t1)	4.45	1.70	.969	.888	.515	.574	.464	-.710	-.629	-.713	.602	.733	.630	.591	.515	.524	.694							
15	Exploitation (t2)	4.58	1.78	.980	.923	.646	.698	.668	-.711	-.702	-.651	.588	.686	.671	.748	.674	.731	.839	.816						
16	Exploration-to-revert (t0)	2.72	1.40	.924	.859	.094	.056	.021	-.021	-.059	-.146	-.057	-.068	-.170	.138	.162	.118	.105	.018	.147					
17	Exploration-to-revert (t1)	2.29	1.20	.901	.822	.201	.170	.081	-.030	-.054	-.144	.143	-.011	-.135	.047	.021	-.077	-.087	.071	.073	.550				
18	Exploration-to-revert (t2)	2.21	1.24	.949	.904	.045	-.020	.138	.143	.163	.312	-.012	-.139	-.155	.003	.183	.001	-.054	-.346	-.051	.441	.294			
19	Avoidance (t0)	2.55	1.36	.910	.718	-.535	-.578	-.503	.277	.331	.228	-.344	-.543	-.539	-.574	-.519	-.587	-.303	-.521	-.544	.272	.200	.375		
20	Avoidance (t1)	2.57	1.66	.942	.805	-.615	-.591	-.567	.657	.744	.651	-.607	-.631	-.620	-.634	-.629	-.696	-.643	-.653	-.681	-.053	.054	.247	.605	
21	Avoidance (t2)	2.40	1.60	.980	.924	-.683	-.664	-.642	.676	.669	.622	-.645	-.698	-.560	-.673	-.686	-.688	-.631	-.579	-.638	-.095	.045	.055	.411	.802	

Table 4. Measurement model of the overall sample

5.2 RESULTS

Longitudinal analyses integrate intercepts and slopes of constructions to capture the initial status of individuals (intercept) of constructs (at the first time point) and to develop a trajectory (slope) for each individual over time. Each individual has their own intercept and slope, and considerable inter-individual variation is expected in both the intercept and the slope. Table 5 shows graphically the intercepts and slopes of perceived opportunity, perceived threat, and perceived controllability.

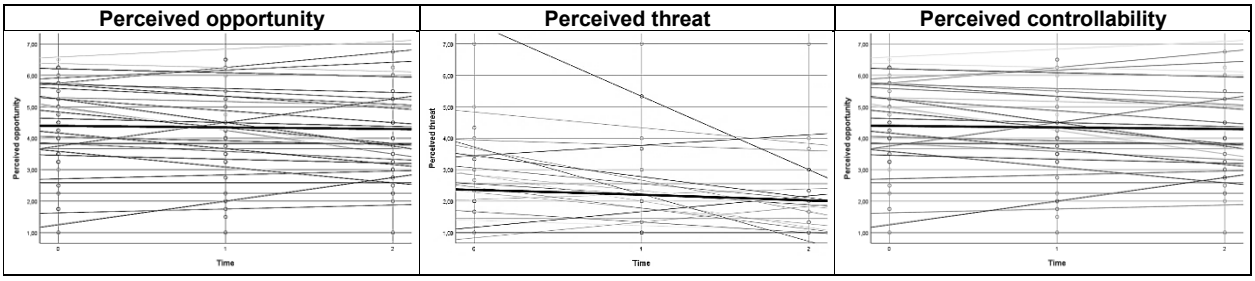

Table 5: Intercepts and slopes of each individual

Our underlying motivation for estimating five different models was that we were interested in investigating which technology adaptation behavior predicts reappraisal. Therefore, stepwise-we amended a simple baseline model (Model 1; $\gamma_{ti} = \beta_{00} + \beta_{10}(time)_{ti} + r_{0i} + r_{1i} + \in_{ti})$ with the specific predictors defined in our theoretical development section to analyze how the model fit would differ between them (Raudenbush and Bryk 2002). The baseline Model 1 included random intercepts and slope. Next, we obtained Model 2-5 by adding our predictor variables exploration-to-innovate (Model 2; $\gamma_{ti} = \beta_{00} + \beta_{10}(TIME)_{ti} + \beta_{20}(EXPLRI)_{ti} + \beta_{30}(EXPLRI * TIME)_{ti} + r_{0i} + r_{1i} + \in_{ti})$, exploitation (Model 3; $\gamma_{ti} = \beta_{00} + \beta_{10}(TIME)_{ti} + \beta_{20}(EXPLT)_{ti} + \beta_{30}(EXPLT * TIME)_{ti} + r_{0i} + r_{1i} + \in_{ti})$, exploration-to-revert (Model *4*; $\gamma_{ti} = \beta_{00} + \beta_{10}(TIME)_{ti} + \beta_{20}(EXPLRV)_{ti} + \beta_{30}(EXPLRV * TIME)_{ti}\, r_{0i} + r_{1i} + \in_{ti})$, avoidance

(*Model 5*; $\gamma_{ti} = \beta_{00} + \beta_{10}(TIME)_{ti} + \beta_{20}(AVOID)_{ti} + \beta_{30}(AVOID * TIME)_{ti} + r_{0i} + r_{1i} + \in_{ti}$) for all three variables perceived opportunity, threat, and controllability.

The parameters are estimated using a mixed-effects maximum likelihood regression procedure. We assessed statistics and calculated corresponding *p*-values for the path coefficients (Rabe-Hesketh and Skrondal 2012). Moreover, we evaluated and compared the nine different regression models using established goodness-of-fit test statistics (McCullagh and Nelder 1999). Specifically, we computed log-likelihood values (Box et al. 1994) and compared the results between the models. The HLM results for the perceived opportunity, threat, and controllability are presented in Table 5 and explained subsequently.

Concentrating on perceived *opportunity***,** findings show that we found no significant slope, so that there was no linear growth in perceived opportunity during the implementation phase of the new IS. Hence, we found no support for H1 (Model 1; $ß_{10} = -0.090$; $p > 0.05$), which might be explained by the positive and negative influences from the adaption behaviors negating each other so that no effect could be found.

Regarding the predictor variables, findings indicate regarding the initial starting point that exploration-to-innovate (Model 2; $ß_{20} = 0.545$; $p < 0.005$) and exploitation (Model 4; $ß_{20} = 0.339$; $p < 0.005$) increases perceived opportunity, so we can support H1a and H1c, whereas no significant effect can be found for avoidance (Model 8; $ß_{20} = -0.162$, $p > 0.05$) so H1g cannot be supported. In addition, the effect of exploration-to-revert (Model 6; $ß_{20} = 0.161$; $p < 0.05$) is significant but reversed, so employees initially high in exploration-to-revert have higher perceived opportunity than those low in exploration-to-revert. Therefore, H1e cannot be supported. Regarding the influences of the IT adaptation behavior on the slope of perceived opportunity, the findings demonstrate that exploration-to-innovate (Model 3; $ß_{20} = 0.090$; $p > 0.05$), exploitation (Model 5; $ß_{20} = -0.020$; $p > 0.05$), exploration-to-revert (Model 7; $ß_{20} = 0.039$; $p > 0.05$), and avoidance (Model 9; $ß_{20} = 0.083$, $p > 0.05$) have no effect on the timely development of opportunity, so H1b,d,f,h cannot be supported.

Turning to perceived *threat*, findings show that we found a significant slope, indicating there is a linear growth in perceived threat during the use phase (Model 1; $ß_{10} = -0.221$; $p < 0.005$). Hence, perceived threat decreases during the implementation phase of the new IS, so H2 can be supported.

Regarding the predictor variables, findings indicate concerning the initial starting point that exploration-to-innovate (Model 2; $ß_{20} = -0.439$; $p < 0.005$) and exploitation (Model 4; $ß_{20} = 0.-678$; $p < 0.005$) decreases perceived threat, so we can support H2a and H2c. In addition, avoidance (Model 6; $ß_{20} = 0.418$; $p < 0.005$) increased perceived threat, so H2g can be supported, whereas no significant effect can be found for exploration-to-revert (Model 8; $ß_{20} = 0.121$; $p > 0.05$), so H2e cannot be supported. Regarding the influences of the IT adaptation behavior on the slope of perceived threat, the findings demonstrate that exploration-to-innovate (Model 3; $ß_{30} = 0.096$; $p > 0.05$), exploration-to-revert (Model 7; $ß_{30} = -0.076$; $p > 0.05$), and avoidance (Model 9; $ß_{30} = -0.069$, $p > 0.05$) have no effect on the timely development of opportunity, so H1b, H1f, and H1h cannot be supported. In the case of exploitation (Model 5; $ß_{30} = 0.305$; $p < 0.005$) a significant reversed effect could be found, so employees high in exploration are found to have a more positive slope than employees at the grand mean. Consequently, H1d cannot be supported.

Concentrating on perceived *controllability***,** findings show no significant slope so there is no linear growth in perceived controllability during the implementation phase (Model 1; $ß_{10} = -0.246$; $p > 0.05$). Hence, we found no support for H3, which might be explained by the positive and negative influences of the adaption behaviors negating each other such that no effect could be found.

Regarding the predictor variables, findings concerning the initial starting point indicate that exploration-to-innovate (Model 2; $ß_{20} = 0.437$; $p < 0.005$) and exploitation (Model 4; $ß_{20} = 0.424$; $p < 0.005$) increases perceived controllability, so we can support H3a and H3c, whereas no significant effect can be found for exploration-to-revert (Model 6; $ß_{20} = 0.245$; $p > 0.05$) and avoidance (Model 8; $ß_{20} = 0.463$; $p > 0.05$), so H3e and H3g cannot be supported. Regarding the influences of IT adaptation behavior on the slope of perceived

controllability, the findings demonstrate that exploration-to-innovate (Model 3; $ß_{30}$ = -0.303; p > 0.05) and exploration-to-revert (Model 7; $ß_{20}$ = 0.129; p > 0.05) have no effect on the timely development of controllability, so H3b and H3f cannot be supported. In the case of exploitation (Model 5; $ß_{30}$ = -0.450; p < 0.005) and avoidance (Model 9; $ß_{20}$ = 0.369, p < 0.05) a significant reversed effect could be found such that employees high in exploitation have a negative slope in controllability and employees high in avoidance have a positive slope in controllability. Hence, H3d and H3h cannot be supported.

Model	1	2	3	4	5	6	7	8	9
Perceived opportunity									
Intercept	4.427*** (0.181)	4.434*** (0.155)	4.432*** (0.152)	4.408*** (0.171)	4.409*** (0.169)	4.450*** (0.194)	4.450*** (0.194)	4.458*** (0.18)	4.458*** (0.166)
Time (ß10)	-0.090^{NS} (0.181)	-0.051^{NS} (0.062)	-0.055^{NS} (0.058)	-0.075^{NS} (0.059)	-0.075^{NS} (0.059)	-0.081^{NS} (0.056)	-0.081^{NS} (0.057)	-0.092^{NS} (0.057)	-0.089^{NS} (0.063)
EXPLRI[a] (ß20)	-	0.545*** (0.113)	0.468*** (0.127)	-	-	-	-	-	-
Time* EXPLRI[a] (ß30)	-	-	0.090^{NS} (0.06)	-	-	-	-	-	-
EXPLT[a] (ß20)	-	-	-	0.339*** (0.106)	0.357*** (0.122)	-	-	-	-
Time*EXPLT[a] (ß30)	-	-	-	-	-0.020^{NS} (0.064)	-	-	-	-
EXPLRV[a] (ß20)	-	-	-	-	-	0.161* (0.062)	0.128^{NS} (0.098)	-	-
Time*EXPLRV[a] (ß30)	-	-	-	-	-	-	0.039^{NS} (0.067)	-	-
AVOID[a] (ß20)	-	-	-	-	-	-	-	-0.162^{NS} (0.088)	-0.272* (0.106)
Time*AVOID[a] (ß30)	-	-	-	-	-	-	-	-	0.083^{NS} (0.072)
Model fit									
-2LL	287.769	253.849	254.092	249.973	249.928	257.809	257.613	260.804	260.807
Δ X^2		33.92***	-0.243^{NS}	37.796***	0.045^{NS}	29.96***	0.196^{NS}	26.965***	-0.003^{NS}
AIC	299.769	267.849	270.092	263.973	265.928	271.809	273.613	274.804	276.807
BIC	316.239	286.624	291.549	282.551	287.16	290.453	294.921	293.513	298.19
Perceived threat									
Intercept	2.397*** (0.212)	2.395*** (0.192)	2.394*** (0.189)	2.386*** (0.151)	2.382*** (0.131)	2.396*** (0.211)	2.396*** (0.214)	2.397*** (0.196)	2.396*** (0.195)
Time (ß10)	-0.221*** (0.212)	-0.247*** (0.081)	-0.256*** (0.079)	-0.213* (0.090)	-0.228* (0.097)	-0.218** (0.077)	-0.215** (0.077)	-0.218* (0.081)	-0.220*** (0.079)
EXPLRI[a] (ß20)	-	-0.439*** (0.138)	-0.531*** (0.16)	-	-	-	-	-	-
Time* EXPLRI[a] (ß30)	-	-	0.096^{NS} (0.083)	-	-	-	-	-	-
EXPLT[a] (ß20)	-	-	-	-0.678*** (0.118)	-0.874*** (0.122)	-	-	-	-
Time*EXPLT[a] (ß30)	-	-	-	-	0.305*** (0.097)	-	-	-	-
EXPLRV[a] (ß20)	-	-	-	-	-	0.121^{NS} (0.082)	0.193^{NS} (0.127)	-	-
Time*EXPLRV[a] (ß30)	-	-	-	-	-	-	-0.076^{NS} (0.091)	-	-
AVOID[a] (ß20)	-	-	-	-	-	-	-	0.418*** (0.108)	0.466*** (0.139)
Time*AVOID[a] (ß30)	-	-	-	-	-	-	-	-	-0.069^{NS} (0.088)
Model fit									
-2LL	300.273	291.365	290.205	282.379	278.427	296.917	296.366	289.279	288.781
Δ X^2		8.908***	1.16^{NS}	17.894***	3.952**	3.356*	0.551^{NS}	10.994***	0.498^{NS}
AIC	312.273	305.365	306.205	296.379	294.427	310.917	312.366	303.279	304.781
BIC	328.254	324.009	327.513	314.89	315.582	329.494	333.598	321.923	326.089
Controllability									
Intercept	4.680*** (0.186)	4.827*** (0.167)	4.823*** (0.164)	4.827*** (0.166)	4.834*** (0.147)	4.838*** (0.19)	4.840*** (0.19)	4.821*** (0.188)	4.825*** (0.184)
Time (ß10)	0.246^{NS} (0.186)	0.119^{NS} (0.171)	0.106^{NS} (0.164)	0.162^{NS} (0.178)	0.143^{NS} (0.168)	0.096^{NS} (0.167)	0.101^{NS} (0.174)	0.104^{NS} (0.167)	0.114^{NS} (0.16)
EXPLRI[a]	-	0.437*** (0.143)	0.589*** (0.163)	-	-	-	-	-	-
Time*EXPLRI[a]	-	-	-0.303^{NS} (0.157)	-	-	-	-	-	-
EXPLT[a] (ß20)	-	-	-	0.424*** (0.141)	0.632*** (0.146)	-	-	-	-
Time*EXPLT[a] (ß30)	-	-	-	-	-0.450*** (0.163)	-	-	-	-
EXPLRV[a] (ß20)	-	-	-	-	-	0.147^{NS} (0.151)	0.087^{NS} (0.191)	-	-
Time*EXPLRV[a] (ß30)	-	-	-	-	-	-	0.129^{NS} (0.172)	-	-
AVOID[a] (ß20)	-	-	-	-	-	-	-	-0.080^{NS} (0.154)	-0.280^{NS} (0.178)
Time*AVOID[a] (ß30)	-	-	-	-	-	-	-	-	0.369* (0.168)
Model fit									
-2LL	371.269	251.876	248.275	243.063	238.9	252.481	252.122	255.806	251.29
Δ X^2		119.393***	3.601*	128.206***	4.163**	118.788***	0.359^{NS}	115.463***	4.516**
AIC	383.269	265.876	264.275	257.063	254.9	266.481	268.122	269.806	267.29
BIC	399.58	282.462	283.231	273.378	273.546	282.888	286.873	286.302	286.144

Note: *** p < 0.005; ** p < 0.01; * p < 0.05; NS p > 0.05; EXPLRI: exploration-to-innovate; EXPLT: exploitation; EXPLRV: exploration-to-revert; AVOID: avoidance; [a]= group centered; values in parentheses = standard error

Table 6: HLM results

6 DISCUSSION

Employees have to adapt towards new IS because organizations continuingly implement new IS to increase efficiency and effectiveness (Bala and Venkatesh 2015; Morris and Venkatesh 2010; Sykes 2015). Employees are forced to adapt to newly implemented IS (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005). In particular, employees first appraise the newly implemented IS and, second, perform an adaptive behavior (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005) to increase organizational efficiency and effectiveness. However, previous IS literature treats appraisal and technology adaptation behavior towards IS implementation as a static process (Bala and Venkatesh 2015), whereby psychological literature shows that it instead depicts a continual process of appraisal-adaptation-reappraisal unfolding over time (Folkman 1982; Lazarus and Folkman 1984). Past IS literature only investigates the appraisal-adaptation relationship (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005) and neglects reappraisal.

As technology adaptation behaviors of employees are essential for the successful implementation of an IS, the present study tries to examine how employees reappraise the new IS and how technology adaptation behaviors influence theses reappraisals over time. We conducted a longitudinal study in a university library, which implemented a new IS to validate the research model. Our findings indicate that perceived threat decreases significantly during the implementation phase of an IS, whereas perceived opportunity and controllability show no significant changes. Moreover, we demonstrate that technology adaption not only influences organizational outcomes but also reappraisal (initial state and slopes) during the implementation. The present paper contains several theoretical and practical contributions, which are discussed in the following.

6.1 THEORETICAL CONTRIBUTION

The present research provides three theoretical contributions. First, we introduce reappraisal regarding changed cognitive appraisal during the implementation phase of the IS. Second, we extend general adaptation literature by empirical testing the effect of reappraisal in the context of IS implementations. Third, we extend the technology adaptation model by providing empirical evidence that employees reappraise the new IS and by revealing decreasing and increasing effects of specific technology adaptation behaviors (e.g., exploration-to-innovate, exploitation, exploration-to-revert, and avoidance) on reappraisal.

6.1.1 Reappraisal: changed cognitive appraisal during an IS implementation

The present paper contributes to adaptation literature which considers the cognitive appraisal process by not only investigating how cognitive appraisal influence adaptive behavior but also by examining how employees reevaluate the IS implementation over time, which is called reappraisal. In particular, previous literature mostly captures cognitive appraisal towards an IS implementation conceptually or with a single wave measurement (Bala and Venkatesh 2015; Beaudry and Pinsonneault 2005) and neglects the reappraisal. For example, Beaudry and Pinsonneault (2005) conceptually develop the CMUA which partly considers reappraisal but does not validate this assumption empirically. In addition, Bala and Venkatesh (2015) build upon a multiple wave study, which however measures appraisal only within one wave and hence does not examine reappraisal during the implementation phase of a new IS. Hence, the present research contributes to the literature by conducting a longitudinal study capturing reappraisal towards IS implementation using three measurement waves. By applying a longitudinal analysis approach with hierarchical linear models (HLM), we can reveal reappraisal during an implementation phase of up to four weeks. The result shows that perceived threat is significantly reappraised by showing decreasing effects during the IS implementation phase.

In summary, we contribute to adaptation literature as we are one of the first to investigate reappraisal in the context of technology adaptation by using longitudinal data. In our study, we revealed significant reappraisals in terms of changes in cognitive appraisal over time. As we show that technology adaptation and reappraisal change over the implementation phases of an IS, one wave examinations offer only a snapshot of the current situation and do not consider the change over time, so future research should be aware of these changes by interpreting static results under this new light and so consider the effect of temporal changes.

6.1.2 Extending adaptation theory

The present research contributes to CMUA (Beaudry and Pinsonneault 2005) which conceptually assumes that technology adaptation behaviors lead to a reappraisal of the newly implemented IS by empirically proving their effect in the context of IS implementations. In particular, we demonstrate that technology adaptation behavior influences reappraisal. Our findings show that the technology adaptation behaviors increase perceived opportunity and controllability and decreases perceived threat regarding the initial status. In addition, some significant effects of adaptive behaviors on cognitive appraisal over time has been revealed. In the same light, we also empirically validate the assumptions by Liang et al. (2009), who theoretically suggest that adaptation efforts influence threat appraisal over time. Our findings underline the importance of the time-dependent effect of the CMUA (Beaudry and Pinsonneault 2005) such as the effect of technology

adaptation behaviors on reappraisal as shown in the present paper. As the effect of technology adaptation behavior and reappraisal are time-dependent, we call for a rigorous consideration of longitudinal effects by applying the CMUA.

In summary, we extend the CMUA (Beaudry and Pinsonneault 2005) by introducing the effect of reappraisal into the IS context and empirically demonstrate its effects. By investigating the effect of technology adaptation behavior on reappraisal we add another piece of the puzzle regarding how employees manage newly implemented IS, as appraisal and adaptation are no static but change over time as shown in the present paper. Future research based in the CMUA should consider reappraisal by investigating not only one point in the process of an IS implementation but consider the whole appraisal-adaptation-reappraisal process during the implementation phase, as the newly implemented IS is reappraised over time and which can be explained by technology adaptation behaviors. Hence, based on our results we call for a consideration of longitudinal effects when using CMUA as a theoretical basis for studies in the context of technology adaptation.

6.1.3 Extending the model of technology adaptation behaviors

In the context of technology adaptation, the present research extends the model of technology adaptation behaviors (Bala and Venkatesh 2015) which investigate the appraisal-adaptation relationship by concentrating on reappraisal and so investigate the adaptation-reappraisal relationship (Folkman 1982; Lazarus and Folkman 1984). In other words, the technology adaptation model investigates appraisal and adaptation as a static process which the present paper extends, as we show that employees reappraise the new IS which is influenced by technology adaptation behaviors.

More precisely, Bala and Venkatesh (2015) reveal that *exploration-to-innovate* is positively influenced by perceived opportunity and controllability and in turn increases job performance and satisfaction. The present research extends these findings by demonstrating that exploration-to-innovate in the relationship between adaptation and reappraisal also increases regarding the initial state of perceived opportunity, reduces perceived threat, and increases controllability. Also, we indicate that this technology adaptation behavior is indeed a benefits-maximizing strategy as it not only increases performance and satisfaction as shown by Bala and Venkatesh (2015), but also reduces perceived threat, and increases perceived opportunity and controllability regarding the initial status. Employees might get into a positive loop when performing this technology adaptation behavior as it is caused by perceived opportunity, and employees rated high in performing such behavior have a higher rate of initial perceived opportunity.

Concentrating on *exploitation*, Bala and Venkatesh (2015) show that perceived opportunity affects exploitation and that exploitation, in turn, increases job performance and satisfaction. We extend these findings by showing that exploitation regarding the initial state increases perceived opportunity and controllability, whereas perceived threat is reduced. Exploitation is also a benefits-maximizing strategy as it not only increases performance and satisfaction as shown by Bala and Venkatesh (2015), but also increases opportunity, controllability, and decreases threat regarding the initial state. One unanticipated finding is that exploration increases perceived threat and reduces perceived controlability over time, so employees rated high in performing such behavior perceive more threat and less controllability over time. One explanation might be that the employees realise by exploiting the IS the real extent of the new IS which reduces the controllability and increases the perception of threat.

Regarding *exploration-to-revert,* a previous examination shows that perceived threat increases and controllability decreases this kind of adaptive behavior (Bala and Venkatesh 2015). Also, exploration-to-revert reduces job performance and satisfaction. We show the reverse effect by concentrating on the adaptation-reappraisal relationship. The present paper indicates that exploration-to-revert behaves differently than hypothesized as it increases rather than decreases perceived opportunity regarding their initial states. Also, exploration-to-revert has no significant effect on perceived threat or controllability and also shows no effect on the slopes of cognitive appraisal. Hence, we show that exploration-to-revert indicates that although

it has a negative effect on job performance and satisfaction it still increases the perception of opportunity.

Focusing on *avoidance*, Bala and Venkatesh (2015) demonstrate that perceived opportunity and controllability negatively influence this technology adaptation behavior, whereas perceived threat increases avoidance. In addition, the previous literature shows that avoidance does not affect job performance and satisfaction. We extend these findings by demonstrating that avoidance also has a positive effect on perceived threat such that perceived threat is also the cause and the consequence of avoidance. Therefore, avoidance might not directly influence job performance and satisfaction of employees, but it increases the perception of threat. Hence, we show that the performance of avoidance is not irrelevant in the context of organizational outcomes as suggested by past research (Bala and Venkatesh 2015), it instead increases the threatening perceptions of the IS implementation and hence might influence job outcomes indirectly due to an increased perception of threat. Consequently, employees might get into a threatening and negative loop whereby perceived threat increases avoidance which in turn increases perceived threat. Contrary to expectations, this study shows that avoidance does not decreases perceived controllability but instead increases it over time. One explanation might be that employees avoid the new IS by performing workarounds to acompish their tasks and their succesful accomplishment increases their controllabiliy as they find such ways to control the situation with the new IS.

In summary, the present paper shows that the process of appraisal and adaptation unfolds over time, as shown by the reappraisal of the new IS. Moreover, we demonstrate that reappraisal is predicted by technology adaptation behavior, so we indicate that technology adaptation behaviors not only influence organizational outcomes and, for example, increase job performance but influence reappraisal over time, and might indirectly influence organizational outcomes by reappraising the new IS more favourably. As we indicate that employees might get into positive and negative loops, future adaptation research should investigate whether employees are trapped either in a positive or in a negative reappraisal loop, and should consider the longitudinal effect of appraisal-adaption-reappraisal. The unexpected and surprising effect of several adaptation behaviors should also be considered in future research.

6.2 Practical Implication

The present research contains several practical implications. Our findings should guide IS managers in developing effective change management strategies for an IS implementation. The present research indicates that technology adaptation behavior not only has an effect on organizational outcomes such as job performance or satisfaction but also on reappraisal during an IS implementation. Hence, managers should be aware that the appraisal of the IS implementation changes over time.

Regarding technology adaptation behaviors, we indicate positive as well as negative perception loops. On the on hand, exploration-to-innovate and exploitation are caused by opportunity and in turn increases opportunity, which depicts the positive perception loop. Managers should try to support the development of such positive loops. Technology adaptation behaviors also both reduce perceived threat and increase controllability. On the other hand, avoidance is caused by perceived threat and increases perceived threat, which depicts the negative loop. Therefore, IS manager should support exploration-to-innovate behaviors as they not only increase job performance but also reduce perceived threat and increase opportunity, as well as controllability during an IS implementation, and employees might thus get into the positive perception loop. In contrast, IS managers could develop a change strategy which reduces avoidance as employees might get into a negative loop where threat perception causes avoidance and avoidance again increases threat perception. Past literature indicates that avoidance behavior has no effect in the context of job performance and satisfaction, whereas the present research indicates that this behavior might indirectly influence organizational outcomes by increasing negative perceptions over time. Managers need strategies to disrupt these negative loops which might develop over time.

6.3 Limitations and Future Research

Like every form of research, the present study has several limitations. The study is based on a small overall sample size. Nevertheless, as HLM is especially suitable for such small samples (Raudenbush and Bryk 2002), the present sample is appropriate for evaluating the hypotheses. Moreover, we considered random effects by reappraisal but neglect this effect from technological appraisal behaviors. Therefore, future research might consider the linear growth of both, the reappraisal as well as technology adaptation behaviors. In addition, referring to the appraisal-adaptation-reappraisal relationship, the present study focuses only on the adaptation-reappraisal relationship and neglects the influences that reappraisal on technology adaptation behavior has over the implementation phase. Also, the present paper neglects the inside effects between perceived opportunity, threat, and controllability which might influence each other over time. Regarding technology adaptation behaviors, we only consider the four technology adaptation behaviors based on Bala and Venkatesh (2015), and neglect the numerous other adaptation behaviors which exist (see Table 1). Hence, future work might investigate other adaptation behaviors in the context of reappraisal. The present study investigates reappraisal over the time of four weeks, whereas adaptation literature demonstrates that the implementation phase of an IS can take up to one year depending on the size of the organization. As the size of the university library is small, a period of four weeks is deemed appropriate for the present study, but future research might investigate reappraisal in a bigger organizations and over a longer time period. In addition, previous literature in the context of IT implementation has shown that resistance is a significant influencing factor which we neglect in the present study. Also, the innovative use of an IS is limited by the functionalities of the IS, which we do not control for in the present study. Therefore, future research in this context should consider resistance as well as the requirements for using the IS in an innovative way.

7 Conclusion

Employees have to adapt to newly implemented IS, because organizations continuingly implement new IS to increase efficiency and effectiveness. However, the process of technology adaptation behavior is not stable as suggested by previous literature. It is instead dynamic such that employees reevaluate the new implemented IS over time, which is called reappraisal. As firms continue to implement IS, an understanding of reappraisal and the influence of technology adaptation behavior is vital to ensuring successful implementation and gaining a positive return on investment. Therefore, the present paper investigates reappraisal unfolding over time, and the influence of four different technology adaptation behaviors during the implementation phase of an IS. Our results show that employees reappraise the new IS during the implementation phase. Also, we offer insight in to how technology adaptation behavior influences reappraisal during the implementation phase of an IS.

8 References

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9 APPENDIX

Composite		Step 2			Step 3					
		c value (=1)	95% confidence interval	Compositional invariance?	Difference of the composite's mean value	95% confidence interval	Equal mean values?	Logarithm of the composite's variances ratio	95% confidence interval	Equal variances?
Perceived opportunity	t0 vs. t1	0.999	[0.996;1.000]	YES	0.004	[-0.465;0.473]	YES	-0.176	[-0.598;0.746]	YES
	t0 vs. t2	0.999	[0.998;1.000]	YES	-0.009	[-0.476;0.500]	YES	-0.266	[-0.615;0.695]	YES
	t1 vs. t2	1.000	[0.999;1.000]	YES	0.023	[-0.562;0.580]	YES	-0.100	[-0.661;0.684]	YES
Perceived threat	t0 vs. t1	0.999	[0.997;1.000]	YES	0.002	[-0.454;0.441]	YES	-0.153	[-0.755;0.818]	YES
	t0 vs. t2	0.999	[0.996;1.000]	YES	-0.012	[-0.517;0.458]	YES	0.146	[-0.972;0.947]	YES
	t1 vs. t2	1.000	[0.999;1.000]	YES	-0.018	[-0.579;0.483]	YES	0.297	[-1.220;1.171]	YES
Perceived controllability	t0 vs. t1	1.000	[0.999;1.000]	YES	-0.007	[-0.456;0.433]	YES	-0.261	[-0.522;0.701]	YES
	t0 vs. t2	1.000	[0.999;1.000]	YES	-0.003	[-0.501;0.472]	YES	0.339	[-0.694;0.710]	YES
	t1 vs. t2	1.000	[0.999;1.000]	YES	0.012	[-0.552;0.492]	YES	0.590	[-0.614;0.636]	YES
Exploration to innovate	t0 vs. t1	1.000	[0.999;1.000]	YES	0.007	[-0.459;0.482]	YES	0.448	[-0.486;0.554]	YES
	t0 vs. t2	1.000	[1.000;1.000]	YES	0.000	[-0.506;0.491]	YES	0.416	[-0.460;0.512]	YES
	t1 vs. t2	1.000	[0.999;1.000]	YES	0.033	[-0.515;0.601]	YES	-0.029	[-0.628;0.574]	YES
Exloitation	t0 vs. t1	1.000	[1.000;1.000]	YES	0.000	[-0.503;0.480]	YES	0.152	[-0.534;0.586]	YES
	t0 vs. t2	1.000	[1.000;1.000]	YES	0.006	[-0.458;0.482]	YES	0.029	[-0.536;0.629]	YES
	t1 vs. t2	1.000	[1.000;1.000]	YES	0.012	[-0.519;0.512]	YES	-0.127	[-0.538;0.573]	YES
ExplorationToRevert	t0 vs. t1	0.942	[0.768;1.000]	YES	-0.001	[-0.504;0.482]	YES	0.216	[-0.422;0.462]	YES
	t0 vs. t2	0.924	[0.623;1.000]	YES	0.005	[-0.495;0.494]	YES	0.641	[-0.604;0.601]	YES
	t1 vs. t2	0.922	[0.549;1.000]	YES	0.001	[-0.554;0.505]	YES	0.394	[-0.749;0.746]	YES
Avoidance	t0 vs. t1	0.995	[0.988;1.000]	YES	-0.018	[-0.476;0.426]	YES	-0.441	[-0.480;0.522]	YES
	t0 vs. t2	0.999	[0.995;1.000]	YES	-0.007	[-0.488;0.481]	YES	-0.371	[-0.654;0.676]	YES
	t1 vs. t2	0.998	[0.995;1.000]	YES	-0.009	[-0.512;0.566]	YES	0.055	[-0.690;0.680]	YES

Table 7: MICOM results

Constructs	Items	Loadings (min-max t0-t2)
Perceived threat α_{t0} = 0.917 α_{t1} = 0.916 α_{t2} = 0.851	I am scared that the system will have harmful (or bad) consequences for me.	0.875-0.982
	I am worried that the system may worsen my job performance.	
	I feel that the system might actually degrade my status in the organization.	
	I feel stressed about having to use the system to accomplish my job.	
Perceived opportunity α_{t0} = 0.899 α_{t1} = 0.940 α_{t2} = 0.940	I am confident that the system will have positive consequences for me.	0.735-0.952
	I feel that the system will open new avenues for success in my job.	
	The system will provide opportunities to improve my job performance.	
	The system will provide opportunities to gain recognition and praise.	
Perceived controllability α_{t0} = 0.940 α_{t1} = 0.935 α_{t2} = 0.937	I personally have what it takes to deal with the situations caused by the system.	0.901-0.965
	I have the resources I need to successfully use the system.	
	I have the knowledge necessary to use the system.	
	I am confident that I will be able to use the system without any problems.	
Exploration-to-innovate (EXPLRI) α_{t0} = 0.949 α_{t1} = 0.956 α_{t2} = 0.961	Explore the system for potential new application to my work context.	0.858-0.98
	Explore the system to find new ways of accomplishing my tasks.	
	Discover new ways of using the system to accomplish my tasks.	
	Experiment with the system to find features to accomplish tasks in novel ways.	
Exploitation (EXPLT) α_{t0} = 0.957 α_{t1} = 0.961 α_{t2} = 0.971	Routinely use the same features of the system that I learned from training or others to perform my tasks.	0.921-0.976
	Use a set of common system features that were suggested during the training or by others.	
	Routinely use a set of system features that were recommended during the training and by others	
	Use the features that I learned from training or from others to do my job.	
Exploration-to-revert (EXPLRV) α_{t0} = 0.897 α_{t1} = 0.877 α_{t2} = 0.887	Search for those system features that would support my old ways of doing things.	0.803-0.999
	Try to modify system features to perform my tasks in my old ways when this system was not here.	
	Search for those features that would help me accomplish tasks the way I used to perform them before the system was implemented.	
	Change some system features so that it fits my old work habits.	
Avoidance (AVOID) α_{t0} = 0.869 α_{t1} = 0.923 α_{t2} = 0.955	Try to avoid the system as much as I can.	0.722-0.992
	Find ways to complete most of my daily activities without using the system.	
	Try to perform most of my tasks without using the system.	
	Stay away from using the system as much as I can.	
Note: All items are assessed on a 7-point-likert scale (7= strongly agree to 1 strongly disagree). Shaded items have been removed from the model because of validity reasons.		

Table 8.Measurement items

Appendix

1 PUBLICATIONS

1.1 JOURNAL-ARTIKEL (PEER REVIEWED)

Maier, C., Laumer, S., Weinert, C., and Weitzel, T. (2015), The Effects of Technostress and Switching-stress on Discontinued Use of Social Networking Services: A Study of Facebook Use, Information Systems Journal (ISJ) (25:3), p. 275-308, http://dx.doi.org/10.1111/isj.12068,

Laumer, S., Beimborn, D., Maier, C., and Weinert, C. (2013), Enterprise Content Management, Business & Information Systems Engineering (BISE) (5:6), p. 449-452, http://link.springer.com/article/10.1007/s12599-013-0291-3

1.2 KONFERENZ-ARTIKEL (PEER REVIEWED)

Weinert, C., Maier, C., Laumer, S., and Weitzel, T. (2019), How do Users Respond to Technostress? An Empirical Analysis of Proactive and Reactive Coping, Forthcoming in: Proceedings of the Hawaii International Conference on System Sciences (HICSS), Maui, USA

Weinert, C. (2018), Coping with Discrepant Information Technology Events: a Literature Review, Proceedings of the 26th European Conference on Information Systems (ECIS), Portsmouth, England,

Weinert, C., Laumer, S., Maier, C., and Weitzel, T. (2016), Is Information Technology Solely to Blame? The Influence of Work-home Conflict Dimensions on Work Exhaustion, Proceedings of the International Conference on Information Systems (ICIS), Dublin, Ireland

Weinert, C. (2016), Coping the Dark Side of IT Usage - Mitigating the Effect of Technostress, Proceedings of the Doctoral Consortium ACM SIGMIS CPR Conference, Alexandria, Virgnia USA (Research in Progress)

Weinert, C., Maier, C., Laumer, S., and Weitzel, T. (2015), Extending Moore's Exhaustion Model: Including Further Dimensions of Burnout and Investigating Their Influence on Turnover Intention Among IT Professionals, Proceedings of the 2015 ACM SIGMIS CPR Conference, Newport Beach, California USA

Weinert, C., Maier, C., and Laumer, S. (2015), Do we behave based on our implicit attitudes? Proposing a research model and an experimental study to investigate their influence on behavioral intentions, Proceedings of the 23rd European Conference on Information Systems (ECIS), Münster (Research in Progress)

Weinert, C., Maier, C., and Laumer, S. (2015), What does the skin tell us about information systems usage? A literature-based analysis of the utilization of electrodermal measurement for IS research, Proceedings of the 2015 Gmunden retreat on NeuroIS, Gmunden, Austria

Weinert, C., Maier, C., and Laumer, S. (2015), Why are teleworkers stressed? An empirical analysis of the causes of telework-enabled stress, Proceedings of the 12th International Conference on Wirtschaftsinformatik , Osnabrück

Maier, C., Laumer, S., and Weinert, C. (2015), Enterprise resource planning systems induced stress: a comparative empirical analysis with young and elderly SAP users, Proceedings of the 12th International Conference on Wirtschaftsinformatik , Osnabrück

Weinert, C., Maier, C., and Laumer, S. (2014), The Relationship between Psychological, Physiological, and Behavioral Strain towards Technostress, Proceedings of the 2014 Gmunden retreat on NeuroIS, Gmunden, Austria (Research in Progress)

Weinert, C., Maier, C., and Laumer, S. (2014), Technostress-induced Skin Conductance Response Patterns and Performance, Proceedings of the 2014 Gmunden retreat on NeuroIS, Gmunden, Austria (Research in Progress)

Weinert, C., Maier, C., Laumer, S., and Weitzel, T. (2014), Does teleworking negatively influence IT professionals? An empirical analysis of IT personnel's telework-enabled stress, Proceedings of the 2014 ACM SIGMIS CPR Conference, Singapore

Weinert, C., Laumer, S., Maier, C., and Weitzel, T. (2013), The Effect of Coping Mechanisms on Technology Induced Stress: Towards a Conceptual Model, Proceedings of the 19th Americas Conference on Information Systems (AMCIS), Chicago (IL)

Laumer, S., Maier, C., and Weinert, C. (2013), The negative side of ICT-enabled communication: the case of social interaction overload in online social networks, Proceedings of the 21th European Conference on Information Systems (ECIS), Utrecht, The Netherlands

Weinert, C., Maier, C., and Laumer, S. (2012), The Shady Side Of Facebook: The Influence Of Perceived Information And Network Characteristics On The Attitude Towards Information Overload, Proceedings of the 18th Americas Conference on Information Systems (AMCIS), Seattle (WA)

1.3 Workshop-Artikel (Peer Reviewed)

Weinert, C., Maier, C., Laumer, S., and Weitzel, T. (2015), What happens when users are not able to perform coping mechanisms? An investigation of the habituation process, Proceedings of the Special Interest Group on Adoption and Diffusion of Information Technology (DIGIT) (Pre-ICIS Workshop), Forth Worth, TX, USA (Research in Progress) Best Paper Nominee

Weinert, C., Maier, C., Laumer, S., and Weitzel, T. (2015), Implicit Attitudes: An Investigation of Implicit Attitudes and Their Influences on Behavioral Intentions, Proceedings of the 14th Annual HCI/MIS Research Workshop (Pre-ICIS-Workshop), Forth Worth, TX, USA

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Maier, C., Laumer, S., Weinert, C., and Eckhardt, A. (2011), Is Facebook Usage Becoming Stressful? Proposing and Validating a Theory of Stress-induced ICT Discontinuous Usage, Proceedings of the Special Interest Group on Adoption and Diffusion of Information Technology (DIGIT) (Pre-ICIS Workshop), Shanghai, China

1.4 Buchkapitel

Weinert, C., Maier, C., Laumer, S., and Weitzel, T. (2015), Controlling der Rekrutierung: Erhebung von Kennzahlen entlang des Recruiting-Prozesses in Praxishandbuch Controlling, W. Becker and P. Ulrich (eds.), Wiesbaden: Springer Fachmedien Wiesbaden, pp. 1-14

1.5 Sonstige

Weitzel, T., Laumer, S., Maier, C., Oehlhorn, C., Weinert, C., and Wirth, J. (2018), Mobile Recruiting - Ausgewählte Ergebnisse der Recruiting Trends 2018 und der Bewerbungspraxis 2018, Research Report, Otto-Friedrich-Universität Bamberg

Weitzel, T., Laumer, S., Maier, C., Oehlhorn, C., Weinert, C., and Wirth, J. (2018), Employer Branding - Ausgewählte Ergebnisse der Recruiting Trends 2018 und der Bewerbungspraxis 2018, Research Report, Otto-Friedrich-Universität Bamberg

Weitzel, T., Laumer, S., Maier, C., Oehlhorn, C., Weinert, C., and Wirth, J. (2018), Digitalisierung der Personalgewinnung - Ausgewählte Ergebnisse der Recruiting Trends 2018 und der Bewerbungspraxis 2018, Research Report, Otto-Friedrich-Universität Bamberg

Weitzel, T., Laumer, S., Maier, C., Oehlhorn, C., Weinert, C., and Wirth, J. (2018), Social Recruiting und Active Sourcing - Ausgewählte Ergebnisse der Recruiting Trends 2018 und der Bewerbungspraxis 2018, Research Report, Otto-Friedrich-Universität Bamberg

Weitzel, T., Laumer, S., Maier, C., Oehlhorn, C., Wirth, J., Weinert, C., and Eckhardt, A. (2017), Employer Branding und Personalmarketing - Ausgewählte Ergebnisse der Recruiting Trends 2017 und der Bewerbungspraxis 2017, Research Report, Otto-Friedrich-Universität Bamberg

Weitzel, T., Laumer, S., Maier, C., Oehlhorn, C., Wirth, J., Weinert, C., and Eckhardt, A. (2017), Active Sourcing und Social Recruiting - Ausgewählte Ergebnisse der Recruiting Trends 2017 und der Bewerbungspraxis 2017, Research Report, Otto-Friedrich-Universität Bamberg

Weitzel, T., Laumer, S., Maier, C., Oehlhorn, C., Wirth, J., Weinert, C., and Eckhardt, A. (2017), Women in IT - Ausgewählte Ergebnisse der Recruiting Trends 2017 und der Bewerbungspraxis 2017, Research Report, Otto-Friedrich-Universität Bamberg

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