INDIVIDUAL INFORMATION SYSTEMS

An Empirical Investigation of Emerging Concepts and New Methodological Approaches

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UNIVERSITÄT SIEGEN

Individual Information Systems

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Foreword

"One size does not fit all," which is why in today's professional world it is more important than ever to acknowledge individual differences to enhance satisfaction, productivity, and innovativeness. Therefore, it is not surprising that organizations increasingly allow employees to use their own technologies for job-related tasks because they are better aligned with individual preferences compared to standardized technologies. Systems that are designed or used according to idiosyncratic preferences, namely individual Information Systems (IS), are gaining momentum. Yet, there is a significant theoretical and empirical gap in terms of how those systems are used and how they influence the individual. Michael Klesel addresses this gap and provides a striking piece of research that offers theory-driven foundations, the results of several empirical studies, and a new methodological approach to investigate individual IS that acknowledges group-wise differences.

This thesis is impressive in many ways. It identifies and conceptualizes important concepts such as *psychological ownership of IT*, *IT resilience*, *choice self-efficacy,* and *IT mind wandering* that allow future research to investigate contemporary and emerging phenomena such as issues related to work-life balance more thoroughly. At the same time, it offers new perspectives on important phenomena and opens the door for promising future research. Methodologically, it includes a broad range of established approaches such as case studies, surveys, and experimental research that are carefully selected to address the underlying research questions. Besides the application of existing methodologies, it also includes a methodological advancement, namely a new test for multigroup analysis. All parts of this thesis are well prepared to contribute to a larger body of knowledge and the advancement of the discipline rather than being a conclusion in itself. Therefore, scholars from related research areas, including management science or psychology, can also benefit from these insights by using and adopting the results for use in their domains. In addition to theoretical explanations, this thesis also provides valuable insights for practitioners on how to design future workplaces.

Michael Klesel's results, which have been published in leading international conferences and journals, contribute to a more sophisticated understanding of individual IS and related phenomena. This thesis is recommended to anyone who is interested in individual IS and the acknowledgement of individual differences.

Siegen, March 2019 Prof. Dr. Dr. Björn Niehaves

Acknowledgements

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Siegen, March 2019 Michael Klesel

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Abbreviations

AMCIS	American Conference on Information Systems
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
AST	Adaptive Structuration Theory
BYOB	Bring Your Own Behavior
BYOD	Bring Your Own Device
CAIS	Communications of the AIS
COPE	Company Owned Privately Enabled
DSR	Design Science Research
ECIS	European Conference on Information Systems
EDT	Explanatory Design Theory
EFA	Exploratory Factor Analysis
FWER	Family-Wise Error Rate
GSCA	Generalized Structured Component Analysis
HICSS	Hawaii International Conference on System Sciences
ICIS	International Conference on Information Systems
IS	Information Systems
MKWI	Multikonferenz Wirtschaftsinformatik
PLS	Partial Least Squares
PLSc	Consistent PLS
PLS-PM	Partial Least Squares Path Modeling
POIT	Psychological Ownership of IT
RCPC	Repeated Comparisons of Path Coefficients
RQ	Research Question
SEM	Structural Equation Modeling
SLR	Systematic Literature Review
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology

Part A

"One of history's few iron laws is that luxuries tend to become necessities and to spawn new obligations. Once people get used to a certain luxury, they take it for granted. Then they begin to count on it. Finally, they reach a point where they can't live without it."

— Yuval Noah Harari

1 Introduction

1.1 The Commoditization of Mobile Technologies

When Steve Jobs introduced the first iPhone over a decade ago, it was perceived as a luxury device for premium customers such as business managers and directors. Today, more than 2.5 billion people are using smartphones such as the iPhone (McNair 2017). As a consequence of this massive diffusion, mobile technologies, including smartphones and tablets, have become commodities.

Mobile technologies are used in most areas of our daily life. Their high degree of usability makes them the preferred choice for private-related aspects (e.g., private communication). In addition, their high computing power makes them eligible for several work-related tasks including professional communication. Using mobile applications, smartphones can also be used for more complex business processes (e.g., sales processes).

The prevalence of mobile technologies has a significant impact on how people use them. One reason is that employees are no longer dependent on enterprise IT, but use their privately owned devices to fulfill a great number of tasks (Köffer, Ortbach, et al. 2015). This type of use behavior, which is known as bring your own device (BYOD) behavior, has the potential to make an employer more attractive (Weeger et al. 2016) and can result in more innovative work (Junglas et al. 2018).

Using privately owned technologies for work-related purposes and vice versa (i.e., using organizational IT for private purposes) is called the consumerization of IT (Niehaves et al. 2012) or the individualization of Information Systems (IS) (Baskerville 2011a). Both research and academia have recognized the distinct advantages of individual IS, including a higher degree of satisfaction (Harris et al. 2012). At the same time, the individualization of IS results in new obligations (Mazmanian et al. 2013) and new challenges, including maintaining one's work-life balance (Duxbury et al. 2014; Köffer, Anlauf, et al. 2015).

Although this stream of research has gained increasing attention, the phenomenon of individual IS has not been fully understood yet. Particularly, in contrast to established streams of research, including research on technology acceptance (Venkatesh et al. 2016), there is a considerable lack of conceptualizations and empirical evidence on related effects. In the light of the increasing amount of mobile technologies, this lack is crucial as it hampers the theorization of contemporary phenomena. For example, aspects related to the dark side of information technology (D'Arcy et

al. 2014) are oftentimes related to individual use (e.g., Soror et al. 2015). Thus, a proper conceptualization is required for further analysis.

Against this background, the overall objective of this thesis is the investigation of important facets related to individual IS. Specifically, it seeks to provide a theoretical foundation to theorize individual IS, identify and propose important concepts in that context, and extend current methodological approaches to account for individual differences.

1.2 Research Questions

A great amount of IS research focuses on the relationship between IT and organizations (Orlikowski and Robey 1991). Before the rise of consumer technologies, the target IT was commonly a specific type of enterprise system such as decision support systems (Alavi and Henderson 1981; Arnott and Pervan 2012). In order to understand the acceptance and adoption behavior, fundamental theories such as the Technology Acceptance Model (TAM) (Davis 1989) and its extensions (Venkatesh et al. 2003, 2016) have been developed. Similarly, the conceptualization of the use construct and richer conceptualizations (Bagayogo et al. 2014; Barki et al. 2007; Burton-Jones and Straub 2006; Walsh et al. 2016) have been proposed to understand how individuals use (enterprise) IT. With the rise of consumer IT, use behavior has changed significantly. For instance, mobile technologies can now be used everywhere and for work and private-related purposes (Köffer, Ortbach, et al. 2015). Existing research has recognized this change and adopted existing theories. For example, the TAM has been applied in households (Brown and Venkatesh 2005) to investigate how technology is used in the private domain. Furthermore, technology use has also been investigated from a hedonic perspective (van der Heijden 2004). However, emerging aspects and dimensions that are relevant in the context of individual IS are not yet fully understood. Against this background, the first research question (RQ) focuses on understanding the use concept in relation to individual IS:

RQ 1: What are the relevant dimensions to conceptualize technology use in the context of individual IS?

Based on the changing nature of technology use, there are emerging concepts that can explain how individuals relate to technology and how they perceive it. For instance, Junglas et al. (2014) suggest that individual IS has the potential to empower individuals and propose the concept of IT empowerment. Other studies suggest that people perceive a higher degree of privacy risk and financial risk (Ostermann et al. 2017) while using individual IS. In addition to these perceptions, individual IS can also have an impact on our identity (Carter and Grover 2015). Hence, using technology on a more personal level (i.e., by using individual IS) may also influence our identity.

Consequently, the use of individual IS can also influence other technology-related perceptions that have not been uncovered yet. Against this background, the second RQ is:

RQ 2: What are technology-related perceptions when using individual IS?

Besides the several advantages of individual IS (e.g., more autonomy), there are new challenges including maintaining one's work-life balance (Ahuja et al. 2007; Sarker et al. 2018) associated with it. Even though issues related to work-life balance are not new, research suggests that using individual IS intensifies them (Duxbury et al. 2014; Köffer, Anlauf, et al. 2015). Boundary theory (Ashforth et al. 2000; Clark 2000; Kreiner et al. 2009) has been recognized as a useful lens to study issues related to work-life balance. According to boundary theory, individuals create and maintain boundaries in order to manage their environment. Those boundaries are on a continuum between thin (i.e., permeable) and strong (i.e., not influenceable). Based on this stream of research, several studies provide a more detailed perspective on boundary management. For example, Kossek et al. (2012) propose six clusters that can be used to classify individuals and how they manage their boundaries. However, very little research exists that acknowledges the role of IT in this context. Hence, not much is known on how individuals use IT to manage their boundary preferences, how they cope with related issues, and how technology can be designed in the light of their boundaries. To investigate the relationship between individual IS and boundary management, the third RQ is as follows:

RQ 3: What is the impact of individual IS on the individual in terms of boundary management?

Since IS research is a socio-technical discipline, many phenomena of interest differ across groups and require the assessment of group-wise differences to gain a more accurate reflection of the real-world phenomenon. For example, research on technology acceptance recognized an age-related digital divide between young and old users (e.g., Niehaves and Plattfaut 2014). To account for such group-wise differences, researchers can apply multi-group analysis.

Recognizing group-wise differences is also important when it comes to investigating individual IS, because group-differences may also be relevant. For instance, demographic variables including age may separate one group from another (e.g., in terms of (not) using individual IS). Therefore, in order to be able to assess group-wise differences when theorizing individual IS, the final RQ is:

RQ 4: What are the methodological approaches to test for group-wise differences?

1.3 Thesis Structure

This paper-based thesis is divided into two major parts (c.f. Figure 1.1). Part A provides an overview of all studies and shows how they contribute to the proposed research questions. Part B presents the individual research papers that are included in this thesis. It covers ten publications from journals, conferences and one working paper. The journal publications appeared in the Journal of Internet Research and the Communications of the Association of Information Systems (CAIS). Eight conference publications were presented at the International Conference on Information Systems (ICIS), European Conference on Information Systems (ECIS), American Conference on Information Systems (AMCIS), Hawaii International Conference on System Sciences (HICSS), and Multikonferenz Wirtschaftsinformatik (MKWI).

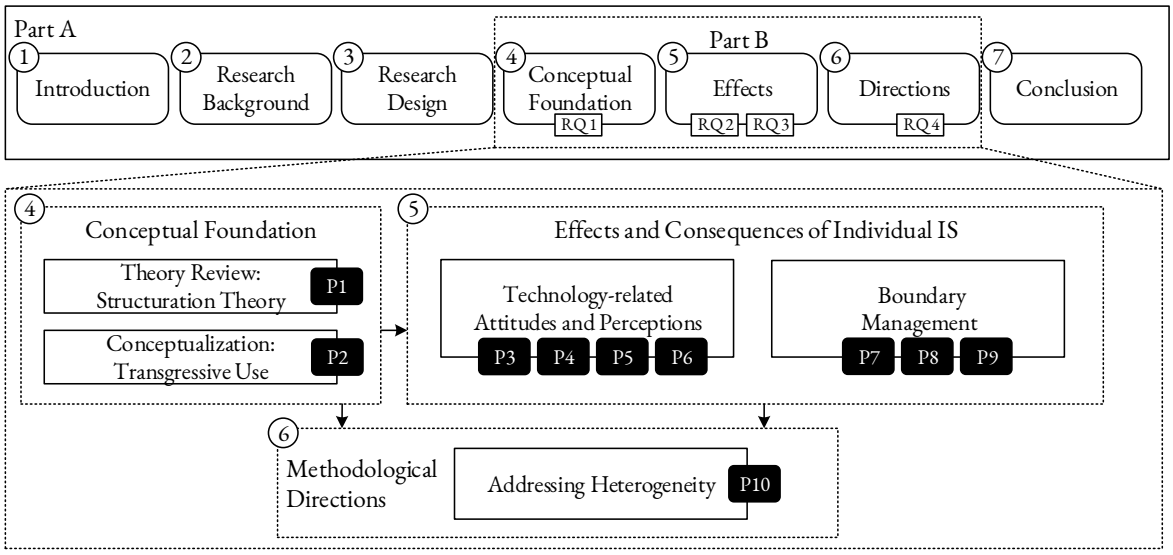


Figure 1.1 Perspective of this Study

All articles are published as shown in Table 1.1. The articles are listed in line with the structure of this thesis instead of their chronological order. No paper attached to this thesis has been modified in terms of its content. However, for the purpose of consistency, all of them have been reformatted. This relates to all heading numbers as well as table and figure references. Note that all studies were developed and published at different times, which is why there might be deviations in terms of terminology and wording.

	Title	VHB[a]	Scopus[b]
P1	**Klesel, M.**, Mokosch, G., and Niehaves, B. 2015. *Maturing, Flagshipping and Piggybacking: On the Use of Structuration Theory in Information Systems Research*, presented at the 21st Americas Conference on Information Systems, Puerto Rico.	D	
P2	**Klesel, M.**, Lemmer, K., Bretschneider, U., and Niehaves, B. 2017. *Transgressive Use of Technology*, presented at the 38th International Conference on Information Systems, Seoul, South Korea.	A	
P3	**Klesel, M.** 2018**.** "A Conceptual Model for IT Work Autonomy," *Forschungskolleg Siegen* (working paper).	(-)	
P4	**Klesel, M.**, Kampling, H., Bretschneider, U., and Niehaves, B. forthcoming. "Does the Ability to Choose Matter? On the Relationship between Bring Your Own Behavior and IT Satisfaction," *Communications of the Association for Information Systems*.	C	1.67
P5	**Klesel, M.**, Ndicu, M., and Niehaves, B. 2016. *Exploring Psychological Ownership of IT: An Empirical Study*, presented at the 24th European Conference on Information Systems, Istanbul, Turkey.	B	
P6	Oschinsky, F. M., **Klesel, M.**, Ressel, N., and Niehaves, B. 2019. *Where Are Your Thoughts? On the Relationship between Technology Use and Mind Wandering*, presented at the 52th Hawaii International Conference on System Sciences, Honolulu, Hi, USA.	C	
P7	Jahn, K., **Klesel, M.**, Lemmer, K., Weigel, A., and Niehaves, B. 2016. *Individual Boundary Management: An Empirical Investigation on Technology-Related Tactics*, presented at the 20th Pacific Asia Conference on Information Systems, Chiayi, Taiwan.	C	
P8	**Klesel, M.**, Narjes, N., and Niehaves, B. 2018. *Conceptualizing IT Resilience: An Explorative Approach*, presented at the Multikonferenz Wirtschaftsinformatik, Lüneburg, Germany.	D	
P9	**Klesel, M.**, Jahn, K., Müller, M., and Niehaves, B. 2016. *How to Design Information Technology That Facilitates Detachment from Work: An Empirical Investigation of Work-Discontinuance Intention*, presented at the 20th Pacific Asia Conference on Information Systems, Chiayi, Taiwan.	C	
P10	**Klesel, M.**, Schuberth, F., Henseler, J., and Niehaves, B. forthcoming. "A Test for Multigroup Comparison in Partial Least Squares Path Modeling," *Internet Research*. (https://doi.org/10.1108/IntR-11-2017-0418).	(-)	4.72

[a] VHB-JOURQUAL3 (https://vhbonline.org/vhb4you/jourqual/vhb-jourqual-3/)
[b] CiteScore according to Scopus ranking (https://www.scopus.com/sources)

Table 1.1 Overview of Publications

2 Research Background

In the last decade, both practice and academia showed an increasing interest in the use of mobile technologies. According to a bibliometric study provided by Sørensen and Landau (2015), there is a considerable rise in the number of papers focusing on mobile technologies. Based on published literature from the senior scholar basket of eight (which includes the European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems, and MIS Quarterly), their study shows that 6.2% of all IS papers relate to mobile technologies. Similarly, studies approximate the number of smartphone users worldwide which has more than doubled in the last five years (approximately 1 billion users in 2012 and more than 2.5 billion users in 2017) (McNair 2017).

An important phenomenon that accompanies the rise of mobile technology is the "consumerization of IT" or "IT consumerization" which is understood as the use of consumer technologies (e.g., smartphones, tablets, or wearables) for work-related purposes and vice versa (i.e., using organizational IT for private purposes). The reasons for the attractiveness of consumer IT relate to a higher degree of usefulness and enjoyment that comes with these technologies (Harris et al. 2012; Niehaves et al. 2012; Weeger et al. 2016), especially in contrast to traditional enterprise IT.

To acknowledge the different facets of IT consumerization, Köffer et al. (2015) suggest three different perspectives: the market perspective, the individual perspective, and the organizational perspective. The market perspective primarily focuses on the origin of the technology that is investigated (e.g., Niehaves et al. 2012). Therefore, it is a well-suited perspective to investigate differences including functionalities between enterprise IT and consumer IT. The individual perspective focuses on the ownership of IT tools. Hence, this perspective is preferable when investigating phenomena that are related to the individual user such as individual innovation behavior (Junglas et al. 2018). Finally, one can also take an organizational perspective to investigate organizational aspects such as including policy enactment or the transformation of governance (Gregory et al. 2018).

The use of consumer technologies for work-related purposes triggered a development that has been described as the individualization of IS (Baskerville 2011b; Gaß et al. 2015). According to Baskerville (2011b), an individual IS is an "activity system in which individual persons, according to idiosyncratic needs and preferences, perform processes and activities using information, tech-

nology, and other resources to produce informational products and/or services for use by themselves or others." (p. 3). There is no doubt that consumer IT such as smartphones and tablets invites individuals to use them according to their idiosyncratic needs. Thus, using private IT for work-related purposes in line with individual preferences reflects an individual IS.

With individual IS, technology use happens beyond traditional boundaries such as organizational boundaries. Hence, the commonly used tripartite conceptualization of technology use including the user, an organizational task, and a technology (Burton-Jones and Straub 2006) needs to be extended. The extended perspective is shown in Figure 2.1 using the organizational and the private realm as two important domains where individuals use technology. As indicated, technology can either be organizational IT or private IT. The latter allows employees to fulfill a task beyond the boundaries of the organization.

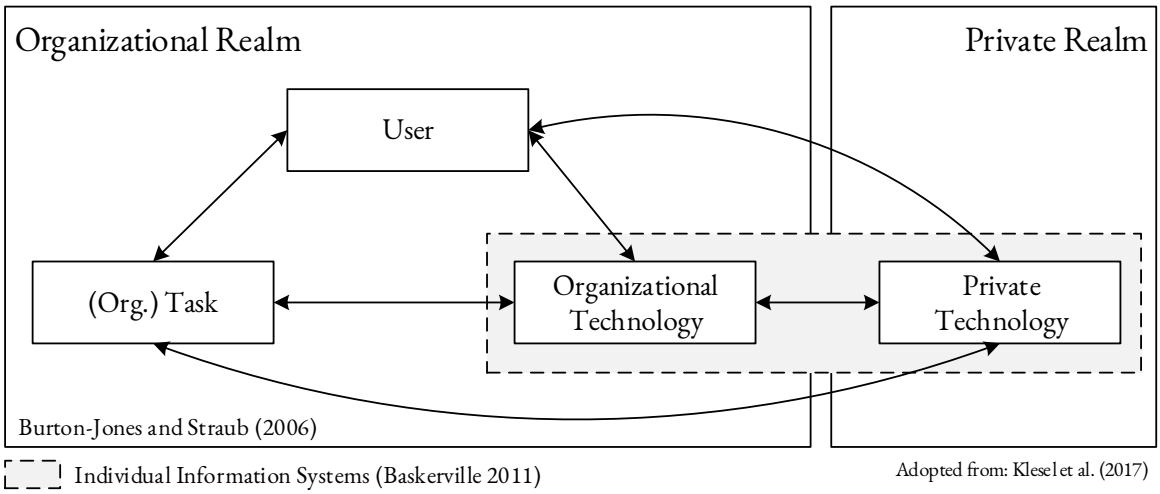


Figure 2.1 Technology Use with Individual IS

This extended perspective differs from previous conceptualizations in several ways: First, it explicitly acknowledges multiple, alternative, and possible competing technologies that can be used to fulfill work. Second, it recognizes that technology use affects several domains of our daily life which helps to understand emerging phenomena and challenges such as work-life conflicts. Third, it encompasses that individual IS empowers the individual to use technology and implement processes aligned with idiosyncratic preferences. This extended perspective and its corresponding assumptions are at the core of this thesis. Hence, most concepts introduced here understand technology use as a behavior that occurs beyond specific boundaries.

3 Research Design

3.1 Overview

This thesis includes different research methodologies to address the identified research questions with the intention to benefit from the major strengths of each method. Three major approaches are included: literature reviews (systematic and narrative), qualitative research (single and multiple case studies), and quantitative research (exploratory and confirmatory). Table 3.1 provides an overview of the research methodology and the underlying dataset.

		Methodology	**Dataset**	**Reference**
Literature Review	P1	Systematic Literature Review	A systematic literature review including eight journals and three conferences covering 106 papers.	(Klesel et al. 2015)
	P3	Narrative Literature Review	A narrative review on autonomy in IS research reviewing contextualized concepts of autonomy and autonomy-related constructs.	(Klesel 2018)
Qualitative Research	P2	Multiple Case Study	A multiple case study with two cases (manufacturing and service) and data from 67 interviews.	(Klesel et al. 2017)
	P5	Singe Case Study, Grounded theory	An explorative study including qualitative data from 20 interviews from industry.	(Klesel, Ndicu, et al. 2016)
	P7	Single Case Study, Grounded theory	Interview data from 15 interviewees are included.	(Jahn et al. 2016)
Quantitative Research	P4	Quantitative, Structural Equation Modelling	Survey data with a representative sample of 400 participants are used. The data was collected with computer assisted telephone interviews.	(Klesel, Kampling, et al. forthcoming)
	P6	Quantitative, Factorial survey	Data from 90 participants have been collected by means of an online questionnaire.	(Oschinsky et al. 2019)
	P8	Quantitative, Factor Analysis	Survey data (n= 80) from a convenience sample is used.	(Klesel et al. 2018)
	P9	Quantitative, Factorial survey	Different design choices are evaluated based on survey data (factorial design) from 67 participants.	(Klesel, Jahn, et al. 2016)
	P10	Quantitative, Monte Carlo Simulation	A Monte Carlo simulation with 50 experimental designs (5 scenarios x 2 different distributions x 5 sample size) provides evidence on the efficacy of a new approach to test for heterogeneity.	(Klesel, Schuberth, et al. forthcoming)

Table 3.1 Overview: Research Methodology and the Datasets Used

3.2 Literature Reviews

A basic principle of academic research is the appreciation and analysis of prior knowledge (vom Brocke et al. 2015; Webster and Watson 2002). One important reason to conduct literature reviews is the analysis of existing theories in order to frame the research questions and to develop new knowledge (Recker 2013). For this reason, the first review (P1) was conducted in the light of a theory review on structuration theory (Giddens 1984; Jones and Karsten 2008). The second review was conducted as a theoretical foundation for the subsequent construct development procedure (MacKenzie et al. 2011). Commonly, two types of reviews can be distinguished: systematic literature reviews (SLR) and traditional narrative reviews (Boell and Cecez-Kecmanovic 2015). Both types are used and explained in the following paragraphs.

Structured Literature Review. In order to address RQ 1, the use of structuration theory in IS research was investigated. As suggested by Gaß et al. (2015), structuration theory is an important lens to investigate individual IS and has also been used to explain IT consumerization (Mokosch et al. 2015). Accordingly, we investigated how structuration theory and its extension, adaptive structuration theory, have been used in IS research. For that purpose, we included the senior scholar basket of eight (European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems, MIS Quarterly) and three international conferences (American Conference on Information Systems, European Conference on Information Systems, International Conference on Information Systems) using the keywords "structuration" in their abstract. Based on 106 articles, we provide insights on how different concepts are used and how the number of papers referring to structuration has increased in the last decade.

Narrative Review. To conceptualize work method autonomy, it is important to extend and adopt current concepts. For that reason, existing literature on autonomy is reviewed. Fundamental theories such as the Job Characteristic Model (Hackman and Oldham 1975) and Reactance Theory (Brehm 1966) are used as an overall perspective and specific studies that used autonomy are identified. This is done in a narrative manner (Boell and Cecez-Kecmanovic 2015). Besides contextualized form of autonomy, constructs such as the overall job autonomy (e.g., Ahuja et al. 2007), task autonomy (e.g., Ozer and Vogel 2015), or climate for autonomy (e.g., Durcikova et al. 2011) autonomy-related constructs from the IS domain such as freedom of choice (Murray and Häubl 2011) and voluntariness (Wu and Lederer 2009) are considered.

A summary of both reviews is shown in Table 3.2.

	P1 (Klesel et al. 2015)	**P3** (Klesel 2018)
Objective	Theory review	Concept review
Type of review	Systematic literature review	Traditional narrative review
Fundamental Theory	Structuration Theory and Adaptive Structuration Theory	Job Characteristic Model Reactance Theory
Considered outlets	8 journals (senior scholar basket of eight), 3 conferences	Not specified
Number of considered studies	106	(-)
Analysis	Structured classification based on concepts from Structuration Theory	Detailed review of autonomy-related concepts and constructs
Main contribution	Status Quo on how Structuration Theory is used in IS research	Proposition of a new concept: IT work autonomy

Table 3.2 Overview of Literature Reviews

3.3 Qualitative Studies

Qualitative approaches are used to identify emerging concepts and to provide the foundation of new theoretical perspectives. Qualitative research has been widely used in IS research to develop a theory and to provide rich descriptions of contemporary phenomena. Oftentimes, qualitative research is conducted in the light of grounded theory (Corbin and Strauss 1990; Glaser and Strauss 1967; Wiesche et al. 2017) or in terms of a case study research (Yin 2014). Both approaches have the objective to develop a theory. However, case study research is often based on data from multiple sources. Eisenhardt and Graebner (2007) argue that theory building based on case studies is most attractive as it allows researchers to bridge qualitative evidence with deductive research. Moreover, it is well suited to develop new constructs and to propose new propositions which can support theory testing. An overview of qualitative studies used here is given in Table 3.3.

Grounded Theory Approach. Grounded theory is well-suited to investigate phenomena where research lacks a sound and established body of knowledge (Corbin and Strauss 1990; Glaser and Strauss 1967). In terms of individual IS and its manifold facets, it is arguably important to take a grounded perspective to identify emerging concepts. In this thesis, the grounded theory approach

has been applied to investigate how individuals use technology to maintain their boundary preferences (P7). Similarly, it has been applied to unveil antecedents and effects of psychological ownership of IT (P5).

Case study research. A comprehensive case study has been used (P2) to propose a new concept of technology use: transgressive use. Two different cases (manufacturing and service) have been investigated to understand how technology is used beyond the boundaries of an organization. For that reason, Mill's method of a most similar systems design was applied (Mill 1843), including cases with similar technology-related strategies but differences in light of contextual aspects (e.g., industry, company size, etc.).

Case 1 (Manufacturing): The first case was conducted in an organization from the manufacturing industry with 3,000 employees and 31 foreign subsidiaries. When the data was collected, the organization had a Company-Owned Privately Enabled (COPE) strategy in place, which allowed employees to use organizational IT for private purposes. In this organization, 27 individuals were interviewed. To obtain a broad perspective, individuals from all different areas (e.g., sales and IT department) and positions were included.

Case 2 (Service): The second case was conducted in a service organization that is specialized in food logistics. Since delivering food oftentimes causes individuals to use technology outside organizational boundaries it is well suited to investigate use behavior. The organization employs 21,000 people and has 30 domestic distribution center. Similar to the first case, it enacted a COPE policy. In addition, employees from all different areas and hierarchies were included. Forty (40) employees were interviewed in total.

	P2 (Klesel et al. 2017)	**P5** (Klesel, Ndicu, et al. 2016)	**P7** (Jahn et al. 2016)
Primary Objective	Theory development	Theory development	Rich description
Technique	Case study research	Methods based on grounded theory	Methods based on grounded theory
Data	67 interviews	20 interviews	15 interviews
Contribution	Conceptual model for a new conceptualization of technology use	Identification of new antecedents and effects of psychological ownership of IT	Rich description of individual boundary strategies using IS

Table 3.3 Overview of Qualitative Studies

3.4 Quantitative Studies

Several aspects of this thesis are investigated using quantitative data. In four studies, questionnaire data is used to investigate structural models (P4), the factorial structure of latent constructs (P8), and the investigation of group differences (P6, P9). Moreover, a Monte Carlo Simulation has been implemented to evaluate a newly developed test statistic for Multigroup Analysis (MGA) (P10). An overview is presented in Table 3.4.

	P4 (Klesel, Kampling, et al. forthcoming)	**P6** (Oschinsky et al. 2019)	**P8** (Klesel et al. 2018)	**P9** (Klesel, Jahn, et al. 2016)	**P10** (Klesel, Schuberth, et al. forthcoming)
Primary Objective	Hypothesis Testing	Hypothesis Testing	Construct Development	Hypothesis Testing	Evaluation of a Test Statistic
Technique for Analysis	Structural Equation Modeling	AN(C)OVA	Exploratory Factor Analysis	Regression Analysis	Monte Carlo Simulation
Data Collection	Survey	Factorial Survey	Survey	Factorial Survey	Random Sampling
Data Points	400	90	80	67	7.485.000

Table 3.4 Overview of Quantitative Studies

3.4.1 Survey Data

A structural model was analyzed (P4) based on survey data from 400 respondents. Structural Equation Modeling (SEM) was used to estimate the proposed research model. Specifically, we used Partial Least Squares (PLS) Path Modeling (PLS-PM) to estimate the model. The dataset includes 81% responses from individuals who hold a managing position, 66% are male (i.e., 34% female). The average age is 47.5 (SD = 10.72), and the average tenure is 18.81 years (SD = 11.59). Since the research model includes common factors, consistent PLS (PLSc) was used (Dijkstra and Henseler 2015).

In order to investigate the relationship between technology use and IT mind wandering (P6), survey data was collected from 105 participants and excluded all observations with less than 3-minute participation time, resulting in 90 observations in total. The average age was 29.72 (SD = 12.10), 48 are male (53.3%), 42 female (46.7%), and had an average tenure of 8.37 years (SD = 10.26). The data was analyzed carrying out an analysis of variance (ANOVA) and an analysis of covariance (ANCOVA).

Survey data can be used for exploratory settings; i.e., to identify new concepts and to test a-priori proposed hypothesis (Recker 2013). Since this thesis includes exploratory and confirmatory aspects, survey data is used for both domains. To investigate the factorial structure of IT resilience (P8), survey data is used to carry out an exploratory factor analysis (EFA). For that purpose, survey data from 177 individuals was collected. We excluded responses with missing data and individuals who did not use their smartphone outside their organization. With 80 complete observations, the EFA was applied. Most participants are between 18-30 years old (74.3%), 48.1% were male and 51.9% were female.

Another set of survey data (n = 67) was used to test the relationship between design choices and work discontinuance intention (P9). Of the participants 37.3% are females and 62.7% are male with an average of 31 years (SD = 9.42) and an average working time per week of 39.23 hours (SD = 11.42). Regression analysis by means of hierarchical model was used to test the proposed relationships.

3.4.2 Monte Carlo Simulation

To investigate the sensitivity and specificity (Parikh et al. 2008) of the new test statistic, a Monte Carlo Simulation was implemented. Sensitivity refers to the degree to which the proposed test correctly classifies group-differences when both groups are indeed different. In contrast, specificity is the test's ability to correctly classify homogeneity when both groups are indeed homogenous.

To investigate the tests performance, five different scenarios are considered: 1) Homogeneity, 2) Small Structural Differences, 3) Moderate Structural Differences, 4) Different Weights, and 5) Structural Differences and Different Weights. Furthermore, the sample size per group (100, 200, 300, 400 and 500 observations per group) and the distribution of the data (normal and non-normal data) are included.

For a saturated structural model with four latent variables, data was drawn from the multivariate normal distribution. For each of the 50 designs, 300 experimental runs were executed with 499 permutations. The simulation was implemented in the statistical programming environment R (R Core Team 2017) using the matrixpls package (Rönkkö 2017) and the MASS package to draw data from the multivariate normal distribution (Ripley et al. 2017).

4 Results

4.1 Overview

In the following sections, the core results of this paper-based thesis are presented. Each section primarily responds to one of the four research questions and presents the essence of each paper involved. First, the conceptual foundations are presented (c.f. section 4.2). This section includes a theory review on structuration theory and the proposition of a new use concept (which is defined as transgressive use) to describe technology use in combination with individual IS. Thereafter, technology-related effects of individual IS are presented, including the role of work-instrument autonomy, IT choice self-efficacy, psychological ownership of IT, and IT mind wandering (c.f. section 4.3). Section 4.4 includes the results related to boundary management. Finally, a new test is proposed that allows the assessment of group-wise differences (c.f. section 4.5).

4.2 Conceptual Foundations

4.2.1 The Relationship between Structure and Agency

Previous literature suggest several perspectives to investigate individual IS and its corresponding use behavior (Gaß et al. 2015). A widely used perspective builds on Giddens' structuration theory (Giddens 1984) which suggests that social relations are a product of the continuous interaction between societal structures and an active subject (i.e., agency). According to Giddens, structures include rules and resources, which is why organizational aspects such as policies can be operationalized as part of structuration theory. In contrast, individual agency refers to the opportunity to act differently at any given time. Hence, use or resistance behavior in terms of individual IS can be included as part of structuration theory.

In IS research, structuration theory has been applied via two distinct approaches (Jones and Karsten 2008). The first was developed by Orlikowski (1992) who adopted the idea of the duality of structure to the context of technology. The "duality of technology" suggests that similar to societal structures, technology is a medium and an outcome of human action. Second, Adaptive Structuration Theory (AST) has been proposed which suggests that structures consist of "structural features" of technology and the "spirit of this feature set" (DeSanctis and Poole 1994).

The review suggests that research has gained interest in the application of structuration theory (c.f. Table 4.1). In fact, from 2008 onwards, there has been a significant increase. Jones and Karsten's (2008) widely received paper is certainly partly responsible for the increasing interest.

Research Stream \ Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Structuration Theory	2	2	1	0	0	1	0	0	1	3	5	3	1	3	1	3	1	2	8	10	9	6	4	6	2	75
Duality of Technology	1	0	0	0	0	0	0	0	0	0	1	3	0	1	1	2	0	2	2	3	4	3	1	2	2	28
Adaptive Structuration Theory	2	2	2	1	1	0	1	0	0	1	1	1	3	4	1	4	0	1	7	7	9	5	2	4	2	62
Total	5	4	3	1	1	1	1	0	1	4	7	7	4	8	3	9	1	5	17	20	22	14	7	12	6	165

Source: Klesel et al. (2015)

Table 4.1 Number of Papers Applying Structuration Theory by Stream, 1990-2014

In contrast to other perspectives on individual IS (Gaß et al. 2015), structuration theory puts emphasis on the dual interaction between external factors (i.e., structures) and individual agency. The impact of structures on agency has also been investigated in the context of individual IS. For instance, Mokosch et al. (2015) demonstrate that all dimensions of Giddens' structuration theory are somehow relevant to investigate individual IS when exploring structural and behavioral aspects. For instance, equipment authority reflects the domination dimensions of structuration theory. It is worth noting that only few studies seek to include both perspectives. Most studies focus on either external factors or individual agency. For example, Gregory et al. (2018) show how governance structures change in the light of IT consumerization. Others are focusing on the micro level; e.g., investigating whether individual IS empowers individual employees (Junglas et al. 2014). Several results presented in the following sections appreciate the idea of agency both explicitly and implicitly. For example, Bandura's concept of self-efficacy (Bandura 1977) that is used to conceptualize choice self-efficacy (Klesel, Kampling, et al. forthcoming) relates to the idea of agency.

4.2.2 A new Conceptualization of Technology Use

Technology use is at core of IS research and is considered as one of the most mature research streams therein (Venkatesh et al. 2016). Well established theories such as the Technology Acceptance Model (TAM) (Davis 1989), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003, 2016), and the IS Success Model (DeLone and McLean 1992, 2003) contribute to an in-depth understanding of drivers and barriers of technology use.

Besides the continuous development of use-related theories, existing literature spend considerable efforts in conceptualizing use and use behavior. As part of this development, research increasingly acknowledged the rich nature of use and its various dimensions (Burton-Jones 2005). For instance, Barki et al. (2007) propose the notion of IS use-related activity which includes technology

interaction, task-technology adaptation, and individual adaptation. Similarly, Bagayogo et al. (2014) introduce the concept of enhanced use of technology which reflects different forms of use behavior (e.g., the use of unused features of a system).

According to Burton-Jones and Straub (2006), technology use can be conceptualized based on the triad of user, task, and technology. Depending on the richness of the underlying use concept, these three dimensions are addressed to a certain degree. For example, cognitive absorption (Agarwal and Karahanna 2000) is considered to address both the user and the system (Burton-Jones and Straub 2006).

The threefold conceptualization of technology use provides an important framework to investigate use-related phenomena in the organizational context. However, in the light of contemporary phenomena (i.e., the consumerization of IT and individual IS), technology is not limited to the organizational domain (e.g., exclusive use of enterprise systems) but also includes technologies such as smartphones and tablets from the private domain. The following interview excerpt summarize this development:

> *"We are already going to use smartphones not only for WhatsApp, but rather for working tasks, to check e-mails. No matter where you are going or where you are, it can be edited. We are heading towards digital interconnectivity." (Klesel et al. 2017, p. 6)*

For that reason, the conceptualization mentioned above is limited when it comes to individual IS. Against this background, work-related technologies should be divided into organizational and private IT. An important consequence of this extended perspective lies in the inclusion of different domains (i.e., organizational and private realm).

Based on the extended perspective (c.f. Figure 2.1, p. 8), transgressive use is defined as "a rich form of technology use behavior, in which technology is mainly de-contextualized, i.e. private technology is used for business-related aspects and vice versa." (Klesel et al. 2017, p. 7). It includes four dimensions:

- degree of individual IS: the degree to which an individual uses IS for work-related purposes. For instance, if an employee uses his/her private IT for a great number of work-related tasks, a high degree of individual IS is assumed. In contrast, if an employee exclusively uses IS that is provided by the organization, a low degree of individual IS is assumed.
- degree of boundary spanning: the given dimension includes the organizational and the private realm. Based on individual IS, an employee can separate both domains or have permeable boundaries. Depending on his preferences and their realization, one can have a high degree of boundary spanning (i.e., separation of domains) or a low degree of boundary spanning (i.e., permeable boundaries).

- degree of intensity: similar to traditional IS usage, there can be a variation related to the intensity of use between users. Hence, employees can have a high degree of intensity (i.e., they use individual IS in a profound way) or with a low degree of intensity (i.e., they use individual IS to a limited extent).
- degree of exploration: IS has a great potential to conduct tasks in novel ways. This is particularly relevant for individual IS. Employees can have a high degree of exploration (i.e., they exploit new functionalities) or with a low degree of exploration (i.e., they use their IT primarily in routines).

The four dimensions can be classified into two groups: degree of individualization and richness of use. Both the degree of individual IS and the degree of boundary spanning reflect to what extent an individual uses individual IS. The consideration of both dimensions allow a more detailed perspective on the degree of individualization. For instance, there might be employees who are seeking to use consumer IT to the highest extent possible (e.g., based on its superior usability), but only to fulfill work at the organization. In contrast, there might also be individuals who prefer to have a high degree of boundary spanning but only with enterprise IT (e.g., using enterprise IT at home). Note that both scenarios are most likely extreme cases. Besides, use behavior has been increasingly conceptualized as a rich concept (Bagayogo et al. 2014; Barki et al. 2007; Burton-Jones and Straub 2006). In this line, the identified dimensions' degree of intensity and degree of exploration can be considered as a more detailed perspective on the richness of use. In addition and similar to the other concepts, both of them can point in the opposite direction. For example, an employee can work very intensely with a specific technology without exploiting its features. Similarly, one can exploit features without working very intensely with a system.

4.3 Technology-Related Effects of Individualization

4.3.1 Instrument Autonomy

Autonomy is considered a key characteristic of workplaces (Deci et al. 1989; Hackman and Oldham 1975; Karasek 1979; Mazmanian et al. 2013) that has been widely used to explain IS-related issues. For instance, Ahuja and Thatcher (2005) include autonomy as an important antecedent of innovation behavior. Morris and Venkatesh (2010) suggest a positive impact of autonomy on job-satisfaction, whereas others show a significant impact on work-to-life conflict (Ahuja et al. 2007; Sarker et al. 2018).

The concept has been used on various levels of analysis (c.f. Table 4.2). Durcikova et al. (2011) use "climate for autonomy" on the organizational level to explain knowledge management success. On the group level, team autonomy has been used to investigate group-level phenomena

(e.g., Lee and Xia 2010). Finally, autonomy has been intensively used to explain a wide range of individual aspects (Ahuja and Thatcher 2005; Moore 2000).

Previous literature emphasized the rich nature of autonomy and its multidimensional structure (Breaugh 1985, 1989; Breaugh and Becker 1987). IS research also acknowledged different dimensions. For instance, Ye and Kankanhalli (2018) include scheduling autonomy, decision-making autonomy, and work-method autonomy to understand user's service innovation.

Besides various contextualized forms of autonomy, IS literature has also proposed several autonomy-related constructs. In the domain of technology acceptance, studies show that the concept of voluntariness is an important factor when it comes to use and adoption behavior (Brown et al. 2002; Wu and Lederer 2009). Murray and Häubl (2011) go one step further by explicitly investigating whether the freedom to choose a specific technology also influences technology-related attitudes. Based on the results of an experimental study, they provide evidence that freedom of choice has a positive impact on perceived ease of use.

Construct	Entity	Dimensions	Reference
Contextualized autonomy constructs			
Job Autonomy	Ind	Uni	(Ahuja and Thatcher 2005; Elie-Dit-Cosaque et al. 2011; Moore 2000; Tripp et al. 2016)
Design Autonomy	Ind	Multi	(Ye and Kankanhalli 2018)
Feelings for Autonomy	Ind	Uni	(Malhotra et al. 2008)
Task Autonomy	Ind	Uni	(Ozer and Vogel 2015)
Team Autonomy	Group	Uni	(Jain et al. 1998; Lee and Xia 2010; Maruping et al. 2009)
IT Project Autonomy	Group	Uni	(Gregory et al. 2015)
Climate for Autonomy	Org	Uni	(Durcikova et al. 2011)
Autonomy-related constructs			
Task authority	Ind	Uni	(Sanders and Courtney 1985)
Freedom of Choice	Ind	Uni	(Murray and Häubl 2011)
Voluntariness	Org	Uni	(Brown et al. 2002; Wu and Lederer 2009)

Ind: Individual, Org: Organization, Uni: Unidimensional, Multi: Multidimensional

Adopted from Klesel (2018)

Table 4.2 Autonomy in IS Research

In an attempt to combine the concept of autonomy and freedom of (technology) choice, the concept of IT work autonomy is proposed that includes existing dimensions of autonomy (Breaugh 1985, 1989; Breaugh and Becker 1987) and extend it with a new dimension, i.e. instrument autonomy (c.f. Figure 4.1). In the light of individual IS that comes with a higher degree of technological alternatives, this conceptualization has the potential to investigate workplace-related phenomena more comprehensively. Since this concept focuses on workplaces, the conceptual model can be used to investigate effects such as (perceived) job satisfaction.

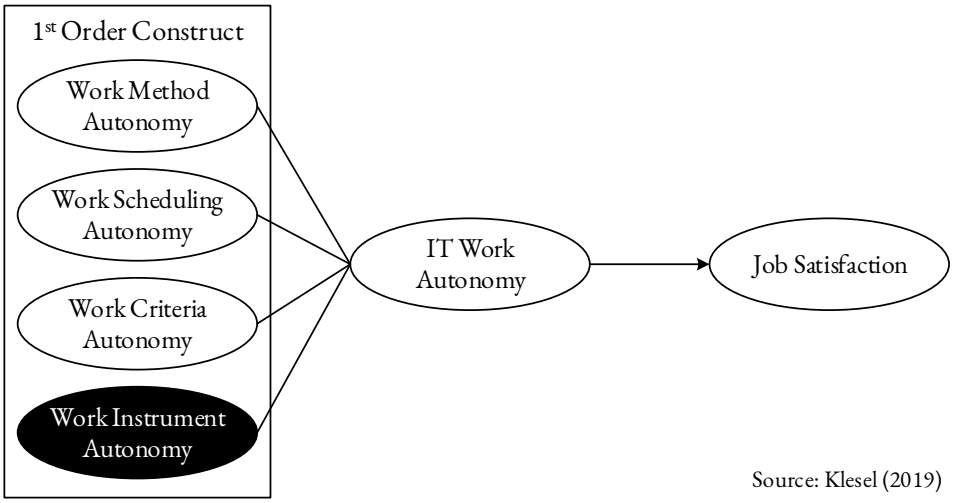


Figure 4.1 Towards IT Work Autonomy

Including work instrument autonomy as a dimension of IT work autonomy, this new concept reflects the role of individual IS as part of the workplace. Besides the investigation of job satisfaction, it is also promising for related aspects such as work-life conflict (Köffer et al. 2014).

4.3.2 IT Choice-Self Efficacy

Several studies from practitioners suggest that individual IS is related to a higher degree of IT satisfaction (Accenture 2011; Dell and Intel 2011; Gens et al. 2011; Harris et al. 2012). However, there are few empirical insights that explain the underlying mechanism that lead to a higher degree of satisfaction.

IT satisfaction is defined as a pleasurable emotional state that results from technology use experience (Bhattacherjee and Premkumar 2004). Previous literature suggests that the concept of satisfaction is similar to attitudinal constructs (Bailey and Pearson 1983; Yajiong et al. 2011), and can thus be included in the TAM (Devaraj et al. 2002; Yajiong et al. 2011).

In order to investigate whether individual IS has an impact on IT satisfaction, a research model is used that is built upon the adoption process proposed by Wei et al. (2011) that includes three

aspects: technology access, digital capability, and digital outcome. Since the focus lies on individual IS, Bring Your Own Behavior (BYOB) is used to reflect technology access. In terms of digital capability, choice self-efficacy is introduced and defined as an "individual's perception of their own ability to choose technology that best fits idiosyncratic needs in order to accomplish a task." (Klesel, Kampling, et al. forthcoming, p. 5). Finally, IT satisfaction is used as the digital outcome variable.

Based on survey data from 400 participants, PLS-PM is used to estimate the proposed research model. Specifically, PLSc is used to correct for attenuation (Dijkstra and Henseler 2015). The goodness of fit measures suggest an appropriate model fit (c.f. Table 4.3).

Fit	**Saturated**			**Estimated**		
indicator	Value	HI95	HI99	Value	HI95	HI99
SRMR	0.0438	0.0460	0.0550	0.0467	0.0496	0.0576
d_{ULS}	0.4441	0.5342	0.7642	0.5522	0.6236	0.8390
d_G	0.2777	0.2886	0.3845	0.3107	0.2884	0.3766

Source: Klesel, Kampling, et al. (forthcoming)

Table 4.3 Model Fit

In order to investigate the internal consistency, the reliability, and the convergent validity, we investigated the Cronbach's alpha, Dijkstra-Henseler's rho (ρ_A), and Jöreskog's rho (ρ_c). Since all measures are above .7, a sufficient degree of reliability can be assumed. Moreover, we investigated the convergent validity by means of the Fornell-Larcker Criterion, which also meets the suggested requirements (c.f. Table 4.4).

Construct	α	ρ_A	ρ_c	BYOB	ChoiceSE	PU	PEOU	ITSF
BYOB	0.7379	0.7947	0.7461	0.5065				
ChoiceSE	0.8717	0.8789	0.8706	0.0498	0.6295			
PU	0.9076	0.9107	0.9074	0.0121	0.0677	0.6215		
PEOU	0.9089	0.9093	0.9088	0.0068	0.1292	0.4699	0.6660	
ITSF	0.8882	0.8899	0.8885	0.0028	0.0768	0.3018	0.3806	0.6662

α = Cronbach's alpha; ρ_A = Dijkstra-Henseler's rho; ρ_c = Jöreskog's rho — Squared correlations; AVE in the diagonal.

Source: Klesel, Kampling, et al. (forthcoming)

Table 4.4 Internal Consistency Reliability and Convergent Validity

With regard to the R^2, the results suggest that 41.1% of the variance of satisfaction can be explained by the model. Moreover, the model can explain 47.0% of the variance of perceived usefulness and 12.9% of perceived ease of use. Finally, there is also a small but significant amount of

variance that can explain choice self-efficacy (4.9%). An overview of the structural model is presented in Figure 4.2.

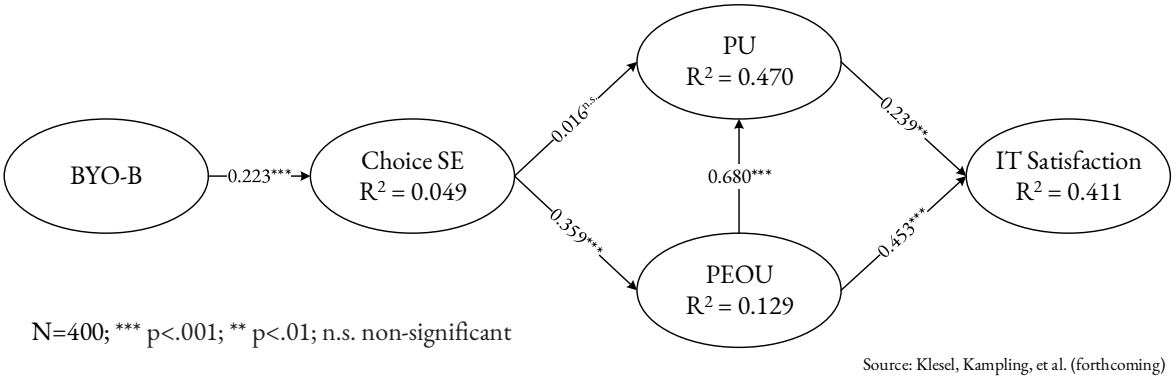


Figure 4.2 Proposed Research Model

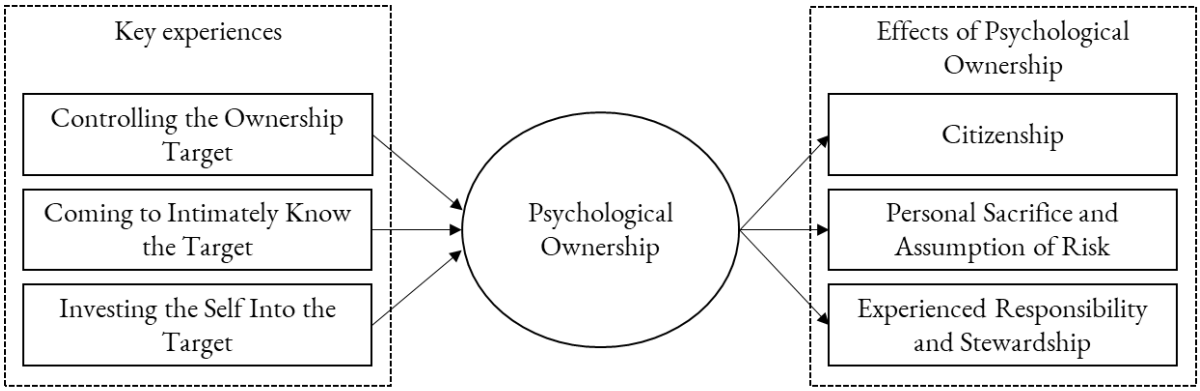
A bootstrap procedure was applied to estimate the significance levels of the path coefficients. Hence, the data suggest significant relationships between all constructs except for the path between choice self-efficacy and perceived usefulness. The evaluated model shows that individual IS (operationalized with Bring Your Own Behavior) has a small but significant impact on choice self-efficacy.

4.3.3 Psychological Ownership of IT

Today, many employees are using technologies for both private and organizational purposes. Usually, this holds when organizations implement Company-Owned Privately Enabled (COPE) policies. An emerging concept in this context is Psychological Ownership of IT (POIT), which is defined as "the sense of ownership an individual feels for an IT or IS" (Barki et al. 2008, p. 270). An important aspect of POIT is its distinction from legal ownership. Hence, an individual can have a high degree of psychological ownership of an object although he or she is not its legal owner. This makes POIT highly relevant for IS research as there are many different IS-related situations where employees are using technology without being its legal owner.

According to Pierce et al. (2003), psychological ownership refers to a state of mind in which individuals perceive a target object as "theirs". Psychological ownership is rooted in three distinct motives, namely efficacy and effectance, self-identity, and having a place. Efficacy and effectance refer to the individuals' control over an object ("Controlling the Ownership Target"). Self-identity reflects the individuals' need to extend their self-identity to others. Finally, individuals need a place which they can refer to as their home. Based on these assumptions, Pierce et al. (2003) propose three key experiences that allow the emergence of psychological ownership: controlling the ownership target, coming to intimately know the target, and investing the self into the target.

Pierce et al. (2003) suggest that psychological ownership leads to citizenship, which refers to individual behavior that contributes to a group or community in a positive way, personal sacrifice and assumption of risk which a person is willing to take on behalf of a social entity. Finally, it results in experienced responsibility and stewardship, which reflects to a high degree to be protective and supportive for the target. The conceptual model for psychological ownership is shown in Figure 4.3.



Source: Pierce et al. (2003)

Figure 4.3 Psychological Ownership

IS research operationalized psychological ownership in different contexts including system design (Barki et al. 2008), system use (Lee and Chen 2011), or social media (Karahanna et al. 2015). For individual IS, POIT is particularly relevant for two reasons: First, mobile technologies are oftentimes provided by the organization (i.e., the legal owner) but used by the employee. Hence, investigating POIT rather than legal ownership becomes more relevant to understand phenomena. Second, mobile technologies are oftentimes positively influencing key experiences. Most notably, those technologies are used intensively, which invites individuals to intimately know the target. Moreover, employees commonly have a high degree of control over individual IS. Hence, POIT is an important concept to understand individual IS. However, the full complexity of POIT has not been fully understood yet.

Against this background, this thesis contributes to the current body of knowledge by identifying new concepts that lead to POIT and new effects that have not been unveiled yet. In specific, three new antecedents and one new effect have been identified:

1) Freedom of choice (antecedent): refers to the ability to choose one's own technology. Having the choice to select a specific technology according to one's own preferences can be considered as an important antecedent that leads to ownership.
2) Multi-context use (antecedent): refers to the use of one specific technology for multiple purposes (e.g., work-related and private-related tasks). If individuals use their technology

for multiple purposes, they spent more time with it, which in turns relates to knowing the target. Hence, this results in a higher degree of ownership.

3) Surveillance (antecedent): relates to the degree to which the employee's use of technology is tracked by an organization. Since surveillance is the covert form of control, it is closely related to controlling the target.
4) Expectation handling (effect): relates to the capability to handle malfunctions or misbehavior of technology. Exception handling is related to a personal sacrifice and citizenship behavior since an individual seeks to find a solution by oneself instead of using the resources of others.

In summary, the identified concepts not only support existing literature but also indicate new aspects that are relevant to understand the complexity of POIT. Therefore, we propose an extended view on POIT that integrates existing knowledge with these new findings (c.f. Figure 4.4).

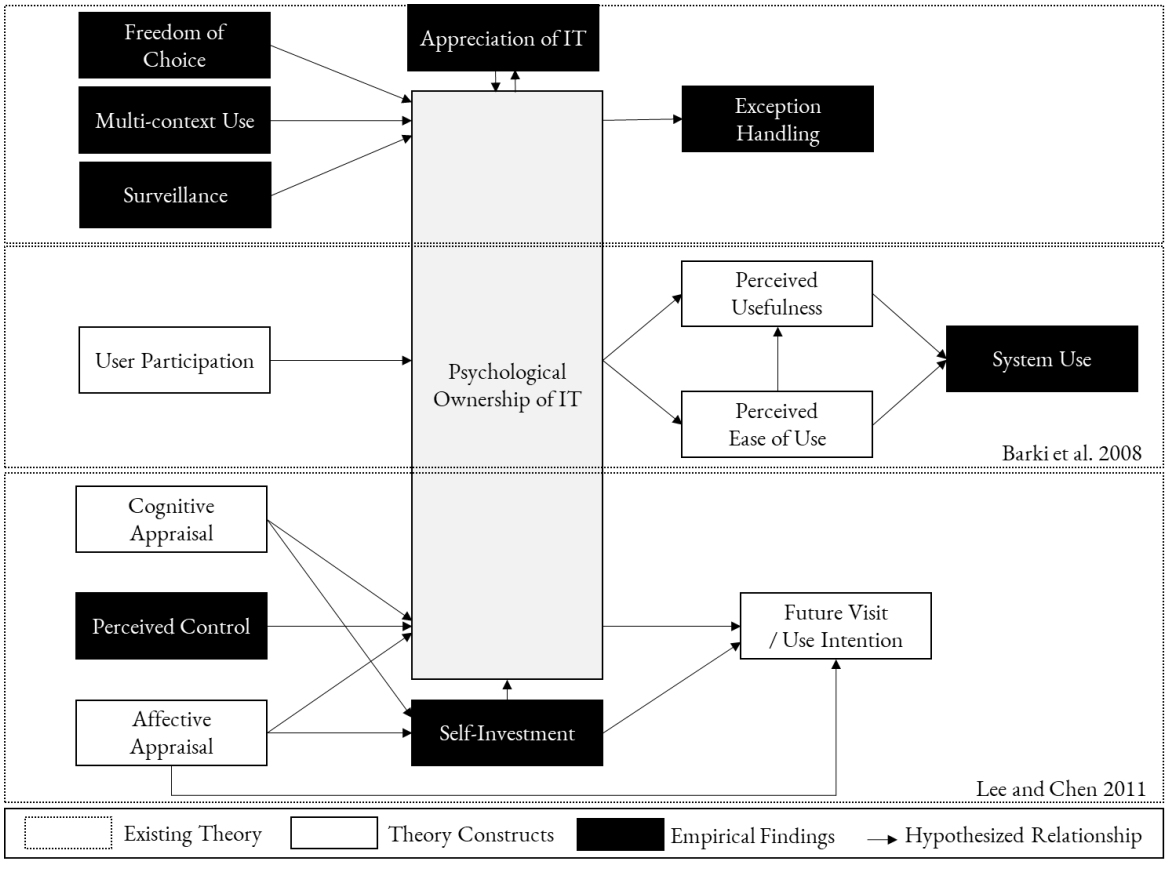


Figure 4.4 Extended View of Psychological Ownership

4.3.4 IT Mind Wandering

In general, two types of systems are distinguished: hedonic and utilitarian systems (see for instance van der Heijden 2004; Lowry et al. 2013). Individual IS are relevant for both types because they

are not only suitable for hedonic systems (such as mobile games) but also for job-related systems (such as E-Mail apps). With the blurring of boundaries and an intensified use of technology across different domains, individual IS hence covers both types of systems. Consequently, it can be assumed that depending on what type of system a user is using with individual IS, it has different effects. More specifically, we investigate whether the use of hedonic systems leads to a higher degree of mind wandering compared to the use of utilitarian systems. In order to test this hypothesis, the concept of IT mind wandering is investigated. IT mind wandering can be defined as a "*task-unrelated thought which occurs spontaneously and the content is related to the aspects of computer systems* " (Sullivan et al. 2015, p. 4).

A factorial survey with four different scenarios (Gaming, Facebook, Booking, E-Mail) were implemented to test the proposed hypothesis. Gaming and Facebook reflect hedonic use and Booking and E-Mail reflect utilitarian use. Our data suggest that there is a significant difference in terms of perceived level of mind wandering (c.f. Table 4.5).

				Tukey's HSD Comparisons		
Group	*n*	M	*SD*	(1)	(2)	(3)
(1) Gaming	22	4.06	1.37			
(2) Facebook	25	4.45	1.52	.806		
(3) Booking	27	3.19	1.69	.194	.017	
(4) E-Mail	16	2.73	1.28	.042	.003	.765

Source: Oschinsky et al. (2019)

Table 4.5 Post Hoc Analysis of Mind Wandering

The results are in favor of the proposed hypothesis as three out of four group-wise comparisons are significant. Based on the results, there is a high level of mind wandering when it comes to using Facebook or playing games. In contrast, there is a lower degree when individuals use their technologies for utilitarian purposes. This somehow relates to the assumption that the task's complexity also plays a role when it comes to mind wandering (Sullivan et al. 2015).

4.4 Boundary Management with Individual IS

4.4.1 Boundary Strategies

Research has recognized that different domains such as work and private life are interdependent and permeable (Ashforth et al. 2000; Clark 2000; Nippert-Eng 1996). Depending on external conditions and individual preferences, an individual can integrate those domains or separate

them. Moreover, one can seek to mediate between integration and separation. Most often, it is assumed that there is a blurring of boundaries; i.e., that different domains are or cannot be separated disjunctively.

In IS research, it is assumed that individual IS have a significant impact on the blurring of boundaries. An increasing number of studies shows that the blurring of boundaries is particularly relevant when it comes to the well-being of employees and their ability to maintain their work-life balance. For instance, Köffer, Anlauf, et al. (2015) show that the use of consumer IT results in an intensified blurring of boundaries. Other studies show that there is a significant impact between the use of consumer IT and work-life balance (Köffer et al. 2014).

Although IT can be considered as a trigger and a cause of work-to-life conflict, it also has the potential to create or maintain boundaries. More specifically, there are three types of strategies: strategies to separate work and private life, strategies to mediate between integration and separation, and strategies to promote integration. Table 4.6 gives an overview of six individual tactics that allow individuals to address their preferences.

Individual tactic	**Primary objective**	**Examples for technological implementation**
Physical detachment	separation	Leaving technology at work when at home; turning work-related technology off when at home or turning technology silent or on vibration.
Automatic response		Using an answering machine; sending e-mail-notifications for e-mails that arrive after hours or on vacation.
Pull Information	mediation between integration and separation	Actively looking up new messages and phone calls without being informed just in time.
Boundary App		Possibility to change actively within the same technology between home and private life domains.
Push Information	integration	Being informed just in time about incoming messages and phone calls.
Dynamic Filtering		Setting up filters that let notifications of specific individuals come through.

Source: Jahn et al. (2016)

Table 4.6 Overview of Individual Tactics

The results show that different strategies are available that can be used to meet the primary objective (separation, mediation between integration and separation, and integration). Moreover, the findings show that there is no one dominant strategy but different ways to reach that goal.

4.4.2 IT Resilience

The individualization of IS makes it almost impossible to detach physically from technology. Therefore, it is important to understand individual characteristics that have the potential to buffer negative consequences. For that reason, the concept of IT resilience is proposed as a potential aspect that allows individuals to handle stress-related stimuli. The concept of resilience has its origin in material sciences and can be used to describe the properties of an object (Sherrieb et al. 2010). Specifically, resilience describes how an object behaves under pressure and how far it is able to return to its original state. The idea of resilience becomes most evident in connection with a mattress that is able to "bounce back" to its original state after being exposed to pressure.

Themes	Resilience	IT Resilience
Self-Efficacy	"having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks" (Luthans et al. 2007)	confidence (self-efficacy) in working with **(mobile) technologies** regardless of the situation (stress, challenging tasks, errors), respectively the ability to adapt to these situations
Positive attribution	"making a positive attribution (optimism) about succeeding now and in future" (Luthans et al. 2007)	being optimistic about finding solutions for problems as well as being adaptable towards **technology-induced** stress, problems or tight deadlines
Persevering towards goals	"persevering towards goals and when necessary, redirecting paths to goals (hope) in order to succeed" (Luthans et al. 2007)	Keeping track of **technology-related goals (e.g., use behavior)** and if necessary readjusting paths to achieve goals by having structured plans
Bounce back	"when beset by problems and adversity, sustaining and bouncing back and even beyond (resiliency) to attain success." (Luthans et al. 2007)	when faced with **technology-related problems (e.g., technostress)** and adversity, sustaining and bouncing back to succeed as well as cultivating social contacts and keeping a work-life-balance

Adopted from Klesel et al. (2018)

Table 4.7 Resilience and IT Resilience

We argue that the idea of resilience is an important perspective in terms of technology-induced stress, i.e., technostress (Ayyagari et al. 2011). In other words, IT resilience can explain why some individuals are able to handle technostress better than others. Previous literature from psychology suggests that resilience has four central themes (i.e., self-efficacy, positive attribution, persevering towards a goal, and bouncing back). We argue that all themes are also relevant in the context of IT. Against this background, we propose the notion of IT resilience. Similar to resilience as used in psychology, IT resilience includes self-efficacy in terms of individual IS, positive attribution

with regard to technology-induced stress, preserving towards goals in the light of technology-related goals, and reflecting the ability to bounce back when faced with technology-related problems. Table 4.7 juxtaposes both concepts and highlights the merits of IT resilience.

Based on the results of an EFA, three dimensions emerged (c.f. Table 4.8):

1) "Bounce back": refers to the ability to bounce back when technostress occurs. This is in line with psychological literature on resilience (Smith et al. 2008; Winwood et al. 2013) and is also relevant in relation to technology. This factor includes eight items.
2) "Self-efficacy": is someone's ability to believe in his/her own skills to work with (mobile) technologies in every given situation. This is particularly relevant in stressful situations. This factor is measured by five items.
3) "Coping": the final dimension refers to the ability to handle negative aspects and problems in combination with technology. For example, a high degree of coping can be expected from individuals who see things in a humorous way even in stressful situations.

ID	Factor 1	Factor 2	Factor 3	Cronbach's α	IT Resilience
RES2	.752				
RES3	.708				
RES4	.653				
RES5	.776			.846	
RES6	.633				
BB1	.590				
BB2	.554				
BB3	.644				
HD1		.586			.859
ADP1		.804			
ADP2		.698		.808	
ADP3		.854			
ADP5		.661			
HD3			.709		
HD4			.609	.676	
INST3			.728		
INST4			.698		

Table 4.8 Factor Loadings of the EFA

4.4.3 How to Design Information Technology

Although there is an increasing body of knowledge that seeks to explain antecedents of work-life-balance (Sarker et al. 2018), very little research is available that investigates how technology can be

designed to support work-life-balance or reduce work-to-life conflicts. This shortcoming is somehow surprising, since technology design can have a significant impact on how technology is used (Singer 2015) and how people interact with it.

Against this background, we investigate whether design choices have an impact on work discontinuance intention which is defined as "the conscious decision to temporarily stop work against the background of individual preferences or in order to prevent negative consequences (such as stress or overload)." (Klesel, Jahn, et al. 2016, p. 5).

This research is conducted in the light of Design Science Research (DSR) with the objective to identify superior design choices. This is most closely related to the notion of an Explanatory Design Theory (EDT) which "seeks to inform a designer about which features should be included in an artifact and why. Structurally, it consists of two or more connected hypotheses, while a single hypothesis in its basic form describes the relationship between an independent variable (cause) and a dependent variable (effect). To fulfill its informative function for a designer, at least one of the hypotheses of an explanatory IS design theory must include an independent variable that can be systematically manipulated through the design of an artifact. In principle, explanatory IS design theories constitute normative theories, which means that at least one dependent variable is regarded as desirable or undesirable." (Niehaves and Ortbach 2016, p. 306). In this context, we seek to inform a designer what features (i.e., design choices) have an impact on work discontinuance intention.

It has been argued that the proposition of design-related hypothesis should be derived based on kernel theories from natural and social sciences (Gregor and Jones 2007; Walls et al. 1992). We draw from nudge theory (Thaler and Sunstein 2008) to build a choice architecture (Thaler et al. 2014). An overview of the conceptualized design choices is provided in Table 4.9. In Figure 4.5 an example is given of how the design option was implemented in the experimental setting.

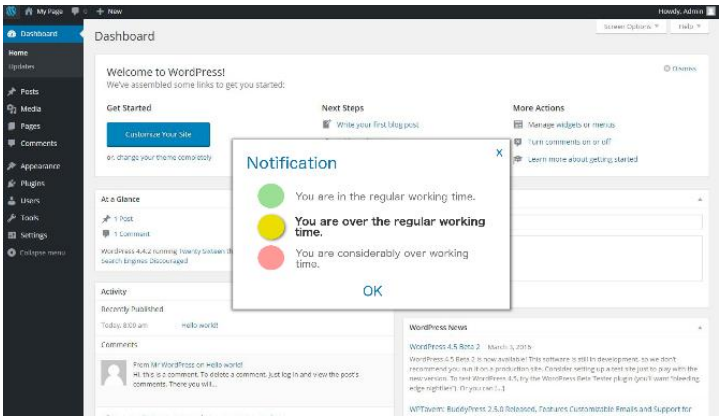
primary strategy	**nudge option**	**main characteristic**
simplify desired choice	default rules[ab] (1. Default)	the desired choice is predefined (default). Therefore, the undesired choice requires proactive behaviour and is, thus, more difficult to put into practice
	reduce number of alternatives[a] / simplification[b] (2. Ease)	increase convenience in making a choice by simplifying choice options
	technology and decision aids[a] (3. Decision aid)	technology aids simplify desired choices
	focusing on satisficing[a]	desired choice is simplified by offering a convenient sufficient solution
	translate and rescale for better evaluability[a] (4. Rescale)	reporting information in a more convenient way to favor the desired choice

	decision staging[a]		choices are presented in sections (i.e. stages) to simplify the desired choice
	partitioning of options[a]		choices are presented in partitions to simplify the desired choice
intensify the tie with desired choice	Customized information[a]	use of social norms[b] (5. Social)	social norms such as information about the behaviour of your colleagues are used to impede undesired choices
		precommitment strategies[b] (6. Precommitment)	precommitment is demanded to stick to the desired outcome
		reminders[b] (7. Reminder)	the individual is reminded of the desired choice
		focus on experience[a] / informing people of the nature and consequences of their own past choices[b] (8. Past Experience)	by revealing the consequences of past choices, the desired choice is encouraged
		focus on experience[a] / eliciting implementation intentions[b] (9. Elicit)	desired choice is intensified by explicitly putting intentions forth
	limited time windows[a] (10. Time Window)		by reducing the time window for choice, the undesired choice is impeded
impede undesired choice	Attribute parsimony and labelling[a] (11. Label)		choices are labelled (e.g., by detaching a symbol to the undesired option)
	warning, graphic or otherwise[b] (12. Warning)		choices are influenced by warnings (e.g., using warning symbols)
	disclosure[b] (13. Disclosure)		by disclosing background-information, the undesired choice can be impeded

[a]Johnson et al. (2012) [b]Sunstein (2014)
(nudge): operationalized as a design option in this study (c.f. Section 4)

Adopted from: Klesel, Jahn, et al. (2016)

Table 4.9 Concepts to Build a Choice Architecture



Nudge option "rescale"

Source: Klesel, Jahn, et al. (2016)

Figure 4.5 Operationalization of a Design Choice

The results show that there are four design choices (i.e., ease, reminder, elicit, and disclosure) that have a significant impact on work discontinuance intention ($0.001 < p < 0.94$). Based on these

insights, a designer who seeks to influence work discontinuance intention can be encouraged to use either one of the four identified design choices.

4.5 Assessing Group-Wise Differences

4.5.1 Motivation

Human behavior differs in many areas, which is why multigroup analysis and the investigation of group-differences is an important approach to accurately estimate contingent effects. Hence, IS research, which is a socio-technical discipline, is oftentimes affected by group-wise differences (see for instance Keil et al. 2000). In the light of individual IS, heterogeneity becomes even more relevant since it allows individuals to build and use IS according to their preferences (Baskerville 2011a). As a consequence, cause effect relationships may differ significantly across several groups.

SEM is well suited to conceptualize and estimate complex relationships and allows the investigation of group-wise differences. PLS-PM is one specific type to estimate complex models that has been widely applied in IS research (Ringle et al. 2012) and further developed. Important milestones include the proposition of the heterotrait-monotrait ratio of correlations (Henseler et al. 2015), consistent PLS (Dijkstra and Henseler 2015), and ordinal PLS (Schuberth et al. 2018).

Observed heterogeneity has been recognized in the context of PLS-PM, and several approaches have been suggested to detect and investigate group-wise differences. This includes parametric and non-parametric approaches for two groups (Keil et al. 2000; Chin and Dibbern 2010; Henseler 2012). To investigate group-differences across more than two groups, literature recommends the omnibus test of group differences which is a combinatorial approach including both bootstrapping and permutation to mimic an overall *F*-test (Sarstedt et al. 2011).

All concepts introduced so far are affected by the multiple comparison which involves the risk of inducing a Family-Wise Error Rate (FWER), which is the probability that at least one single test results in a type I error (i.e., falsely rejecting the null hypothesis) if not properly controlled. This is particularly relevant in complex models with multiple relationships. Let p be the number of parameters and G be the number of models; the number of overall comparisons c is calculated as follows (Equation 1):

$$c = p\binom{G}{2} = \frac{p \cdot G!}{2!\,(G-2)!} \tag{1}$$

Reviewing existing literature that apply MGA in IS research, it can be assumed that several studies suffer from an inflation of type I errors. An overview of the FWER without any kind of correction is shown in Table 4.10.

Reference	Grouping Variable	Paths	Comparisons	FWER
Keil et al. (2000)	culture (Finland, Netherlands, Singapore)	5	15	53.67%
Ahuja and Thatcher (2005)	gender (male, female)	5	5	22.62%
Srite and Karahanna (2006)	cultural values (individualism, collectivism)	4	4	18.55%
Zhu et al. (2006)	users (EDI user, non-user)	16	16	55.99%
Hsieh et al. (2008)	economically (advantaged, dis-advantaged)	9	9	36.98%
Sia et al. (2009)	cultural differences (Australia, Hong Kong)	6	6	26.49%
Shen et al. (2010)	gender (male, female)	6	6	26.49%
Yeh et al. (2012)	gender (male, female)	4	4	18.55%
Dibbern et al. (2012)	country (Germany, United States of America)	5	5	22.62%
Zhou et al. (2015)	indulgence (high indulgence, low indulgence)	4	4	18.55%
Huma et al. (2017)	organization (private, public)	6	6	26.46%
Shi et al. (2018)	gender (male, female)	3	3	14.26%

Source: Klesel, Schuberth, et al. (forthcoming)

Table 4.10 Multigroup Analysis in IS Research

4.5.2 A Test to Assess Group-Wise Differences

In order to test group-wise differences based on the overall model, two tests are proposed that consider the discrepancy between the indicators' model-implied correlation matrices across groups. For that purpose two distance measures are used: the geodesic distance (James 1973; Swain 1975) and the Euclidean distance. The geodesic distance between two groups is based on the model-implied correlation matrix of group 1 ($\boldsymbol{\Sigma}(\boldsymbol{\theta}_1)$) and group 2 ($\boldsymbol{\Sigma}(\boldsymbol{\theta}_2)$) and is calculated as follows (Equation 2):

$$d_g = \frac{1}{2}\sum_{i=1}^{K} \ln(\varphi_i)^2, \tag{2}$$

where φ_i is the i^{th}eigenvalue of the matrix $\boldsymbol{\Sigma}(\boldsymbol{\theta}_1)^{-1}\boldsymbol{\Sigma}(\boldsymbol{\theta}_2)$ and *K* is the number of rows of one of these two matrices. Similarly, the squared Euclidean distance between $\boldsymbol{\Sigma}(\boldsymbol{\theta}_1)$ and $\boldsymbol{\Sigma}(\boldsymbol{\theta}_2)$ is calculated as follows:

$$d_E = \frac{1}{2}\sum_{i=1}^{K}\sum_{j=1}^{K}\left(\sigma_{ij,1} - \sigma_{ij,2}\right)^2, \tag{3}$$

where *K* is the number of rows and $\sigma_{ij,1}$ and $\sigma_{ij,2}$ are elements of the respective matrix.

In order to allow the investigation of more than two groups, the arithmetic mean of all distances across the groups is used. Note that the total number of groups is calculated as $\frac{G(G-1)}{2}$, where *G* is the number of groups. Therefore, the average geodesic distance (D_g) for *G* groups is calculated as follows:

$$D_g = \frac{2}{G(G-1)}\sum_{g=2}^{G}\sum_{h=1}^{g-1}\sum_{i=1}^{K} \ln(\varphi_i)^2 \tag{4}$$

where $\varphi_i$is the i^{th}eigenvalue of the matrix $\boldsymbol{\Sigma}\left(\boldsymbol{\theta}_g\right)^{-1}\boldsymbol{\Sigma}(\boldsymbol{\theta}_h)$. In a similar manner, we calculate the average squared Euclidean distance for more than two groups as follows:

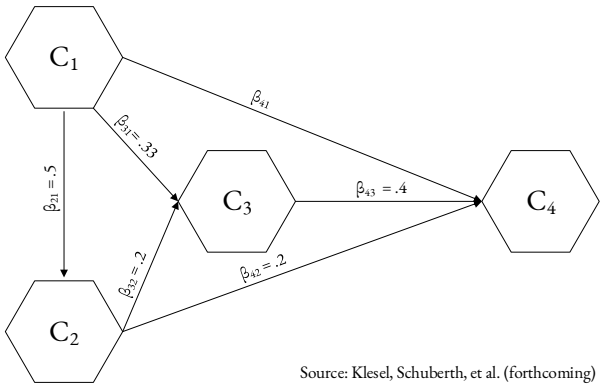
$$D_e = \frac{2}{G(G-1)}\sum_{g=2}^{G}\sum_{h=1}^{g-1}\sum_{i=1}^{K}\sum_{j=1}^{K}\left(\sigma_{ij,g} - \sigma_{ij,h}\right)^2, \tag{5}$$

where $\sigma_{ij,g}$ and $\sigma_{ij,h}$ are the elements of the corresponding model-implied correlation matrix.

Based on the design of the proposed tests, the null hypothesis is as follows: H_0: $\boldsymbol{\Sigma}(\boldsymbol{\theta}_1) = \cdots = \boldsymbol{\Sigma}\left(\boldsymbol{\theta}_g\right) = \cdots = \boldsymbol{\Sigma}(\boldsymbol{\theta}_G)$, where $\boldsymbol{\Sigma}\left(\boldsymbol{\theta}_g\right)$ is the model-implied population correlation matrix of the indicators for group *g*. To obtain the reference distribution of the distance measures permutation is used.

4.5.3 Design of a Monte Carlo Simulation Study

A model with four constructs conceptualized as composites is used to carry out a Monte Carlo simulation (c.f. Figure 4.6). For each composite, three indicators are used with the following weights: 0.3, 0.4, and 0.6 for C_2 to C_4. The weights of C_1 are systematically varied. The simulation covers five different scenarios: 1) homogenous groups, 2) groups with small differences (structural model), 3) groups with moderate differences (structural model), 4) groups with different weights across groups, and 5) groups with different weights and small differences in the structural model. An overview of the population parameters is given in Table 4.11.



Source: Klesel, Schuberth, et al. (forthcoming)

Figure 4.6 Structural Population Model

Scenario	D_g	D_e	g	β_{41}	w_{11}	w_{21}	w_{31}
(i) Homogeneity	0	0	1	0	0.30	0.50	0.60
			2	0	0.30	0.50	0.60
			3	0	0.30	0.50	0.60
(ii) Small Structural Difference	0.0471	0.0133	1	0	0.30	0.50	0.60
			2	**0.1**	0.30	0.50	0.60
			3	**0.2**	0.30	0.50	0.60
(iii) Moderate Structural Differences	0.3293	0.0266	1	0	0.60	0.50	0.30
			2	**0.2**	0.30	0.50	0.60
			3	**0.4**	0.30	0.50	0.60
(iv) Different Weights*	0.2576	0.0337	1	0	0.60	0.50	0.30
			2	0	**0.80**	**0.30**	**0.30**
			3	0	**0.38**	**0.38**	**0.66**
(v) Structural Differences and Different Weights*	0.3138	0.0409	1	0	0.60	0.50	0.30
			2	**0.1**	**0.80**	**0.30**	**0.30**
			3	**0.2**	**0.38**	**0.38**	**0.66**

Group (g); Average geodesic distance (D_g); Average squared Euclidean distance (D_e)

*Weights are rounded (2 digits).

Source: Klesel, Schuberth, et al. (forthcoming)

Table 4.11 Population Parameters

The simulation was implemented in the Statistical Programming Environment R (R Core Team 2017). Multivariate standard normally distributed data sets were generated using the *MASS* packages (Ripley et al. 2017). The PLS estimates were obtained using the *matrixpls* package (Rönkkö 2017), employing Mode B for consistent estimates (Dijkstra 1981). In order to compare the results of this test, a test procedure based on repeated comparisons of path coefficients (RCPC) was applied (Chin 2003; Chin and Dibbern 2010).

4.5.4 Results

The rejection rates of the three tests are summarized in Table 4.12. The results demonstrate that both newly introduced tests are able to maintain the predefined significance level of 5% quite well, while the RCPC rejects the null hypothesis of no group differences far too often.

In terms of detecting group-wise differences, the results also suggest that the new tests perform well. In scenarios with moderate structural differences, both tests are above the recommended threshold of 80% (Cohen 1988). The results also show that the tests are well-suited to detect different weights.

In terms of sample size and data distribution, the results show that both tests benefit from an increasing number of observations, which is in line with existing literature (Qureshi and Compeau 2009). Moreover, both the tests are relatively robust when applied with non-normal data.

		Normal Data			Non-Normal Data		
Scenario	n/group	D_g	D_e	RCPC	D_g	D_e	RCPC
1) Homogeneity	100	5.7%	7.0%	50.3%	5.0%	7.3%	51.7%
	200	5.0%	4.3%	51.0%	3.0%	2.7%	53.3%
	300	2.3%	4.7%	52.7%	6.7%	5.7%	54.3%
	400	4.7%	4.7%	55.0%	4.3%	2.3%	47.0%
	500	4.0%	6.3%	48.0%	4.7%	5.0%	56.0%
2) Small Structural Differences	100	12.3%	9.0%	68.7%	8.7%	4.7%	64.7%
	200	19.7%	11.7%	77.0%	16.7%	15.3%	71.3%
	300	32.0%	22.7%	84.7%	22.7%	18.3%	78.7%
	400	45.7%	28.3%	91.0%	30.7%	24.3%	86.7%
	500	56.7%	36.7%	96.3%	41.0%	33.7%	92.3%
3) Moderate Structural Differences	100	70.3%	25.3%	91.3%	41.0%	18.7%	85.7%
	200	99.0%	59.3%	99.7%	84.3%	46.7%	97.0%
	300	100.0%	86.3%	100.0%	99.0%	76.7%	100.0%
	400	100.0%	96.3%	100.0%	99.7%	86.3%	100.0%
	500	100.0%	99.3%	100.0%	100.0%	96.3%	100.0%
4) Different Weights	100	54.3%	59.0%	52.7%	37.3%	42.7%	56.3%
	200	97.7%	97.0%	58.0%	85.3%	83.7%	58.0%
	300	100.0%	100.0%	62.3%	99.0%	99.3%	60.3%
	400	100.0%	100.0%	62.0%	99.7%	99.7%	59.3%
	500	100.0%	100.0%	63.0%	100.0%	100.0%	62.0%
5) Structural Differences and Different Weights	100	71.7%	70.0%	64.3%	51.7%	56.3%	61.3%
	200	99.7%	99.0%	80.7%	93.0%	94.7%	72.3%
	300	100.0%	100.0%	89.7%	100.0%	100.0%	82.0%
	400	100.0%	100.0%	93.3%	100.0%	100.0%	89.3%
	500	100.0%	100.0%	97.0%	100.0%	100.0%	95.3%

Source: Klesel, Schuberth, et al. (forthcoming)

Table 4.12 Rejection Rates

5 Discussion and Conclusion

5.1 Contribution to Theory and Practice

The overall objective of this thesis is to provide a better understanding of individual IS with respect to technology-related perceptions, its impact on outcome variables and methodological directions that are relevant for this context. Based on the results of the empirical studies presented here, the main contributions are discussed in the light of theoretical and practical implications.

Ad RQ 1: What are the relevant dimensions to conceptualize technology use in the context of individual IS?

With regard to RQ 1, this thesis contributes to IS research in three ways: first, it provides the results of a comprehensive literature review, which can be used as a theoretical foundation to investigate individual IS. The review shows that existing research made only little use of the various dimensions offered by structuration theory, which in turn invites future research to better utilize the fundamental concepts. Since existing research already showed initial efforts to apply structuration theory and individual IS (Gaß et al. 2015; Mokosch et al. 2015), other studies can benefit from these insights.

Second, a new concept (i.e., transgressive use of technology) has been proposed to conceptualize individual IS. Existing literature lacked a use conceptualization that recognizes dimensions that are relevant in terms of individual IS. Hence, this thesis contributes to existing literature on technology use by providing a new concept that is better aligned with contemporary use behavior. By including new dimensions (e.g., boundary spanning), this research can be an important step towards future research on the relationship between technology and work-life balance as the boundaries between work and private life are increasingly blurring.

Third, the results also contribute to practice. Most importantly, the results contribute to a better understanding on how individuals use individual IS. For organizations, it is important to recognize new forms of use behavior to develop and implement organizational structures accordingly. A more detailed understanding can thus contribute to a more useful implementation of policies (Gregory et al. 2018) or to a higher degree of employer attractiveness (Weeger et al. 2016).

Ad RQ 2: What are additional technology-related perceptions when using individual IS?

With respect to RQ 2, this thesis recognizes four technology-related concepts: IT instrument autonomy, IT choice-self-efficacy, psychological ownership of IT, and IT mind wandering. Since these concepts have been investigated in an exploratory manner (e.g., exploring new antecedents

of POIT) and confirmatory manner (e.g., testing of a structural model including choice self-efficacy), they contribute to IS research in several ways: first, by exploring new concepts and their dimensions, future research can draw from this knowledge and include these conceptualizations for theory development. For instance, the concept of IT resilience can be embedded in structural models that seek to explain the relationship between technology use and negative outcomes. Second, by testing a structural model, this thesis extends the current body of knowledge related to individual IS. Particularly in light of several studies from industry who suggest a positive relationship between individual IS and employee satisfaction, this study contributes by providing a more detailed understanding of underlying mechanisms.

Since emerging technologies are increasingly intertwined with the individual (e.g., wearables), psychological constructs such as psychological ownership of IT or IT mind wandering are becoming more important. Hence, individuals are likely to develop a feeling of ownership. In the same vein, interacting with technology continuously increases situations where individuals are drifting away with their thoughts while using IT (i.e., IT mind wandering). Hence, the identified concepts provide a solid foundation for theory development in the context of individual IS. In addition, they can be considered useful for design-related research as they guide a designer to derive a new design-related hypothesis.

Besides theoretical contributions, technology-related perceptions are important indicators for organizations. Specifically, this research provides specific factors that can be designed, manipulated and influenced by organizations. For instance, work instrument autonomy is a specific job characteristic that can be influenced by organizational policies. For example, organizations can enact policies that allow employees to choose their IT themselves. This seems particularly feasible with regard to knowledge workers. Similarly, organizations can extend or limit the degree of control employees have over their IT, resulting in a higher or lower degree of POIT.

Ad RQ 3: What is the impact of individual IS on the individual in terms of boundary management?

In terms of RQ 3, this thesis contributes to existing literature by investigating the role of technology in the context of boundary management. In doing so, this research extends existing efforts on leveraging technology (Kreiner et al. 2009) in order to handle boundaries. The insights are important for academia and practitioners alike. On a theoretical level, this thesis identified a set of behaviors that are executed to meet one's preferences (e.g., explicit physical detachment). This can be important to understand why some people are more stressed at work than others. Future research can use these insights to further investigate different use behaviors in specific situations.

In the same vein, this thesis recognizes that there is an increasing number of technologies that cannot be detached (physically) easily. For that reason, IT resilience was introduced as an important concept to cope with possible technology-related stressors. In doing so, this thesis contributes to existing literature on technostress and the dark side of technology by proposing a new concept (i.e., IT resilience) that has the potential to explain stress-related relationships.

A specific example is given on how to design technology in order to avoid negative consequences. This is done using the example of overwork. Hence, the thesis contributes to existing literature on design science research by testing specific design-related hypothesis (Niehaves and Ortbach 2016) in the context of boundary management. Future research can build on these insights, and extend them by including other dependent variables or new design choices.

The results related to boundary management are also relevant for practitioners. First, it highlights the importance of different preferences in terms of boundary management and how individuals cope with it. From an organizational perspective, it is recommendable to provide solutions that allow individuals to comply with their preferences in order to avoid overload and stress. Second, it provides specific design alternatives that can be implemented in enterprise IT. For instance, if organizations seek to reduce overwork, they can implement nudge options in their systems.

Ad RQ 4: What are the methodological approaches to test for group-wise differences?

This thesis also contributes to research on SEM. First, it allows researchers to test group-wise differences with PLS-PM on a pre-defined error rate. Hence, it support researcher to conduct MGA. Second, it allows the assessment of multiple groups. Since research oftentimes investigates multiple groups (e.g., Keil et al. 2000), this test can be used in various contexts. For example, literature on the digital divide (Niehaves and Plattfaut 2014) can benefit from this new approach for group-wise differences. Third, the generic nature of the test also allows the application with other techniques such as Generalized Structured Component Analysis (GSCA) (Hwang and Takane 2004) or GSCA that accounts for errors in indicators ($GSCA_m$) (Hwang et al. 2017). Hence, future research can extend the usability of the proposed test in conjunction with other estimators as well.

Since statistical tools are also relevant for practitioners, the proposition of a new test statistic also contributes to practitioners that use SEM to estimate structural models. Specifically, analysts can benefit from this approach to enhance their analysis.

5.2 Limitations and Future Research

As with every research, this thesis has several limitations. Since major limitations of the individual studies are mentioned in each paper, this section focuses on the limitations of the overall thesis.

First, since the papers have been published over a period of more than four years, research on individual IS and related methodologies has evolved significantly. For instance, besides structuration theory, research has identified other streams of research that are relevant for individual IS (Gaß et al. 2015). Similarly, the terminology has changed during this time. For example, there are several studies focusing on IT consumerization where others refer to similar phenomena as individual IS. As a result, early papers in this study primarily relate to IT consumerization (e.g., Klesel et al. 2015), while more recent publications focus on individual IS (e.g., Klesel et al. 2017). Due to the different terminologies, the research results can vary in terms of their interpretation and their scope. The issues related to terminology are not resolved yet. Hence, future research should address this challenge by clarifying related concepts.

Second, while the purpose of this thesis was the acknowledgement of the manifold facets of individual IS, it is limited in terms of an in-depth investigation of specific concepts or constructs, which in turn opens the door for future research. For example, the concept of psychological ownership of IT has been investigated to identify emerging concepts. Future research can draw from these insights and investigate the role of POIT in different settings (e.g., in longitudinal studies or those based on different technologies).

Third, at the core of this thesis is the individual, which is why a great amount of research investigates the individual as the unit of analysis. As suggested by structuration theory (Giddens 1984) and shown by Mokosch et al. (2015), structures, including organizational structures, have an impact on individual IS. Hence, several aspects might have been overseen as they emerge on the group or organizational level.

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Part B

"The journey of a thousand miles begins with one step."

— Lao Tzu

7 Structuration Theory in Information Systems Research

Title	**Maturing, Flagshipping and Piggybacking: On the Use of Structuration Theory in Information Systems Research**
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Table 7.1 Fact Sheet Publication

Maturing, Flagshipping and Piggybacking: On the Use of Structuration Theory in Information Systems Research

Abstract. The debate on structure and agency has a long-standing tradition in the social sciences. Developed by the British sociologist Anthony Giddens, Structuration Theory proposed the "duality of structure", the notion that structure and agency are inseparable in practice. Information Systems (IS) researchers have developed IS-specific adaptations of Giddens's ideas. We add to previous reviews on the use of Structuration Theory in IS by focusing on the adoption of individual concepts set forth by the theory and its IS adaptations. Based on our analysis of references to these concepts in the major journals and conferences we argue that the use of Structuration Theory in IS has matured over the past decade. We also find that some structurational concepts are frequently used as flagships and in combination ("piggybacked"). Finally, we plead in favor of a more widespread use of agency as a fundamental concept of Giddens's theory.

Keywords: Structuration Theory, Adaptive Structuration Theory, Duality of Technology

7.1 Introduction

Information Systems (IS) researchers have found a productive tool in Structuration Theory. Developed primarily by the sociologist Anthony Giddens in the 1970s and 1980s, Structuration Theory is an account of the emergence, reproduction and transformation of social systems (Giddens 1976, 1979, 1981, 1984). The theory regards social relations as a product of the continuous interaction between the eponymous societal "structures" and active subjects. In their attempt to understand the relationships between technologies, organizations and individuals, IS researchers have frequently adapted Structuration Theory and applied this lens to wide range of phenomena. Such phenomena include, for example, mobile computing (Cousins and Robey 2005) and IT implementation (Heracleous and Barrett 2001). In the process, Structuration Theory has become one of the dominant theories of the social realm employed in IS (Poole and DeSanctis 2004). Sociology aside, IS has been among the disciplines that have proved to be most receptive to Giddens's ideas (Stones 2005).

A number of previous studies provide an overview of the use of Structuration Theory in IS. Jones and Karsten (2008) supply the most comprehensive one to date. Their literature review comprises four important contributions: (1) a conceptual discussion of Giddens's ideas in relation to IS research; (2) a systematic exposition of the topics to which Structuration Theory has been applied

in the field and in what ways; (3) an analysis of the implications for the use of social theory in IS; and, finally, (4) a detailed research agenda. Other reviews have focused on one or two of these four aspects (Jones 1999; Poole and DeSanctis 2004; Pozzebon and Pinsonneault 2005) or on specific topics such as public-sector IS (Veenstra et al. 2014) and knowledge management (Timbrell et al. 2005).

We add to these existing reviews by zooming in on the level of specific concepts that have been produced by Structuration Theory. We first identify fundamental concepts within the various IS research streams that apply Structuration Theory and then conduct a quantitative analysis of references to these concepts in IS literature. This approach enables us to identify developments and trends in the use of Structuration Theory at a more detailed level than previous literature reviews. From these trends we can draw lessons for future applications of Structuration Theory in the field.

The remainder is organized as follows. In the following section we briefly expose key concepts of Structuration Theory and its developments in IS. Then we introduce our method for data collection. In Section 7.4, we present the findings of our review and discuss them in section 7.5.

7.2 Structuration Theory and IS Research

7.2.1 Structuration Theory as devised by Giddens

Social scientists have discussed how people and their social environments interact in the debate on agency versus structure. Simply put, the controversy has been about whether people's behavior originates from their free will or is determined by the characteristics outside of people's control. While the starting point of this debate dates back to second half of the 19th century and the works of Émile Durkheim and Karl Marx, it reached its high point in the 1970s and 1980s and has remained one of the central sociological issues to this day. Giddens developed Structuration Theory to find a middle ground between objectivism and subjectivism (Cohen 1989). Objectivism puts its emphasis on social contexts that exist beyond individuals' remit, whereas subjectivism emphasizes people's personal efficacy. At the same time, Giddens rejected positivism for his theory and opted for a hermeneutic approach (Bryant and Jary 2010).

At the heart of Giddens's theory of the social world are structures, or "rules and resources, organized as properties of social systems" (Giddens 1984, p. 25, see Table 7.2). Rules are either "generalizable procedures" such as customs and routines or "formulated rules" such as in sports (Giddens 1984, p. 17ff.). Resources are "transformative capacity generating commands" over either

objects (allocative resources) or people (authoritative resources) (Giddens 1984, p. 33). In addition to these two types of structure, there are three dimensions of structure: signification, domination and legitimation. Domination draws on resources, whereas signification and legitimation draw on rules. When people interact with each other in the form of communication, power, or sanctions, they employ these three dimensions of structure through three modalities, respectively: interpretive schemes, facilities and norms. Thus, according to Giddens (1984, p. 177), structures do have a constraining effect on people as they are "limits upon the range of options open to [them]", but they also enable action. Structures further allow "the 'binding' of time-space in social systems", that is, the fact that social practices exist across time and space (Giddens 1984, p. 17). Giddens repeatedly stresses the importance of time-space relations for sociological theory and identifies a "distanciation" of time and space in modernity brought about by technology (Giddens 1990).

In addition to structure, Structuration Theory incorporates agency as a core premise of the social world. For Giddens (1979, p. 56; 1984, p. 9), agency involves the notion that "the agent could have acted otherwise" and the "capability to make a difference". Giddens repeatedly emphasizes the importance of agency vis-à-vis the social context in explaining human affairs, rendering his theory a highly voluntaristic one (Sewell 1992). Part of this perceived efficacy stems from agents' knowledgeability, the assumption that agents have considerable knowledge of their social contexts and are able to reflect upon their interactions with these contexts.

Structure and agency form a symbiotic, mutually constitutive relationship known as the "duality of structure". When engaging in social practices, actors refer to structures (in the form of "memory traces", i.e. mentally) and (re-)produce them in the process, creating the "structuration cycle". Structure, as Giddens (1984, pp. 5, 64) puts it, enters "[...] simultaneously into the constitution of the agent and social practices, and exists in the generating moments of this constitution". Having no physical existence, structures are "both medium and outcome of reproduction of practices". In light of this duality, not only are actions constrained and enabled by structures; structures are produced and reproduced by these very actions. Thus, agency and structure are two sides of the same coin.

Structuration Theory has been applied by IS researchers primarily via two distinct approaches (Jones and Karsten 2008; Pozzebon and Pinnsonneault 2005). The first, developed by Orlikowski (1992) and frequently referred to as Duality of Technology, translates Giddens's concepts of structure, agency and their duality into a technological context; Giddens himself paid little attention to technology in his writings on Structuration Theory. The second is Adaptive Structuration Theory, introduced by Poole and DeSanctis (1994), that also incorporates some fundamental

structurational ideas vis-à-vis technology but unlike the Duality of Technology stream deviates from Giddens's theory in major aspects. These two streams will be explained in the following.

7.2.2 Duality of Technology

Orlikowski (1992) applied Giddens's notion of the duality of structure to technology. The result was what she called the "duality of technology", which "[...] identifies prior views of technology as either objective force or as socially constructed product as a false dichotomy" (Orlikowski 1992, p. 406). Like structures, technology is a medium and an outcome of human action. Technology is hence essentially social and more than simply a material artifact. Furthermore, technology exhibits "interpretive flexibility", that is, technology does not have static influence but its effects depend on users' attitudes and knowledge towards a given technology. In the organizational context, there is a "time-space discontinuity" since the people who design a technology are typically not the same who use it; in most cases, the designers and users do not even belong to the same organization. Beyond this design/use disconnect, Orlikowski (1992, p. 408) emphasizes that "[...] the structurational model of technology posits artifacts potentially modifiable throughout their existence".

Technologies, however, are not structures themselves according to a later development of the theory by Orlikowski (2000). In line with Giddens's view of the instantiation and physical non-existence of structures, Orlikowksi posits that technological structures are "emergent" in practice and not "embodied" by the technology artefact per se. This is what she calls the "practice lens". Thus, "technologies in practice" have structuring effects through continuous interactions by human agents. These agents enact structures when using technologies that influence how they use these technologies. Orlikowski argues in favor of in-depth qualitative studies to understand how structurational processes work empirically in the specific context of interest.

7.2.3 Adaptive Structuration Theory

Adaptive Structuration Theory (AST) explores the social structures that are considered to be directly inscribed in technology and how users interact with them (DeSanctis and Poole 1994). These structures consist of two elements: the "structural features" of the technology and the "spirit of this feature set". The structural features provide control and meaning and are thus equivalent to the dimensions domination and signification, respectively, as expounded by Giddens. The spirit is equivalent to the legitimation dimension and refers to the technology's "general intent with regard to values and goals", as represented by its underlying design metaphor, its features and their presentation, its user interface and its provision of training as well as other help (DeSanctis and Poole 1994, p. 126). People draw upon the technology's structures through "appropriation",

equivalent to Giddens's modalities, that is enacted through "appropriation moves", such as direct use or evaluation. The appropriation of a technology can be faithful or unfaithful (with reference to the designers' original intent) and can include different instrumental uses and attitudes.

AST differs from Giddens's and Orlikowski's accounts of Structuration Theory in two major ways. First, as shown above, AST posits that social structures are inscribed in technology itself rather than being emergent through human interaction. Second, AST features a positivist epistemology, including hypotheses that can be tested empirically through variance approaches. Therefore, AST as an IS-specific application of Structuration Theory is a pronounced departure from Giddens's original ideas. In fact, Poole and DeSanctis (2004) argue that further development of Structuration Theory in IS should jettison some of Giddens's core tenets.

Previous reviews have identified these streams and analyzed how and to what extent they have been received by the IS community at a general level (Jones and Karsten 2008; Pozzebon and Pinnsonneault 2005). However, there is no such analysis on the level of individual concepts that have been introduced by these streams. We argue that filling this gap will reveal more fine-grained insight into the use of Structuration Theory in IS.

	Concept		Definition/Description	Source
Structuration Theory (Giddens)	Duality of Structure		"The duality of structure [...] relates to the fundamentally recursive character of social life, and expresses the mutual dependence of structure and agency."	Giddens 1979, p. 69
	Agency		"Agency concerns events of which an individual is the perpetrator, in the sense that the individual could, at any given phase in a given sequence of conduct, have acted differently".	Giddens 1984, p.9
	Structure		"Rules and resources, organized as properties of social systems."	Giddens 1979, p. 66
	Dimensions		"The dimensions of the duality of structure are [signification, domination, legitimation]".	Giddens 1984, p. 29
	Dimensions	Legitimation	"[...] systems of moral rules."	Giddens 1976, p. 130
		Signification	""[...] systems of semantic rules (or conventions)."	Giddens 1976, p. 130
		Domination	"[...] systems of resources."	Giddens 1976, p. 130

	Modalities		"What I call the 'modalities' of structuration serve to clarify the main dimensions of the duality of structure in interaction, relating the knowledgeable capacities of agents to structural features."	Giddens 1984, p. 28
Modalities		Interpretive Scheme	"'Interpretive schemes' are the modes of typification incorporated within actors' stocks of knowledge, applied reflexively in the sustaining of communication."; modality of the dimension signification	Giddens 1984, p. 29
		Facility	modality of the dimension domination	Giddens 1984, p. 29
		Norm	modality of the dimension legitimation	Giddens 1984, p. 29
Duality of Technology	Duality of Technology		"Technology is the product of human action, while it also assumes structural properties. That is, technology is physically constructed by actors working in a given social context, and technology is socially constructed by actors through the different meanings they attach to it and the various features they emphasize and use."	Orlikowski 1992, p. 406.
	Practice lens		"This practice lens posits humans as constituting structures in their recurrent use of technology. Through their regularized engagement with a particular technology (and some or all of its inscribed properties) in particular ways in particular conditions, users repeatedly enact a set of rules and resources which structures their ongoing interactions with that technology."	Orlikowski 2000, p. 407.
	Interpretive Flexibility		"[...] the degree to which users of a technology are engaged in its constitution (physically and/or socially) during development or use."	Orlikowski 1992, p. 409.
	Time-Space Discontinuity		"With many types of technology the processes of development and use are often accomplished in different organizations. That is, many of the actions that constitute the technology are often separated in time and space from the actions that are constituted by the technology [...]."	Orlikowski 1992, p. 407.
Adaptive Structuration Theory	Spirit		"Spirit is the general intent with regard to values and goals underlying a given set of structural features."	DeSanctis and Poole 1994, p. 126.
	Appropriation		"[...] the immediate, visible actions that evidence deeper structuration processes [...] of the technology."	DeSanctis and Poole 1994, p. 128.

Appropriation move	"[...] [G]roups may choose to appropriate a given structural feature in different ways, invoking one or more of many possible appropriation moves. Given the availability of technology structures, groups may choose to: (a) directly use the structures; (b) relate the structures to other structures (such as structures in the task or environment); (c) constraint or interpret the structures as they are used; or (d) make judgments about the structures (such as to affirm or negate their usefulness)."	DeSanctis and Poole 1994, p. 129.
Faithful and unfaithful appropriation	"Faithful appropriations are consistent with the spirit and structural feature design, whereas unfaithful appropriations are not."	DeSanctis and Poole 1994, p. 130.

Table 7.2 Definitions of Key Terms

7.3 Research Method

As a first step of our review, we conducted a systematic search for relevant articles. To this end, we employed the EBSCO Host Business Source Complete and the Association for Information Systems (AIS) database. We scanned the eight major IS journals and the proceedings of the three major conferences. We selected all the articles published in these outlets that feature the keyword "structuration" in their abstracts. Our search yielded 106 research papers in total (see Table 7.3). 67 and thus the majority of the papers are conference papers, 39 articles were published in journals.

Next, we searched these 106 papers for the occurrence of the relevant concepts as posited by the three streams of Structuration Theory in IS (see Table 7.2). For each concept, we conducted an electronic search within the articles' running texts, figures and appendices but not abstracts, headlines and captions. We included both singular and plural forms (i.e. "structure" and "structures"). Further, we checked the use of the concepts in their context; for example, we only considered the concept *norm* when specifically used as a modality as proposed by Giddens. If a concept was mentioned in a paper at least once, this paper would be marked in our data set as referencing the concept regardless of further mentions of the same concept in the same paper. For example, if the search for *legitimation* in a paper resulted in five hits, this paper was marked in the same way as a paper that yielded a single hit. In the subsequent analysis, we used Boolean operators to allocate concepts to different groups such as research streams or superordinate concepts; for instance, we included the operation "*legitimation* OR *signification* OR *domination*" to find out whether a given paper referenced any of the dimensions set forth by Giddens.

Journal / Conference	First year of publication	Identified papers
Information Systems Research	1991	7
Journal of MIS	1991	8
American Conference on Information Systems	1998	18
European Conference on Information Systems	2000	20
International Conference on Information Systems	2000	29
Journal of Information Technology	2000	1
Journal of AIS	2003	6
Information Systems Journal	2007	6
Journal of Strategic Information Systems	2008	2
MIS Quarterly	2008	3
European Journal of Information Systems	2009	7
Total		106

Table 7.3 Number of Identified Papers per Journal/Conference

7.4 Findings

Table 7.4 summarizes the resulting data. For each concept, we list the percentage share of papers that mentioned this concept, relative to the total number of 106 analyzed papers (see Appendix). Given their fundamental role in all three streams, we included the concepts s*tructure, agency* and d*uality of structure* separately.

We draw five major findings from the data. First, the basic concepts *structure* and *agency* are widely used. Almost every paper mentioned s*tructure* at least once. The concept a*gency* occurs much less frequently, but still in close to every second paper. Overall, about 98% of the papers mention either *structure* or *agency* or both. The prevalence of *structure* is not surprising given their dominant role in the theory that Giddens named accordingly. However, the fact that only about half as many papers reference the similarly important concept *agency* is remarkable.

Second, concepts proposed by Giddens (50%) are most frequently mentioned. Concepts from AST follow close behind (48%), whereas only a quarter of the papers reference concepts from the Duality of Technology stream. The relatively low level of representation of this stream is notable in light of the much higher share of papers that mention of Giddens's concepts. After all, Duality of Technology is an application of Giddens's theory to IS that adheres closely to the original theory's concepts and principles. A sizeable number of authors decided to stick to Giddens's theory

rather than to its technology-specific application. By contrast, AST as a less faithful development of Giddens's ideas has elicited much more reverberation in the IS community.

Third, IS researchers reference concepts from each stream to very different degrees. The AST concept a*ppropriation* is mentioned frequently (39%) but the closely related concept *appropriation move* by less than half as many papers (18%). In the Duality of Technology stream there is an imbalance in occurrence between the eponymous concept *duality of technology* (18%) and *time-space discontinuity* (2%). Giddens's constructs are referred to more evenly, with both the various dimensions and modalities being referenced by about 40% of the papers.

Research Stream	**Occurrence**	**Concept**			**Occurrence**
Structure or Agency	98%			Structure	97%
				Agency	45%
Structuration Theory (Giddens 1984)	50%	Dimensions	38%	Legitimation	31%
				Signification	32%
				Domination	34%
		Modalities	40%	Interpretive Scheme	30%
				Facility	25%
				Norm	32%
Duality of Technology (Orlikowski 1992)	25%			Duality of Technology	18%
				Interpretive Flexibility	8%
				Time-space discontinuity	2%
				Practical Lens	8%
Adaptive Structuration Theory (DeSanctis and Poole 1994)	48%			Spirit	34%
				Appropriation	39%
				Appropriation move	18%
				Faithful	24%

Table 7.4 Occurrence of Structurational Constructs (Share of Total Number of Papers)

Fourth, an analysis of the occurrence of the concepts over time reveals a peak in the year 2010 (see Table 7.5). Before 2008, structurational constructs were referenced by less than ten papers every year. There is a dramatic upward surge from the year 2007 (5) to 2010 (22) that only decreases to pre-2008 levels in 2012. Jones and Karsten's (2008) widely received review paper is certainly in some part responsible for the massive rise of interest in Structuration Theory among IS researchers. However, given the much lower levels of papers mentioning one of the structurational concepts in 2012 and 2014, this wave of interest may have been restricted to a few years.

Research Stream \ Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Structuration Theory	2	2	1	0	0	1	0	0	1	3	5	3	1	3	1	3	1	2	8	10	9	6	4	6	2	75
Duality of Technology	1	0	0	0	0	0	0	0	0	0	1	3	0	1	1	2	0	2	2	3	4	3	1	2	2	28
Adaptive Structuration Theory	2	2	2	1	1	0	1	0	0	1	1	1	3	4	1	4	0	1	7	7	9	5	2	4	2	62
Total	5	4	3	1	1	1	1	0	1	4	7	7	4	8	3	9	1	5	17	20	22	14	7	12	6	165

Table 7.5 Number of Papers by Stream, 1990-2014

Fifth, concepts from each of the three streams are frequently mentioned in combination with concepts from the two other streams (see Table 7.6). 34% of the papers combine concepts in this way. However, only about a tenth mentions concepts from all three streams. Conversely, a fifth solely references the fundamental concepts *structure* and a*gency* but not any of the stream-specific concepts. Duality of Technology very rarely occurs on its own but almost always in combination with one or both of the other two research streams. AST is the stream that is most frequently referenced exclusively (25%). Given their diverging principles, there is little surprise in the fact that Duality of Technology and AST are least frequently combined.

	Giddens Structuration Theory	Duality of Technology	Adaptive Structuration Theory	Occurrence
Only Structure or Agency occur				20%
Exclusive occurrence	x			19%
		x		3%
			x	25%
Combined occurrence	x	x		10%
	x		x	11%
		x	x	3%
	x	x	x	9%

Table 7.6 Occurrence of Concepts by Research Stream

7.5 Discussion

From the above findings we derive four major developments. In the following, we expose these trends and consider their implications for the further application of Structuration Theory in IS.

Agency: These two most fundamental concepts of Giddens's theory both enjoy frequent use, but in comparison *agency* plays a much less important role. Despite its name, Structuration Theory does not argue for *structure* to be superior to *agency* when its comes to explaining social relations. On the contrary, his proposed *duality of structure* implies that they are not only equally important

in analysis but also inseparable in ontology. Therefore, the fact that many IS researchers have chosen to adopt the concept *structure* but not *agency* deserves explanation. One major reason for this imbalance is that AST is primarily concerned with structures but less with agency. Consequently, in our data set, only about 40% of the papers that reference AST concepts also reference *agency*; for the papers that reference Giddens and/or Duality of Technology, the share is about 65%. In light of these numbers agency is certainly no blind spot in IS applications of Structuration Theory. But given the centrality of the *duality of structure* to this theory, the numbers show that IS researchers have perhaps not given agency as much as attention as is warranted. Jones (1999) explicitly points out that "[a]ttempts to use structuration with methods that ignore the irretrievably hermeneutic' character of social science, with causal models, or with a focus solely on a single level of analysis (particularly where individual agency is excluded), are therefore at odds with central principles of the theory" (p. 131).

Maturing: Since Giddens proposed Structuration Theory more than three decades ago its IS-specific applications and developments have matured. Structurational concepts have seen a rising use in the past ten years compared with the two previous decades. Relatively recent advancements like Strong Structuration Theory (Greenhalgh and Stones 2010) or new perspectives on AST (Markus and Silver 2008) demonstrate continuing interest in Structuration Theory. We encourage IS researchers to contribute to this productive tradition.

Flagship concepts: IS researchers frequently cherry-pick one or two concepts from each stream (with the exception of Giddens's original theory). As we have seen, this is most obviously the case in the stream Duality of Technology, where the eponymous concept *duality of technology* is mentioned much more often than the other concepts proposed by Orlikowski. In many cases, such cherry-picking presumably happens because authors find some concepts more useful than others. In other cases, however, authors might use crucial concepts such as *appropriation* as flagships. That is, they reference a key concept of a stream to showcase knowledge or even use of that stream's theoretical framework without taking into account the theory as a whole. In such an event, flagshipping might be inferior to the comprehensive acknowledgement of the theory. This is true for the very fundamentals of Structuration Theory. As shown above, a significant share (19%) of all the papers only mention *structure* and/or *agency* but not any of the more specific concepts proposed by the three streams. Referencing these two concepts might in some cases be sufficient for arguing that one employs a structurational approach and particularly Giddens's theory. However, we agree with Jones and Karsten (2008) that Structuration Theory's more fine-grained concepts such as the dimensions and modalities could be more frequently applied in IS in addition to the basic concepts.

Piggybacking concepts: The fact that concepts are frequently combined within and across streams supports the notion that they become more useful through such cross-fertilization. In other words, authors have concepts "piggyback" each other. This finding suggests that IS researchers who employ structurational approaches do not only profit from the increasing maturity of Structuration Theory in IS but also from the diversity of streams and concepts. Therefore, we argue that the branching-out of Structuration Theory into different streams, topics and applications is a strength rather than a weakness.

7.6 Conclusion

We provided a state-of-the-art picture of the use of Structuration Theory in IS by spotlighting individual theoretical concepts. Through our quantitative analysis of the occurrence of these concepts in major IS journals and conferences, we presented five major findings: agency has been living in the shadow of structure, Structuration Theory in IS has matured over the course of past decades, some structurational concepts serve as flagships, and concepts are frequently piggybacked to enhance their use further.

There are, of course, several limits to this study. First, rather than including as many publishing outlets as possible, we based our analysis on the Senior Scholars' Basket of Journals (as defined by the Association for Information Systems) and the three major conferences. However, since we focused on the leading IS journals and conferences, we believe that broader coverage would yield similar findings. Second, we included the three major research streams of Structuration Theory in IS as identified by previous reviews. A more comprehensive analysis should incorporate further approaches and streams (e.g. Markus and Silver 2008; Stones 2005). Third, we focused on the essential theoretical constructs of each stream, but these streams feature further concepts whose analysis might provide further insight. Finally, we used a relatively rough quantitative method to present an overview of the degree to which structurational concepts are used in IS. Further research can use a more fine-grained quantitative approach or have an in-depth look at the contexts of use.

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7.8 Appendix

Authors	Year	Publication	Structure or Agency	Structuration Theory	Agency	Structure	Dimension	Legitimation	Signification	Domination	Modalities	Interpretive Scheme	Facility	Norm	Duality of Technology Theory	Duality of Technology	Interpretive Flexibility	Time-space discontinuity	Practice Lens	Adaptive Structuration Theory	Spirit	Appropriation	Appropriation move	Faithful
DeSanctis et al.	1989	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Walsham and Han	1990	ICIS	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0
Orlikowski, Wanda	1991	ISR	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
DeSanctis et al.	1991	JMIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
Sandoe and Olfman	1992	ICIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheeler and Mennecke	1992	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Goppal et al.	1992	JMIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Davidson	1993	ICIS	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Miranda and Bostrom	1993	JMIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Nagasundaram and Bostrom	1994	JMIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Robey	1995	ICIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheeler and Valacich	1996	ISR	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Hocking	1998	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schultze et al.	1998	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naik et al.	1999	AMCIS	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Miranda and Bostrom	1999	JMIS	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1
Higgins, Guy M. Jr.	2000	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pozzebon	2000	AMCIS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Cushman et al.	2000	ECIS	1	1	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
Gregor and Johnston	2000	ECIS	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hassall	2000	ECIS	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Hirt and Limayem	2000	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Miller et al.	2000	ICIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Askenäs and Westelius	2000	ICIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marginson et al.	2000	JIT	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flynn and Hussain	2001	ECIS	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0

Johnston	2001	ECIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pozzebon and Pinsonneault	2001	ECIS	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0
Rose and Scheepers	2001	ECIS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0
Chae	2001	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Haggerty and Golden	2002	ICIS	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
Salisbury, Wm. David et al.	2002	ISR	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Reining und Bongsik	2002	JMIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Im and Raven	2003	ECIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Melin	2003	ECIS	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0
Bhattacherjee and Harris	2003	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Allport, Christopher	2003	ISR	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Sarker and Sahay	2003	JAIS	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Flynn and Hussain	2004	ECIS	1	1	0	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Siregar and Tan	2004	ECIS	1	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0
Becker and Cline	2005	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gupta and Bostrom	2005	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Sedera and Dey	2005	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Atkinson and Brooks	2005	ICIS	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Phang and Kankanhalli	2005	ICIS	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0
Timbrell et al.	2005	ICIS	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0
Staehr et al.	2006	ECIS	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Chu and Smithson	2007	ISJ	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0
Silva	2007	ISJ	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Schmidt et al.	2008	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kirwan et al.	2008	ICIS	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	1	1	0
Bélanger	2008	ISJ	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DeSanctis et al.	2008	JAIS	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Markus and Silver	2008	JAIS	1	1	1	1	1	0	0	1	0	0	0	0	1	1	0	0	0	1	1	1	1	1
Niederman et al.	2008	JAIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Phang et al.	2008	JSIS	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0	1	0	0
Jones and Karsten	2008	MISQ	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bess	2009	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Menchen-Trevino et al.	2009	AMCIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0
Cao et al.	2009	EJIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Payton and Kiwanuka-Tondo	2009	EJIS	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0
Zhang et al.	2009	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hussain and Cornelius	2009	ISJ	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gupta and Bostrom	2009	JAIS	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1
Ning Nan and Johnston	2009	JAIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Bostrom et al.	2009	JMIS	1	1	1	1	1	1	1	1	0	0	0	0	1	0	1	0	0	1	1	1	0	1
Rai et al.	2009	JMIS	1	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Jones and Karsten	2009	MISQ	1	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0
Iyami	2010	AMCIS	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Mohan et al.	2010	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
Nyella and Mndeme Mathew	2010	AMCIS	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	0	1
Prifling	2010	AMCIS	1	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Rosenbaum	2010	AMCIS	1	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Ali	2010	ECIS	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Kabana and Brown	2010	ECIS	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Naidoo and Leonard	2010	ECIS	1	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0
Hunter III	2010	EJIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rodon and Sese	2010	EJIS	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Thomas and Bostrom	2010	EJIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nai and Kim	2010	ICIS	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Boonstra	2010	ISJ	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0
Krogh and Haefliger	2010	JSIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thomas and Bostrom	2010	MISQ	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1
Grgecic und Rosenkranz	2011	ECIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
Alotaibi and Kuk	2011	ICIS	1	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0

Ng et al.	2011	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1
Raeth et al.	2011	ICIS	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	1	0	1	0	0
Rosenkranz	2011	ICIS	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	0	0	1	1	1	1	0
Triche et al.	2011	ICIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Jie Mein Goh et al.	2011	ISR	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uppatumwichian	2012	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grgecic	2012	ECIS	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0
Nasution and Dhillon	2012	ECIS	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0
Obal et al.	2012	ECIS	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chen and Brown	2012	ICIS	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Kaewkitipong et al.	2012	ICIS	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Engelbert and Graeml	2013	AMCIS	1	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	1	1	1
Rigoni	2013	AMCIS	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cao et al.	2013	EJIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Alotaibi and Kuk	2013	ICIS	1	1	1	1	0	0	0	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0
Comi et al.	2013	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Gupta, Saurabh	2013	ISR	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1
van Veenstra et al.	2014	ECIS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	0	1
Burleson et al.	2014	ICIS	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0
Pozzebon et al.	2014	ISJ	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Tsohou et al.	2015	EJIS	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Total			104	53	48	103	40	33	34	36	42	32	26	34	27	19	8	2	8	51	36	41	19	25
%			98	50	45	97	38	31	32	34	40	30	25	32	25	18	8	2	8	48	34	39	18	24

Table 7.7 Overview of the Occurrence of Theory Constructs in IS Research

8 Transgressive Use of Technology

Title	**Transgressive Use of Technology**
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Table 8.1 Fact Sheet Publication

Transgressive Use of Technology

Abstract. Technology use is a central construct of information systems (IS) research that has been continuously reflected and re-conceptualized in order to understand use behavior. In light of the individualization of IS, use behavior has changed significantly. Therefore, existing conceptualizations, which primarily exist in a utilitarian environment, are not sufficient to explore current phenomena comprehensively. We propose transgressive use of technology as a new conceptualization of technology use that specifically acknowledges the individualization of IS. Our conceptualization is based on rich data from a multiple case study including 67 interviews from the service and manufacturing industry suggesting that transgressive use has four sub-dimensions: degree of individualization, degree of exploration, degree of boundary spanning, and degree of intensity. We show that transgressive use not only corresponds to previous conceptualizations but also extends them significantly. We conclude by providing propositions on how transgressive use can enhance future research.

Keywords: Transgressive Use of Technology, Technology Use, Case Study Research, Individual Information Systems

8.1 Introduction

Every discipline draws from central constructs that allow researchers to proper analyze phenomena of interest. In Information Systems (IS) research, *technology use* can be considered a vital aspect. In fact, technology use has been one of the most important constructs in IS research (DeLone and McLean 1992, 2003). As those constructs are crucial for a discipline, it is essential to ensure that they describe the phenomenon of interest in the best way possible. Therefore, continuous reflection and re-conceptualization is required.

Due to technological advancements and environmental changes, technology use has been subject to numerous extensions, adaptations, and re-conceptualizations. As a result of this ongoing process, previous literature has emphasized the multi-dimensionality of technology use (Burton-Jones and Gallivan 2007) and has proposed different notions accordingly. For instance, Barki et al. (2007) propose the notion of activity-related system use (Barki et al. 2007) that acknowledge technology-related interaction behavior. Similarly, Bagayogo et al. (2014) propose the concept of enhanced technology use that recognizes the employment of IT features.

With the rise of mobile technologies (Sørensen and Landau 2015), the ubiquity of technology (Ransbotham et al. 2016), and the individualization of technology (Baskerville 2011), technology use has changed significantly. Whereas work-related technology has traditionally been used within

organizations (e.g. using terminal systems), mobile technologies, be it privately- or company-owned, are now commonly used beyond geographical and time-related boundaries for both private and work-related purposes (Ashforth et al. 2000; Cousins and Robey 2015; Jahn et al. 2016; Köffer, Anlauf, et al. 2015; Kreiner et al. 2009). Therefore, it is important thinking about a re-conceptualization in order to capture current trends.

In line with previous literature that has contributed to a deeper understanding of IT usage, we aim to continue this tradition in light of current developments. Specifically, we seek to shift the focus from previous conceptualizations, which have primarily directed our attention towards productivity-based technology use in the organizational realm (Burton-Jones and Straub 2006), to a new form of conceptualization that also takes into account technology use outside organizations. In doing so, we aim to capture technology use as indicated by the individualization and consumerization of IT (Baskerville 2011; Niehaves et al. 2012).

Against this background, we propose "transgressive use" of technology as a new and rich way to conceptualize technology use that has four sub-dimensions: *degree of individualization*, *degree of exploration*, *degree of boundary spanning*, and *degree of intensity*. It is worth emphasizing that it is not the aim of our research to question the fruitful insights of previous conceptualizations of technology use, but to explore new dimensions that have not been addressed in previous years. Therefore, our intention is not to replace current conceptualizations, but to provide a new complementary lens that can be applied to specific research questions.

There are a number of promising ways to investigate technology use that is more detached from the traditional perspective: First, previous literature has provided various concepts such as IT consumerization behavior (Ortbach et al. 2013), mobile phone use (Soror et al. 2015), or dual use of technology (Köffer et al. 2014) in order to capture contemporary technology use. The variety of constructs hinder IS research from validating related theories. Transgressive use of technology has the potential to remedy this issue. Second, a growing number of negative consequences of technology use is linked to technology use behavior (D'Arcy et al. 2014). However, current types of conceptualizations are limited as they rarely include aspects beyond organizational boundaries. Consequently, exploring the characteristics of use behavior is a promising technique to address the 'dark side of technology' (D'Arcy et al. 2014). Finally, drawing benefits from technology use remains increasingly challenging. Therefore, exploring technology use in more detail is also an important aspect of optimizing technology use in terms of performance, task-technology fit and satisfaction. In order to address our objectives, this paper is guided by the following research question (RQ):

RQ: How to conceptualize transgressive use of technology?

This paper is structured as follows. First, we describe the background of this study demonstrating the need to re-conceptualize technology use. In Section 8.3, we propose our research methodology that we choose to meet our objective in the best way possible. Next, we present the findings of our study in section 8.4. Based on our insights, we conceptualize transgressive use of technology and provide three propositions on the usefulness of transgressive use. We conclude by looking at the limitations of our study and by proposing fruitful approaches for future research.

8.2 Background

Technology use is a central aspect of IS research (Barki et al. 2007) and has been studied for several decades (Barkin and Dickson 1977; Ginzberg 1978). Therefore, the purpose of this section is not to present a comprehensive overview of related research, but to emphasize major milestones related to technology use. For a comprehensive overview of technology use as a construct, we refer to previous literature which provides an excellent in-depth analysis (e.g. Burton-Jones 2005).

There are few constructs in IS research that have received as much attention as technology use (DeLone and McLean 1992, 2003). Widely accepted theories including the technology acceptance model and its extensions (Davis 1989; Venkatesh et al. 2003, 2016), post-adoption theories (Bhattacherjee 2001; Bhattacherjee and Premkumar 2004; Karahanna et al. 1999) and research on discontinuance (Maier et al. 2015; Turel 2016) look at technology use in order to understand technology-related user behavior.

Existing research on technology use is closely linked to organizational science, assuming an organizational context. For instance, Burton-Jones and Straub (2006) base their conceptualization of technology use on the triad of user, task, and technology. Although this model does not exclude other domains (e.g. private domain), it has been widely adopted in order to explore utilitarian phenomena. In addition to that, more and more research is concerned with hedonic systems (Wu and Lu 2013). For instance, van der Heijden (2004) applied hedonic motives to his technology acceptance research. Similar objectives have been addressed in adoption literature (Lowry et al. 2013) and in discontinuance research (Turel 2015).

With the emergence of modern technologies, such as smartphones, tablets or wearables, we have seen a major change in terms of end-user technologies in organizations. New forms of technology use behavior, including Bring-Your-Own-Device (Köffer, Ortbach, et al. 2015), have challenged existing models where technology has primarily been provided by the organization. Today, individuals are equipped with powerful IT, which allows them to do their work using their own devices. "*From these technologies, these individuals and family units are building complex and [..]*

relatively large-scale individually owned- and operated IS." (Baskerville 2011, p. 252). The increasing use of end-user technologies has been described as the Individualization of Information Systems (IIS)(Baskerville 2011; Gaß et al. 2015).

In line with the individualization of IS, we note that technology use is not limited to the organizational domain anymore. Previous literature provides initial evidence that the use of individual IS has a significant impact on the individual (Cousins and Robey 2015; Köffer, Anlauf, et al. 2015). Furthermore, research indicates that new opportunities provided by individual IT (such as smartphones and tablets) intensify Shadow-IT (Haag et al. 2015).

To address our research question, this study is designed to have an integrated perspective, in which IIS is considered a passage point between the organizational realm and the private realm (see Figure 8.1). Therefore, this perspective corresponds to previous concepts of technology use (Burton-Jones and Straub 2006) and the understanding of IIS (Baskerville 2011).

Existing theories have addressed contemporary developments in various ways. For example, technology acceptance models have been applied in various scenarios, including the application in households (Brown and Venkatesh 2005; Venkatesh and Brown 2001). Furthermore, technology use has also been analyzed in terms of hedonic environments (van der Heijden 2004; Lin and Bhattacherjee 2010). Similarly, the conceptualization of technology use as a construct has been adopted in various ways. For instance, Burton-Jones and Straub (2006) have called for richer conceptualizations of technology use in order to better understand individual use behavior. In this vein, the concept of IS use-related activity (Barki et al. 2007) and enhanced use of technology have also been introduced (Bagayogo et al. 2014). However, existing conceptualizations of technology use have not contributed to the individualization of IT yet.

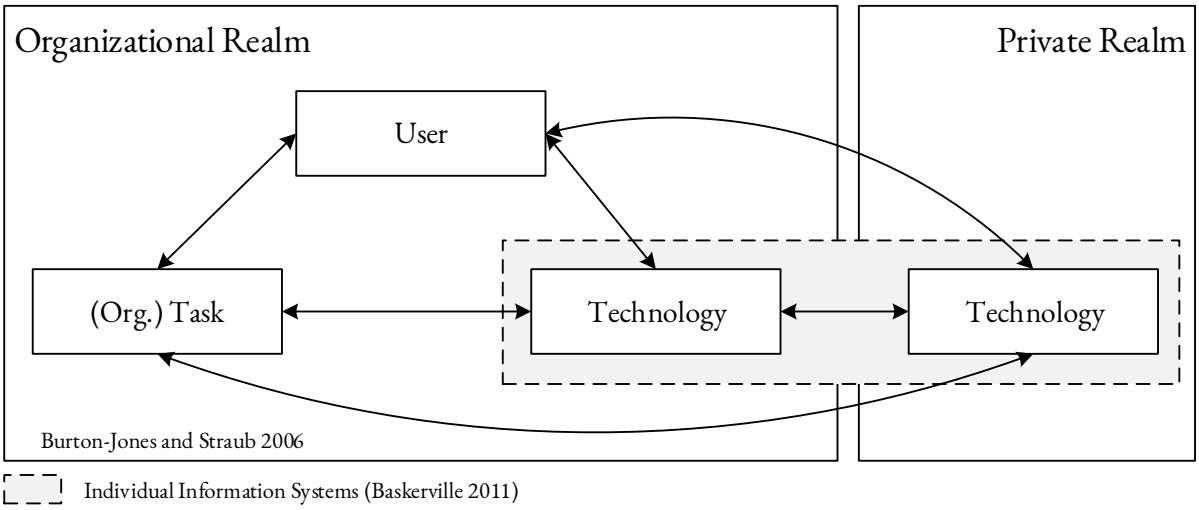

Figure 8.1 Perspective of this Study

In this paper, we propose the notion of '*transgressive use of technology*' to capture contemporary use behavior beyond organizational boundaries. Although previous literature has made considerable efforts to conceptualize use behavior in general (Bagayogo et al. 2014; Barki et al. 2007; Burton-Jones 2005), none has yet focused on technology use when boundaries are blurred and the richness of use is continuously increasing. Against this background, transgressive use seeks to conceptualize contemporary technology use by explicitly acknowledging these two dimensions. In doing so, we aim to contribute to a deeper understanding of technology use in light of the individualization of IS.

8.3 Research Method

8.3.1 Method Selection

In order to explore relevant dimensions of technology use in light of the individualization of IT, we conducted a case study (Yin 2013). Case studies are particularly useful when investing complex phenomena that have not yet been fully explored, which, in turn, does not allow for the analysis of causal relationships (Benbasat et al. 1987; Keutel et al. 2014; Yin 2013). Moreover, case studies allow an in-depth analysis of phenomena that are related to the context where those phenomena occur (Keutel et al. 2014). Since both aspects are relevant to this study, case study research is well-suited for our endeavor.

It is generally assumed that the strength of case studies lies in their internal validity whilst their external validity is often considered a weakness. We took two types of measures to increase the external validity of our case study: First, the research was conducted in a team. All phases, which are described in the following, were conducted by at least two researchers. With this, we reduced idiosyncratic perceptions. Furthermore, with the use of multiple investigators, we were able to implement triangulation (investigator triangulation, Patton 2005). Second, we included multiple cases to reduce case-specific findings (Benbasat et al. 1987; Yin 2013).

8.3.2 Case Design

The context of this study is the individualization of IT (Baskerville 2011). To address our research question, we focused our attention on how individuals use both organizational and private technology beyond organizational boundaries. Therefore, the unit of analysis is the individual. As outlined above, we looked at multiple cases. Therefore, we are able to strengthen our findings in light of replication logic (Eisenhardt 1989; Yin 2013). The implementation of our case study includes four phases: pilot study, case selection, data collection, and data analysis (c.f. Figure 8.2). We briefly describe each phase in the following.

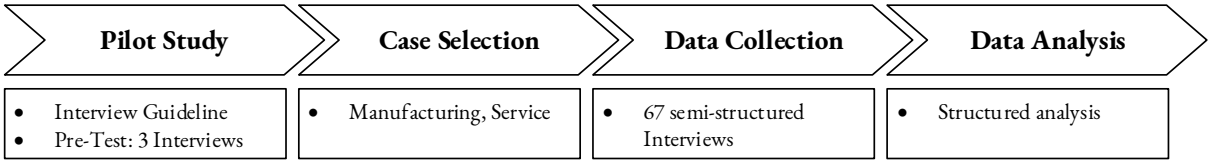

Figure 8.2 Case Study Design

8.3.3 Pilot Study

We first started with a pilot study to make sure that our questions were understandable. We recruited three employees of a mid-sized university that were affected by blurred boundaries due to their use of privately owned technology. After interviewing each of them, we carefully read the transcripts and reformulated unclear questions to make them more understandable.

8.3.4 Case Selection

After finishing our pilot study, we selected two organizations (cases). As a selection criterion, we searched for organizations that were prone to be affected by technology use outside the traditional boundaries of the organizational realm (c.f. Figure 8.1). To that end, we included a manufacturing organization (hereafter *MANUFACTURE*) as it is involved in international projects in over 30 countries, which has a high impact on working times and technology use. Since this organization is affected by blurred boundaries, it has implemented a Company Owned Privately Enabled (COPE) governance for a large amount of employees. Therefore, it can be assumed that transgressive use of technology can be found here. Additionally, we included a service organization specialized in food logistics (hereafter *SERVICE*), as this organization is highly committed to delivering foodstuff on time, which often interferes with technology use outside the organizational boundaries (e.g. due to 24-hour shifts). Again, this organization has implemented a COPE governance and is, therefore, well-suited for the investigation of transgressive use. Apart from the main selection criteria, these cases are well suited for our research question because they differ in size, number of employees, and industry. Therefore, they should provide insights beyond one specific case. An overview of the cases is provided in the following table (Table 8.2).

Case	*MANUFACTURE*	*SERVICE*
Industry	Manufacturing Industry	Food Industry
Employees	3.000	21.000
Distribution	31 foreign subsidiaries	30 domestic distribution centers
IS Governance	COPE	COPE

Table 8.2 Overview Cases

8.3.5 Data Collection

Before the actual data collection started, background information has been collected, identifying the position, age and tenure. By doing this, we ensured that the interview time was only used to collect data which could not be gathered in any other way. The data was gathered over a 3-month period between May and July 2016. As our unit of analysis is the individual, we included employees from all hierarchical levels in both cases. We conducted 70 interviews in total (3 pretest, 67 case-related). Our case-related sample includes 49 male and 18 female participants. An overview of the interviewees is presented in Table 2. The average age is 44.1 (SD = 8.93). The average work experience is 22.49 years (SD = 10.38).

This research follows an interview guide approach, as this is more comprehensive and systematic for data collection than a purely conversational interview. Furthermore, our interview guideline was open-ended to allow the interviewees to bring up additional concerns that we did not cover in our guidelines (Darke et al. 1998). We e-mailed the interview guide to the interviewees of both organizations in advance to give them an insight into the study. We followed the guidelines of Darke et al. (1998) who suggested conducting an interview with at least two interviewers. We recorded the interviews in order to minimize data loss and to provide a complete record of the answers and insights given by the interviewees. The duration of interviews ranged from approximately 25 minutes to 100 minutes. All interviews were transcribed completely.

Case / Position	MANUFACTURE		SERVICE		Total
Employee	From ME1 to ME10	10	From SE1 toSE19	19	29
Manager	From MM1 to MM17	17	From SM1 to SM21	21	38
Total		27		40	67

Table 8.3 Overview Interviewees

8.3.6 Data Analysis

We reviewed our interview transcripts using MAXQDA 12. We specifically looked for indicators of how technology was used by individuals at work and outside their organizational domain. Although we did not intend to analyze our data based on an existing theory, we also did not assume to work with "blank slide" (Urquhart and Fernandez 2013) as indicated by the background of this study. Therefore, we draw from well-known methods from grounded theory (Corbin and Strauss 1990; Glaser and Strauss 1967), i.e. open coding, axial coding and selective coding. Consequently, we went through three phases of analysis.

First, we analyzed the data by means of open coding, meaning we searched for emerging aspects that were related to technology use by analyzing the interviews line by line. Within this initial phase, we took particular care that within the procedure, no themes were excluded due to previous experience or prejudice. Next, we applied what is known as axial coding to harmonize related themes. In this phase, different terminologies were discussed and integrated upon common agreement. Finally, we refined the themes in accordance with previous literature (selective coding).

As this research is explanatory in nature, it is validated by means of concatenation (Nunamaker et al. 2015; Stebbins 2001). Concatenation is similar to replication logic in experimental research, where relationships are discovered and evaluated under different conditions in various studies. Note that the point of saturation, i.e. when no new concepts emerge, makes this approach distinct from experimental research. Whereas an experiment is used to test a hypothesized relationship, new variations are undesirable. In cases where explanatory research is conducted, such as this study, concatenations provide further insights into a phenomenon.

8.4 Findings

8.4.1 The Nature of Transgressive Use

Due to the case study design of this research, which includes employees and managers with different backgrounds, our insights are very diverse. However, there are similar categories that continuously emerged in our interviews, that describe *transgressive use* from different perspectives. First, the participants commonly indicated that technological changes had a great influence on their use behavior. A manager of the service company describes it as follows:

> *"I am completely aware of the changes that have taken place in the last couple of years. The invention of the smartphone, e-mails and iPads changed our whole life significantly. Of course, we are not only working at our (office) desks anymore when doing administrative work tasks, but rather we are working while on the way to or sometimes from home." (SM04)*

This perception is also reflected by employees as the following excerpt illustrates:

> *"We are already going to use smartphones not only for WhatsApp, but rather for working tasks, to check e-mails. No matter where you are going or where you are, it can be edited. We are heading towards digital interconnectivity." (SE06)*

Most importantly, our participants commonly reported that those changes have significantly changed their use behavior as shown in the following example:

> *"Well, my mobile phone is always turned on. At night, I sometimes turn it off, when I am at home. At a hotel, it is always turned on. From time to time, I sit somewhere and check my e-mails on a Sunday at 7pm. When you can answer right away, you are going to do so. Whether it is on vacation or over the weekend, it does not matter. When it is just a task that requires about three minutes to straighten something out, then the person who needs something does not have to wait three weeks until I return." (SE03)*

We observe that technology use is continuously evolving towards rich use by exploring new features or finding new solutions with existing features (Bagayogo et al. 2014). One manager summarizes it as follows:

> *"Well, when there are deviations that need to be discussed, then this instrument [WhatsApp] is really very easy. When I have a group which is simply named 'MANUFACTURE Division XY', I am just texting via WhatsApp, because everyone involved is in this group. Well, but it is no official medium, but, well, maybe later in the future everyone will have it [...]." (MM12)*

Employees also recognize changes in terms of technology use as the following section demonstrates:

> *"WhatsApp works for communication and for calls. WeChat exists as well. This is the Chinese Version of WhatsApp and therefore I use WeChat to communicate with Chinese clients instead of using a landline phone. I think 'why should I spend money for this?' Well, then I also use Facetime and our e-mail program. To communicate with others, Facetime is so much easier than writing e-mails. It always pays off." (MM17)*

Combining the above observations, we understand transgressive use of technology as a combination of individual IS (Baskerville 2011) and rich use of technology (Bagayogo et al. 2014). In line with previous literature on technology use (Bagayogo et al. 2014; Barki et al. 2007; Burton-Jones and Straub 2006), this conceptualization indeed provides a multi-dimensional perspective on technology use. Moreover, we include the individualization of IT as a second dimension. To that end, we define transgressive *use as follows:*

> *Transgressive use of technology is a rich form of technology use behavior, in which technology is mainly de-contextualized, i.e. private technology is used for business-related aspects and vice-versa.*

*A*n integrated perspective on transgressive use and previous conceptualizations is provided in the following figure (Figure 8.3).

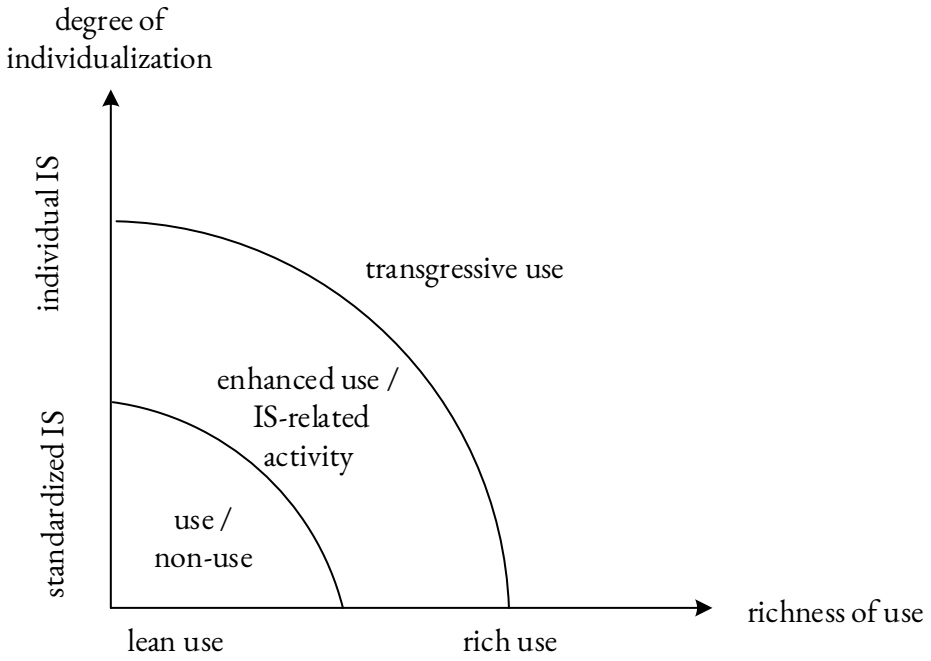

Figure 8.3 Transgressive Use of Technology

The first dimension (degree of individualization) distinguishes between standardized IS and individual IS. The second dimension (richness of use) is a continuum ranging from lean use (i.e. use or non-use) to rich use of IS. Based on these two dimensions, existing concepts as well as transgressive use can be found. Use and non-use of IS (Alavi and Henderson 1981) can be considered the starting point (left-bottom corner). Because of the increasing tendency towards IIS and a rich use of technology, enhanced use (Bagayogo et al. 2014) and the concept of IS-related activity extend this perspective. With the explicit acknowledgement of IIS and the richness of technology use, transgressive use, as proposed here, is another extension of the current scope.

8.4.2 Dimensions of Transgressive Use

Degree of individual IS. With the emergence of consumer technologies in organizations, individualization is easily achieved (Baskerville 2011). In other words, consumer technologies are well-suited to be used in line with individual preferences. The following excerpt illustrates how the degree of individualization is a central aspect of technology use:

> *"My laptop and my smartphone are provided by my employer. Privately, I own a PC, which I do not use as often as my laptop. Privately, I also own an old-fashioned landline telephone. I also own a personal tablet. Sometimes, I check my work emails on there." (SE01)*

A significant number of interviewees mention, that they use their individual IS (e.g. smartphone or tablet) to check and respond to work e-mails in their private time. For instance, one employee describes the use of privately owned IS as follows.

> *"At the office, I definitely use the regular email software. There may also be occasions where I read work emails on my computer at home. That is the reason why I have a smartphone and an iPad that belong to the company, which makes keeping up with emails and other notifications very convenient. You can do it whenever you feel like it – when I have some spare time or when I am bored, I just read and answer a couple of emails. " (MM17)*

In summary, the degree to which individual IS is used shows that there are even more personally owned end-user technologies, which are used to manage different aspects of working life. Individualization of IS helps managers and employees to fulfill their tasks even more productively than standardized enterprise-systems. We conclude that the kind of technology (standard or individual) available is a relevant aspect of use behavior.

Explorative Use Behavior. Information Technology is a tool to enable and enhance organizational processes. Therefore, a lot of research has been carried out in order to align IT with business objectives (Gerow et al. 2014), increase its effectiveness (DeLone and McLean 2003), and minimize discrepancies between technology and tasks (Goodhue and Thompson 1995). With the emergence of mobile technologies, there has been a continuous growth and widespread dissemination in organizations. Therefore, individuals are presented with a large amount of technological alternatives they can choose from to complete their tasks. With the rise of consumer technologies and the consumerization of IT (Niehaves et al. 2012), the number of possibilities to accomplishing tasks in private and working life in a more productive way has increased. Due to the prevalence of mobile technologies, individuals are increasingly keen to exploit their functionalities. This observation is consistent with enhanced use of technology (Bagayogo et al. 2014). For instance, one employee of the service company describes the use of a specific end-consumer technology for one specific purpose. He shares important work information with a particular group of colleagues at short notice using an end-consumer chat application. The following quote describe his explorative use behavior:

> *"There is a possibility. We have a group in WhatsApp. Every consultant is in this WhatsApp group. This is important for me, because when I have something I want to share with the others, I can just bring it up in there. If someone feels the need to share information, they can do so." (SE08)*

This explorative use behavior is often driven to enhance processes that are not properly supported by organizational IT. An employee describes it as follows:

> *"Well, WhatsApp is a pretty good example. I actually do not make any distinction anymore. When I want to send a colleague a fast note, and I want him to see my note as fast as possible, I do not distinguish between sending him a text, WhatsApp message or an email. Normally, I send him a text or a WhatsApp message, as they immediately show up, so when he looks at his phone he knows. That's the reason why I actually don't know whether it is a private matter in everyday working life." (MM07)*

Explorative behavior is diverse with regard to the extent and the degree of innovation. An example of a rather intensive use is described by a manager as follows:

> *"For example, I privately used an alarm on my laptop for a while to start breathing sessions every two hours, but I ignored it very often because I was so concentrated that I wanted to keep working on my task. As a warning signal, it is actually very good, but it should not take you out of your 'work-flow'. I think if I had a bracelet showing me my heart beat was getting too fast or that something else was wrong, that would be very helpful." (SM8)*

In summary, explorative use behavior is an essential aspect of transgressive use. Especially in terms of consumer technologies and the consumerization of IT used in organizations, exploring new ways of doing work is common.

Degree of Boundary Spanning. Apart from technology use within an organization, technology is increasingly used in other domains as well. An established theory that seeks to conceptualize this phenomenon is boundary theory (Ashforth et al. 2000; Clark 2000). Existing literature in IS research already referred to the blurring of boundaries (Cousins and Robey 2015; Köffer, Anlauf, et al. 2015) to describe varying technology use in different domains. An employee of the manufacturing company describes his development of blurring technology boundaries using his corporate owned mobile device:

> *"No, I originally had a private mobile phone, but as I tried to stay available to my company, I noticed that I ran out of battery and so I told myself that the couple of contacts I have, my wife for example, etc. [...], they can call me on my company mobile phone, and everything is fine." (ME03)*

A manager of the same company even says that his way of fully integrating work and private life through the use of technology gives his wife the chance to work with his work calendar, entering and blocking dates:

> *"Interviewee: Your partner is important. This person is the one who says 'so, you're done for today'. My wife blocks all my private events in my calendar. For example, our vacation is blocked, the first day of school of our little one and so on.*
>
> *Interviewer: Just a short note, your wife has access to 'Notes' [Program of the MANUFACTURE company]?*

Interviewee: Yes, that is right." (MM10)

In contrast to the observations above, another employee states that he prefers to separate privately and company owned technology. He only uses his privately owned IT for personal activities and business IT only for work purposes.

> *"One is private and the other is professional. Well, I would not put private things on the laptop of the MANUFACTURING Company and vice versa. I try to separate it in some way." (ME02)*

The degree to which boundaries are crossed has a major impact on how technology is used. An individual has the chance to either integrate company and private IT or to separate it. Using private or company technologies for one domain (e.g. private or work) shows an individual integrating use of IS.

Degree of intensity. In order to understand technology use, IS research has looked at duration and frequency of technology use. Recently, with the penetration of mobile technology, this dimension has gained importance as technology is oftentimes used 24/7. For instance, Soror et al. (2015) referred to frequency and duration in order to describe mobile phone use. The following quote states the duration to which an employee of the service company uses his IS to check on work during vacation:

> *"In the past, especially when I worked in our freshness center, it was really extreme. I worked a lot on weekends, before and after working hours in my free time. In [headquarter of the organization], for example, there was a trailer of the forwarding agent, where goods were stored and where I checked the temperature using the internet every couple of hours every weekend. I checked whether everything was alright, so that the goods would not rot. I also answered emails during this time, even when I was on vacation, I checked them in the evening for one or two hours." (SE05)*

Another employee of the manufacturing company describes how often he uses his IS for working purposes during vacations:

> *"There are two sides of the coin. You are never able to switch off from work, but I love working. I was just on vacation, I checked my e-mails every two to three days, and I still got to rest. But well, I love working." (ME4)*

To summarize, the extended use, duration and frequency are obvious criteria to evaluate the intensified use of IS today.

8.5 Theorizing with Transgressive Use

8.5.1 Conceptualizing Transgressive Use

Based on our findings, we conceptualize transgressive use as a multi-dimensional construct that includes four dimensions (c.f.Figure 8.4): First, the degree of individual IS, which refers to the underlying technology that is used. Second, the degree to which boundaries are crossed, which refers to the extent to which an individual seeks to be accessible when it comes to technology us in different domains. Both aspects combined are related to the degree of individualization. Third, the degree of exploration, which refers to the extent to which an individual seeks new features or alternative technologies in order to complete a task. Finally, the degree of intensity, which includes the amount and frequency of technology use. The last two aspects relates to richness of use.

It is important to understand that each dimension on its own is not new. There is a vast amount of literature on individualization (e.g. Baskerville 2011; Niehaves et al. 2012), explorative behavior (e.g. Bagayogo et al. 2014; Durcikova et al. 2011), boundary management (e.g. Ashforth et al. 2000; Clark 2000; Köffer, Anlauf, et al. 2015) and the intensity of technology use (e.g. Soror et al. 2015; Venkatesh et al. 2008). However, we argue that those dimensions are strongly intertwined and jointly describe transgressive use. Therefore, transgressive use is a significant departure from analyzing each dimension separately.

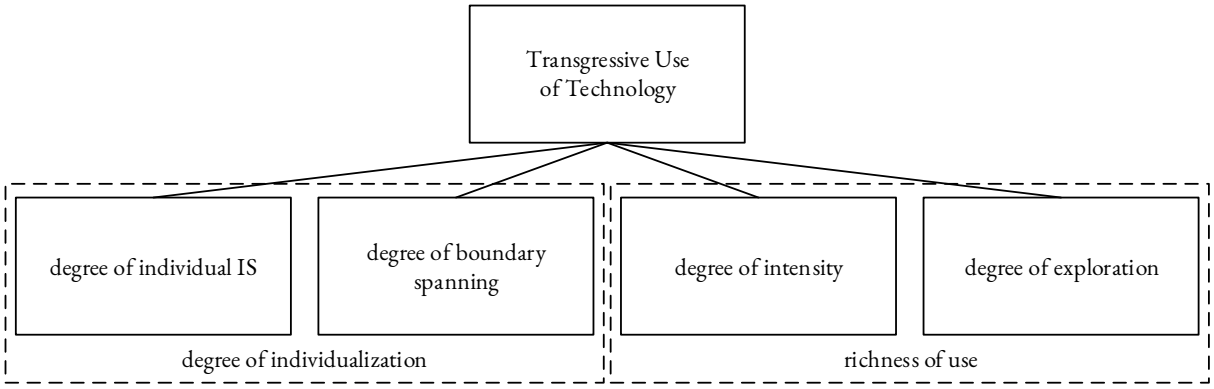

Figure 8.4 Dimensions of Transgressive Use of Technology

8.5.2 Propositions on Transgressive Use

This study is motivated by the consumerization and individualization of technology (Baskerville 2011; Niehaves et al. 2012). Within this area of research, various constructs have been proposed to capture changes regarding use behavior. For instance, Köffer et al. (2015) refer to "Use of [company provided/privately owned] [traditional/consumer] IT tools" to analyze innovation behavior related to technology use. Similarly, Junglas et al. (2014) use "*Consumer IT usage within the Organization*" to explore IT empowerment. Others have focused their attention on the underlying

behavior instead of the technology itself (Ortbach et al. 2013). We conclude that research has yet to establish a comprehensive construct that is able to capture the individualization and consumerization of technology. As previous literature shows, individualization is a complex phenomenon, which in turn requires rich conceptualization. Against this background, we suggest that transgressive use of technology is a suitable approach to enhance current literature on IIS and IT consumerization. In conclusion, we put our first proposition forward:

Proposition 1: *Transgressive use has the potential to bundle existing operationalizations of IIS and IT Consumerization.*

There is little doubt that IT also has its negative effects. In IS research, this overall issue is discussed under the umbrella of 'Dark Side of Technology Use' (D'Arcy et al. 2014). Specifically, D'Arcy et al. (2014) provide four domains that are most relevant: (1) *Stress caused by IT*. Technostress has been subject to numerous studies indicating that technology characteristics have a significant effect on stress (Ayyagari et al. 2011). Current literature already includes mobile phone use within this context (Soror et al. 2015). Therefore, transgressive use has the potential to give further insights into the relationship of technology use and stress. (2) *Information Overload and Multitasking*. Information Overload at the workplace has often been analyzed (Galluch et al. 2015). Due to the prevalence of mobile technologies, information overload and multitasking is also most relevant on a large scale beyond the boundaries of a workplace. As the degree to which boundaries are crossed is a fundamental aspect of transgressive use, this study can contribute to further analyze this issue. (3) *Technology-related Addictions*. Although this study does not focus on addiction, transgressive use may also contribute to research in this domain, as the extent of use is a major indicator of addiction (Xu et al. 2012). (4) *Information Technology Misuse*. Misuse has also been part of the dark side of the IS movement. Due to the richness of transgressive use, it also has the potential of being used to predict of technology misuse. Technology use is critical for research on negative aspects of IT. Combining the arguments above, we propose our second proposition:

Proposition 2: *Transgressive use has the potential to give further insights into the 'Dark Side of Technology Use'.*

Through condensed technology innovation cycles, organizations are able to produce new technologies that infiltrate organizations within short periods of time. In the last decade, the consumerization of IT has shown that consumer technologies have great potential to be used in organizations. Therefore, new innovations, such as wearables or affective technologies which have been primarily designed for a non-organizational purpose, are being used for business-related purposes. As those technologies differ from organizational technology (e.g. with regard to purpose or usa-

bility) more research will be needed within this domain than in the traditional organizational domain. Increasing research on mobile technologies (Sørensen and Landau 2015) and the role of (psychological) ownership of technology (Barki et al. 2008; Klesel et al. 2016) provides further evidence for this development. Against this background, IS research can benefit from conceptualizations that include further dimensions that also hold true for emerging technologies. Although transgressive use is suitable for all purposes, it has the potential to promote research on emerging technologies as it features various dimensions (such as the degree of individualization), which is increasingly relevant for emerging technologies. With this in mind, we present our third proposition:

Proposition 3: *Transgressive use has the potential to be used for emerging technologies.*

8.6 Discussion and Outlook

Technology use behavior has changed significantly from lean use within a defined scope of use towards rich use beyond defined boundaries. This paper seeks to conceptualize this change by proposing transgressive use of technology. With regard to our RQ ("*How to conceptualize transgressive use of technology?*"), we identified four dimensions that are relevant to describe transgressive use: degree of individual IS, degree of exploration, the degree to which boundaries are crossed and degree of intensity.

Our research contributes to existing theories in several ways: We contribute to previous literature on technology use (Burton-Jones and Straub 2006) by extending the scope of analysis. Technology use has primarily been analyzed within an organization and from a utilitarian perspective. By including new dimensions such as boundary crossing, we explicitly recognize the blurring of boundaries that comes along with technology use. We also contribute to existing literature on enhanced use of technology (Bagayogo et al. 2014). By including explorative use behavior, transgressive use is in line with enhanced use of technology, yet with a different focus.

There is more and more research that relates to the individualization of IS (Baskerville 2011; Niehaves et al. 2012). We contribute to this literature, by including individualization as a major aspect of transgressive use. Therefore, future research on individualization can refer to transgressive use in order to gain deeper insights into related phenomena.

IS research acknowledges that mobile technologies contribute to the fact that boundaries are blurred (Duxbury et al. 2014, 1992; Köffer, Anlauf, et al. 2015). Including boundary spanning as a sub-dimension of transgressive use, research on work-to-life conflict can use this conceptualization to promote their research.

Explorative use is a major aspect of enhanced use of technology (Bagayogo et al. 2014). As it is a central aspect of transgressive use, future research on technology acceptance and adoption can also refer to transgressive use, to analyze effects outside the organizational domain. This might be particularly relevant when it comes to emerging technologies that are increasingly detached from organizations (such as wearables).

Finally, we also contribute to existing literature that is concerned with the extent of technology use. We propose the degree of intensity as a central aspect of transgressive use. Therefore, related literature that is interested in use duration or frequency (e.g. Soror et al. 2015) might refer to transgressive use to explore their phenomena more comprehensively.

This study also has practical implications. Most importantly, by revealing four dimensions of technology use, managers have a promising point of departure to influence their employees' use behavior. For instance, one may limit or expand boundaries of use by defining a corresponding governance. Moreover, transgressive use can be used as a tool to influence organizational cultures. In particular, for industries that are prone for technology use beyond boundaries such as the service industry and consulting firms, transgressive use can inform leaders what aspects need to be adjusted in order to further boost transgressive use, or, in contrast, what is required to reduce technology use according to defined boundaries.

8.7 Conclusion and Outlook

We proposed the transgressive use of technology in order to capture technology use in light of IIS. Like every empirical study, this paper has limitations that leave room for future research. Apart from the typical limitations of case study research (e.g. weak internal validations), it is important to acknowledge the following: First, the nature of this study is explorative. Therefore, it intends to extend current perspectives on technology use. Future research can build upon this explorative approach in order to conduct confirmatory research. Especially in terms of further development, this research provides a solid foundation as it reveals the nature and the dimension of the construct that can be used (MacKenzie et al. 2011). Second, we provided three promising propositions that need further exploration and empirical validation. For instance, future research could address these issues by conducting comparative analyses. Finally, the unit of analysis of this study is the individual. Hence, interaction with their environment is not explored in detail. In order to overcome this limitation, future research might address these issues by using a dual perspective (i.e. organizational and individual) to further explore the phenomena related to duality (Giddens 1984; Jones and Karsten 2008; Mokosch et al. 2015).

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9 IT Work Autonomy

Title	**A Conceptual Model for IT Work Autonomy**
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Table 9.1 Fact Sheet Publication

A Conceptual Model for IT Work Autonomy

Abstract. Autonomy is considered an important predecessor of job-related outcomes such as job satisfaction, job motivation, and work-life-balance. Although widely used in information systems (IS) research, most studies ignore its multi-dimensional nature and technology-related facets related to autonomy. This study contributes to existing literature by proposing IT work autonomy as a rich conceptualization that includes three existing dimensions of autonomy (work method autonomy, work scheduling autonomy, and work criteria autonomy) and a new technology-related dimension (i.e., work instrument autonomy). A conceptual model is proposed and discussed. For IS theory, conceptualizing IT work autonomy promises to enlighten future research that seeks to explore work-related phenomena. Moreover, this new conceptualization has the potential to guide organizations in designing future jobs.

Keywords: Autonomy, Instrument Autonomy, IT-related Dimensions

9.1 Introduction

Digital technologies have significantly changed modern workplaces by increasing employees' autonomy (Mazmanian et al. 2013). Autonomy is commonly understood as "*the degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out*" (Hackman and Oldham 1975, p. 162). Hence, employees' autonomy is widely affected by the prevalence of mobile devices as they allow to schedule and carry out tasks more flexibly in terms of time and space. As a consequence, a great number of employees and knowledge workers in particular receive a considerable amount of autonomy (Ahuja et al. 2007; Mazmanian et al. 2013). For both practice and academia the concept is of vital interest, because it is considered a predecessor of job motivation and job satisfaction (Morris and Venkatesh 2010; Spector 1986; Tripp et al. 2016).

Previous literature has acknowledged the role of autonomy in numerous studies (Ahuja and Thatcher 2005; Elie-Dit-Cosaque et al. 2011; Moore 2000; Ye and Kankanhalli 2018). What most of these studies have in common is the fact that they operationalize autonomy as an overall job characteristic. Contrary to those studies, it has been argued that autonomy is a rich concept with a multi-dimensional factorial structure (Breaugh 1999; Ye and Kankanhalli 2018) including work scheduling autonomy, work method autonomy, and work criteria autonomy. Moreover, with the rise of individual information systems (Baskerville 2011), being autonomous in choosing technology is becoming a vital aspect in modern workplaces. In fact, recent studies suggest that being free to choose a specific technology has a significant impact on how individuals perceive a

specific technology (Murray and Häubl 2011), which in turn has an impact on job performance. Although autonomy is gaining importance, IS literature lacks a conceptual notion that includes a technology-related dimensions. Therefore, IS-related phenomena cannot be investigated in detail. Against this background, this study proposes a conceptual model for IT work autonomy, which includes existing dimensions of autonomy. It extends this notion through the inclusion of work instrument autonomy, which refers to the degree to which a job provides substantial freedom to choose work-related technologies.

9.2 Towards IT Work Autonomy

Autonomy has been a subject of interest in various disciplines including philosophy (Castordiadis 1991), psychology (Deci et al. 1989; Hackman and Oldham 1976; Karasek 1979), organizational sciences (Mazmanian et al. 2013; Trevelyan 2001), and IS research (Ahuja et al. 2007; Ahuja and Thatcher 2005; Moore 2000). Previous IS literature has extensively used autonomy in various research streams. Most notably, autonomy has been used on the individual level as part of job-related theories including the job characteristic model (Hackman and Oldham 1976; Tripp et al. 2016) and self-determination theory (Deci et al. 1989; Weiling and Ping 2010). Since autonomy is often used as a job characteristic, several studies use autonomy to explain job-related outcomes including innovation behavior (Ahuja and Thatcher 2005), job-satisfaction (Morris and Venkatesh 2010; Tripp et al. 2016), or work-to-life conflict (Ahuja et al. 2007; Köffer et al. 2014). In the domain of agile methodologies, Maruping et al. (2009) and Lee and Xia (2010) consider team autonomy to be an important factor that influences software development agility and, thus, performance variables. Autonomy is also used on the organizational level. For instance, Durcikova et al. (2011) provide evidence that autonomy is an important aspect when it comes to psychological climate within an organization. Specifically, their study demonstrates that a higher degree of autonomy leads to a higher degree of solution innovation.

Apart from explicit conceptualizations of autonomy, IS research has also proposed several constructs that relate to autonomy. For example, Sanders and Courtney include task authority in their study on Decision Support Systems success. With an explicit emphasize on technology, Murray and Häubl (2011) provide the results of an experiment with different user-interfaces and demonstrate that freedom of choice plays a vital role in terms of user perception (e.g., perceived ease of use). Another example is voluntariness, which plays an important role within the domain of technology acceptance research. According to Wu and Lederer (2009), who provide evidence from a comprehensive meta-analysis, environment-based voluntariness has a significant influence on belief-variables such as usefulness and ease of use. An overview of autonomy and autonomy-related constructs in IS research is provided in Table 9.2.

Construct	Entity	Dimensionality	Focus	Reference
Contextualized autonomy constructs				
Job Autonomy	I	Uni	Job characteristic	(Ahuja and Thatcher 2005; Elie-Dit-Cosaque et al. 2011; Moore 2000; Tripp et al. 2016)
Design Autonomy	I	Multi	Job characteristic	(Ye and Kankanhalli 2018)
Feelings for Autonomy	I	Uni	External Pressure	(Malhotra et al. 2008)
Task Autonomy	I	Uni	Job Characteristic	(Ozer and Vogel 2015)
Team Autonomy	G	Uni	Group characteristic	(Jain et al. 1998; Lee and Xia 2010; Maruping et al. 2009)
IT Project Autonomy	G	Uni	Paradoxes	(Gregory et al. 2015)
Climate for Autonomy	O	Uni	Psychologic climate	(Durcikova et al. 2011)
Autonomy-related constructs				
Task authority	I	Uni	Focus on tasks	(Sanders and Courtney 1985)
Freedom of Choice	I	Uni	Alternatives	(Murray and Häubl 2011)
Voluntariness	O	Uni	Environmental	(Brown et al. 2002; Wu and Lederer 2009)
I: Individual G: Group: O: Organization, Uni: Unidimensional, Multi: Multidimensional				

Table 9.2 Overview Autonomy in IS research

This review highlights two interesting aspects: First, autonomy is commonly used as a unidimensional construct that captures a contextualized form of autonomy. For instance, job autonomy is operationalized as a generic, overall concept that seeks to reflect a general feeling in terms of a current job (e.g., Ahuja et al. 2007). Although an overall conceptualization of autonomy has helped research to explain import aspects, it neglects the multi-dimensionality of the construct (Breaugh 1999; Ye and Kankanhalli 2018). Thus, explanatory power has not been fully exploited yet.

Secondly, previous IS research has not yet taken technology-related dimensions into consideration. Since autonomy is understood as "the degree to which the job provides substantial freedom, independence, and discretion to the employee [...]" (Hackman and Oldham 1975, p. 162), it is also relevant to technology-related autonomy including the freedom to choose a technology (Murray and Häubl 2011). Through the advancements of consumer technologies and with the rise of Individual Information Systems (Baskerville 2011), employees have been able to

use privately owned technologies for business-related purposes (Köffer et al. 2015). This development significantly increases the number of technologies that are suitable for work. Having an increasing number of technological alternatives in place and being able to choose a technology that best fits to idiosyncratic preferences becomes important. Specifically, previous literature clearly indicates that the freedom to choose technology is important in terms of technology-related perceptions and beliefs. For example, Murray and Häubl (2011) draw from reactance theory (Brehm 1966, 1989; Brehm and Brehm 1981) to show that individuals that are free to choose an interface have a higher degree of positive perception of technology-related asepcts (e.g., perceived ease of use) compared to individuals that are restrained. Consequently, we suggest to extend current conceptualizations of autonomy through the inclusion of a technology-related dimension: Work Instrument Autonomy which accounts for the increasing autonomy in terms of choosing technologies for work (c.f. Figure 9.1).

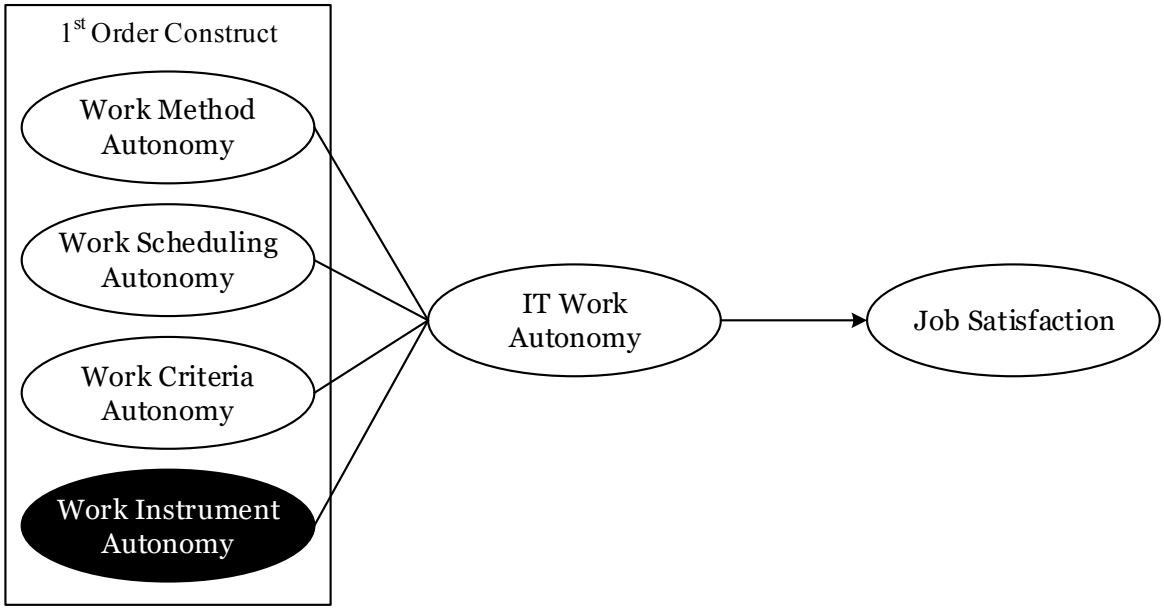

Figure 9.1 Research Model

9.3 Future Work and Expected Contributions

The proposed research model will be evaluated based on quantitative data (e.g., survey data). First, the factorial structure of IT work autonomy will be investigated carrying out a confirmatory factor analysis. Thereafter the concept of IT work autonomy will be further investigated within a nomological net. For that purpose, job satisfaction will be included in order to investigate whether the multidimensional conceptualization of IT work autonomy has indeed a positive effect on job satisfaction. For that purpose, Structural Equation Modeling (SEM) will be used.

Since this research relates to an important aspect of workplace characteristic, we expect important outcomes for theory and practice. For theory, we expect that this can contribute to research that focuses on job-related aspects. Since existing research used the concept of autonomy as an overall construct to address various outcome variables, we expect that IT work autonomy is able to provide a more detailed perspective. For example, research related to innovation behavior (e.g., Ahuja and Thatcher 2005) can benefit from IT work autonomy. For practice those insights can also be beneficial as organizations are able to significantly influence the autonomy dimensions used here. For example, work instrument autonomy can be enhanced by implementing corresponding policies that allows employees to choose their devices such as their laptops. Against this background, we expect that this research provides important implications for organization on how to design workplaces in order to enhance desirable effects such as job satisfaction or innovation behavior.

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10 Choice Self-Efficacy

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Table 10.1 Fact Sheet Publication

Does the Ability to Choose Matter? On the Relationship between Bring Your Own Behavior and IT Satisfaction

Abstract. Employees increasingly complete organizational tasks using privately owned consumer technologies such as private devices (e.g., smartphones) or private Internet accounts (e.g., email accounts). Higher satisfaction constitutes a major reason for this bring-your-own behavior (BYOB). However, little research has theoretically explored and empirically tested this assumption. This study sheds light on this phenomenon by analyzing the effect of BYOB on IT satisfaction. Drawing from social cognitive theory, we propose choice self-efficacy as a new construct that intermediates the relationship between BYOB and IT satisfaction. Building on results from survey data (n = 400), we provide new evidence that BYOB has a positive effect on IT satisfaction whereby choice self-efficacy plays a vital element as it mediates this relationship. Since IT satisfaction shapes how people use technology and how they perform with it, we derive important implications for future research on IT consumerization. Furthermore, we provide several conclusions for practitioners and discuss how to enhance IT satisfaction and choice self-efficacy

Keywords: IT Consumerization, IT Satisfaction, Bring Your Own Behavior, Choice Self-efficacy

10.1 Introduction

Employees fulfill an increasing number of organizational tasks using privately owned consumer technologies and devices such as smartphones and tablets and private Internet accounts such as email or social media accounts. Researchers and practitioners commonly refer to this trend as "IT consumerization" or the "consumerization of IT". On a conceptual level, IT consumerization becomes tangible as a distinct type of technology use behavior: bring-your-own (technology) behavior (BYOB) (Ortbach, Köffer, Bode, & Niehaves, 2013). Note that technology in a broader sense includes both hardware (e.g., smartphones) and software (e.g., email accounts).

Due to a steady increase in mobile technologies (Sørensen & Landau, 2015), the ubiquity of technology (Vodanovich, Sundaram, & Myers, 2010), and IT consumerization, employees recognize more than ever the portfolio of devices they can use and expect to be able to pick and choose the software and devices that best suit their work (Baskerville, 2011). They no longer accept being forced to adopt a certain solution (Dell & Intel, 2011). Therefore, IT consumerization has far-

reaching implications, such as new opportunities for empowerment (Junglas, Goel, Ives, & Harris, 2014), new sources for innovation (Junglas, Goel, Ives, & Harris, 2018), and the emergence of shadow IT (Gregory, Ruch, Kaganer, & Henfridsson, 2014; Haag, Eckhardt, & Bozoyan, 2015).

In reviewing the body of knowledge on IT consumerization, one can see that researchers have conducted little scientific work in this area and that it still remains a challenge (Becker, vom Brocke, Heddier, & Seidel, 2015). Of the research in this area that does exist, most focuses on describing and defining the phenomenon (Niehaves, Köffer, & Ortbach, 2012; Weiß & Leimeister, 2012). Further, many (particularly practitioner) studies assume that BYOB has a positive effect on IT satisfaction (Gens, Levitas, & Segal, 2011; Harris, Ives, & Junglas, 2012). However, these studies do not empirically investigate and validate the underlying mechanisms in the association between BYOB and IT satisfaction. We need to understand these mechanics since many consider IT satisfaction to predict performance (Judge, Thoresen, Bono, & Patton, 2001) and to relate strongly to technology use (Devaraj, Ming, & Kohli, 2002; Yajiong, Huigang, & Liansheng, 2011). By recognizing IT satisfaction predictors, companies can efficiently influence and customize employees' IT satisfaction, which, in turn, leads to employees with higher performance and more intensive technology use.

Despite its relevance to date, literature on IT consumerization neglects to explain BYOB's influence on satisfaction in more detail and on a more scientific level. Until now, the link between BYOB and employee satisfaction seems to be a black box. In order to shed light on this important issue, we propose and test a new theoretical model by diving deeper into the relationship between BYOB and IT satisfaction. Drawing from choice literature, we argue that BYOB involves the freedom to choose one's own technology according to idiosyncratic preferences. We further refer to Bandura's (1977, 1986) notion of self-efficacy, which refers to the extent to which individuals believe they can organize and execute certain actions. Building on this line of argument, we hypothesize that choice self-efficacy has vital importance when it comes to explaining the relationship between BYOB and IT satisfaction. Building on previous literature on IT satisfaction, we include technological beliefs as a precursor of IT satisfaction (Devaraj et al., 2002; Yajiong et al., 2011).

By shedding light on the relationship between BYOB and IT satisfaction, we make three important contributions. First, we extend the current body of knowledge with regard to IT consumerization. In doing so, we answer current calls for more research in this important area (Becker et al., 2015). Second, the research represents an early attempt to provide a theoretical model on the relationship between BYOB and IT satisfaction, which allows practitioners to draw from our findings in order to efficiently manage and customize their employees' IT satisfaction. Third, we

conceptualize choice self-efficacy as a new construct that has particular relevance to BYOB. In doing so, further research can refer to choice self-efficacy in various contexts.

This paper proceeds as follows: in Section 10.2, we review existing literature on IT consumerization and IT satisfaction. In Section 10.3, we present our theoretical development by proposing a research model that addresses the relationship between BYOB and IT satisfaction. We review previous use of self-efficacy in the information systems (IS) literature and conceptualize choice self-efficacy as a new contextualized variable that mediates the relationship between BYOB and IT satisfaction. In Section 10.5, we describe our research methodology. In Section 10.6, we present the results of this study and conclude by discussing the study's implications and promising aspects for future research.

10.2 Related Work

10.2.1 Background on IT Consumerization

In recent years, IT devices that have their origin in the consumer sector have increasingly infiltrated the corporate environment (Cummings, Massey, & Ramesh, 2009, p. 3; Ingalsbe, Shoemaker, & Mead, 2011, p. 259). Researchers initially observed this trend when Web 2.0 technologies, such as wikis, social networks, and blogs, emerged (Cummings et al., 2009; Holtsnider & Jaffe, 2012). Companies use these Web 2.0 technologies to improve collaboration (e.g., via Doodle), to exchange information (e.g., via Twitter), or as a form of multilateral cooperation in conjunction with social networks (e.g., via Facebook or LinkedIn). In addition to Web 2.0 technologies, mobile devices from the consumer market, such as laptops, tablets, and smartphones, have and continue to force their way into the corporate sector (Holtsnider & Jaffe, 2012). For example, employees increasingly use personally owned iPhones in companies as a substitute for the classic business smartphone (usually a BlackBerry).

IT consumerization has major effects on organizations. For instance, many organizations have shifted from top-down innovation to a bottom-up approach (Leclercq-Vandelannoitte, 2015a, 2015b). In this context, Andriole (2012) states that "there's a reverse technology-adoption life cycle at work: employees bring experience with consumer technologies to the workplace and pressure their companies to adopt new technologies" (p. 51). Today, employees recognize more than ever the portfolio of devices they can use and expect to be able to select the software and devices that best suit their work. In other words, they no longer accept being forced to adopt a certain solution (Dell & Intel, 2011).

Consequently, one can view IT consumerization from different angles (Köffer, Ortbach, Junglas, Niehaves, & Harris, 2015b). First, one can view it from a market perspective with a focus on the origin of the underlying technology. This perspective emphasizes consumer IT (e.g., Web 2.0 technologies or mobile devices from the consumer market). Second, one can view it from an individual perspective that focuses on the ownership of the IT. This perspective focuses on the question: "who owns the technology?". Third, one can view it an organizational perspective that focuses on policies about using private IT. Since we focus on privately owned technology, we primarily refer to the individual perspective in this study.

Existing literature on IT consumerization provides mixed results with regard to the effects that privately used technologies have on employees. On the one hand, some studies demonstrate their positive aspects, such as an increased level of convenience and comfort using privately owned technologies. Many studies have found that employees are more familiar with devices or technologies they use at home, which leads to productivity gains (Disterer & Kleiner, 2013; Köffer, Ortbach, & Niehaves, 2014). On the other hand, studies have also raised concerns about, for example, security (Disterer & Kleiner, 2013) and blurred boundaries (Jahn, Klesel, Lemmer, Weigel, & Niehaves, 2016; Köffer, Anlauf, Ortbach, & Niehaves, 2015a). Current literature also demonstrates that employees often use privately owned technologies alongside organizational IT, which, in turn, causes new forms of inconvenience for the user including work life conflict concerns, or perceived privacy risks(Klesel, Lemmer, Bretschneider, & Niehaves, 2017; Ostermann, Wiewiorra, & Franzmann, 2017).

Despite the importance of IT consumerization, researchers have conducted little scientific work in this area. Most papers limit their scope to simply describing and defining the phenomenon (Niehaves et al., 2012; Weiß & Leimeister, 2012). Initial empirical work primarily focused on the benefits and pitfalls of IT consumerization. For instance, Harris et al. (2012) conducted a worldwide quantitative study and concluded that increases in employee satisfaction, innovation, and productivity represent IT consumerization's main benefits. Gens et al. (2011) also found an increased level of satisfaction to constitute an important benefit. Other studies stress that an increasing level of autonomy for individuals has positive effects on motivation (Dell & Intel, 2011; Murdoch, Harris, & Devore, 2010; Niehaves et al., 2012). Related work also discusses the negative implications that such autonomy can have on an individual level; for example, that workers feel more pressure to work longer due to the overlap of private and corporate IT, which makes it "difficult [for them] to switch off from work" (Dell & Intel, 2011).

Consulting firms have also executed several empirical studies on the topic. These practice-driven studies have described the phenomenon and offered normative advice for executives. These studies commonly assume that BYOB has a positive effect on satisfaction (Gens et al., 2011; Harris et

al., 2012). However, these studies neglect to explain the influence of BYOB on satisfaction in more detail and on a more scientific level. They do not challenge the underlying mechanisms in the association between BYOB and IT satisfaction. In this paper, we go beyond existing literature by more deeply explaining the relationship between BYOB and IT satisfaction.

10.2.2 Background on IT Satisfaction

Research on IT satisfaction has a longstanding tradition in IS research (Briggs, Reinig, & de Vreede, 2008) since it forms a key aspect in technology acceptance research (Devaraj et al., 2002; Yajiong et al., 2011) and is considered an antecedent to IS success (DeLone & McLean, 1992, 2003). IT satisfaction refers to a pleasurable emotional state that results from using technology (Bhattacherjee & Premkumar, 2004). Previous literature has argued that satisfaction is similar to attitudinal constructs (Bailey & Pearson, 1983; Yajiong et al., 2011) and, thus, that one can include it in the technology acceptance model (Devaraj et al., 2002; Yajiong et al., 2011). In an extensive literature review, Nabavi, Taghavi-Fard, Hanafizadeh, and Taghva (2016) considered IT satisfaction as a central antecedent to continuance intentions. Moreover, IT satisfaction has several antecedents in distinct research contexts. For instance, in service continuance intentions, Kang and Lee (2010) explain satisfaction with website information quality and website system quality. Chang (2013) explores determinants of e-learning systems with a focus on perceived value and service quality. Other predictors of IT satisfaction focus on response time, conversation (in this case, social interactions), and pricing behavior in an online service to explain continuance (Ruth, 2012). Other researchers examine and predict satisfaction in the context of a user's holistic experience when using IT with expectation disconfirmation (Lankton & McKnight, 2012), perceived hedonic and utilitarian performance, and cognitive absorption (Deng, Turner, Gehling, & Prince, 2010).

Although studies have investigated the role that IT satisfaction has on the individual from different perspectives (Briggs et al., 2008), they have yet to link IT consumerization to IT satisfaction. Since individuals now increasingly use consumer IT in both the private and business environment, this gap leaves important questions in terms of the relationship between IT consumerization and IT satisfaction unanswered. Against this background, in section 10.3, we address this gap by introducing a research model that focuses on the relationship between BYOB and IT satisfaction.

10.3 Theoretical Development

10.3.1 Research Model

In this study, we depart from the notion that satisfaction represents an emotional state that results from technology use (Bhattacherjee & Premkumar, 2004). Accordingly, we propose a research model (see Figure 10.1) that explains the relationship between technology use via BYOB and IT satisfaction. By including mediating effects (i.e., choice self-efficacy, perceived ease of use, perceived usefulness), we account for a rich relationship between use and IT satisfaction in the model. This perspective concurs with the adoption process (Wei, Teo, Chan, & Tan, 2011), which uses technology access, digital capability, and digital outcome. In our context, BYOB relates to (digital) access. We use choice self-efficacy as a specific type of (digital) capability, and we include perceived usefulness (PU), perceived ease of use (PEOU), and IT satisfaction as (digital) outcome variables.

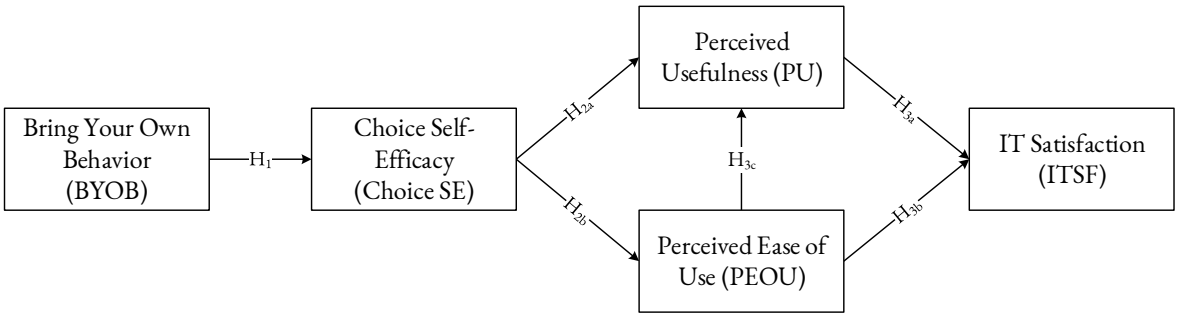

Figure 10.1 Proposed Research Model

We define IT satisfaction as "an individual's state following IT usage experience [which] involves two dimensions: valence (positive versus negative) and intensity (Oliver, 1993)" (Bhattacherjee & Premkumar, 2004, p. 237). For this study, we understand IT satisfaction in terms of the IT usage experience for work-related purposes. We define perceived usefulness (PU) and perceived ease of use (PEOU) as the extent to which people "believe [a specific technology] will help them perform their job better" (Davis, 1989, p. 320) and the degree to which they "believe that using a particular system would be free of effort" (Davis, 1989, p. 320), respectively. We define choice self-efficacy, which is new in this context, as individuals' perceptions of their own ability to choose technology that best fits their idiosyncratic needs in order to accomplish a task. Finally, we define bring-your-own behavior (BYOB) as behavior in which people use technologies other than those that their companies provide them with to perform work tasks (Ortbach et al., 2013). Hence, we consider a specific type of use behavior (or usage experience) that relates to the individual perspective of IT consumerization (Köffer et al., 2015b).

10.3.2 Why Choice Self-Efficacy Is Necessary

Bandura (1986, 2001) and Bandura and Adams (1977) have conceptualized self-efficacy as part of social cognitive theory. Social cognitive theory deals with the human development of personality and learning and builds on three factors: environment, cognition, and behavior. These factors pertain to the concepts of self-regulation, self-reflection, and self-efficacy. Self-reflection represents a necessary prerequisite of self-efficacy (Keith, Babb, Lowry, Furner, & Abdullat, 2015; Nisbett & Wilson, 1977). It refers to individuals' ability to understand emotions and experiences to assess their own cognitions and beliefs and to change their own behavior based on this evaluation. Bandura's self-efficacy notion relates to the idea that personal beliefs form the fundamental basis for action. In addition, self-efficacy refers to the degree to which individuals have confidence in their own performance (e.g., in fulfilling a particular task). Individuals who have a high degree of self-efficacy believe that they have the ability to perform in a certain manner in order to achieve a particular goal (Bandura, 1977). Hence, self-efficacy relates to human performance and one's ability to change one's behavior. Researchers have empirically examined this relationship between behavior and self-efficacy in diverse domains (Bandura, 1997) such as education (Chester & Beaudin, 1996), health (Resnick & Jenkins, 1996), and learning (Agarwal & Karahanna, 2000).

Furthermore, self-efficacy is a prerequisite for an individual's willingness to exhibit a certain behavior such as performing a task or coping with challenges that might arise when undertaking a particular action. In contrast, without self-efficacy, individuals do not persevere in a laborious, unknown, or new task. In general, individuals tend to avoid tasks and situations for which they have a low self-efficacy to control said tasks and situations, and they prefer activities they think they can handle (Bandura, 1977). Additionally, if an individual decides to perform such a task, the individual will spend more time and effort coping with the arising difficulties over the course of these activities. However, self-efficacy does not guarantee success because it simply concerns individuals' belief that they can perform a task. Success depends on the individual's competence, their incentives to complete a certain task, and the collaboration or activities of others (Bandura, 1977).

Researchers need to develop specific self-efficacy constructs that fit in their research context (Hardin et al., 2008; Marakas, Yi, & Johnson, 1998). Many have already done so for various contexts, such as security self-efficacy (Chen & Zahedi, 2016), knowledge self-efficacy (Zhao, Detlor, & Connelly, 2016), and mobile self-efficacy (Keith et al., 2015). Motivated by the IT consumerization and an increasing number of technology alternatives, we assume that self-efficacy becomes more important when it comes to choosing technology. Consequently, we adopt previous conceptualizations that propose choice self-efficacy. We believe that choice self-efficacy has the most

relevance today for several reasons. First, as technology becomes ubiquitous, the number of technology alternatives increases dramatically. Therefore, choice becomes more and more important. In other words, individuals with choice self-efficacy are more likely to find technology that fits their idiosyncratic needs and preferences, which, in turn, leads to more performance and satisfaction. Second, with the ubiquity of technology, individuals are much more familiar with IT. This aspect becomes most notable when it comes to digital natives (Vodanovich et al., 2010; Wang, Myers, & Sundaram, 2013). Consequently, general self-efficacy has become less effective in explaining contemporary phenomena. In contrast, in order to explain satisfaction, self-efficacy with regard to choice becomes more promising. Choice, from a psychological perspective, refers to individuals' ability to decide on their own to use information technology or an alternative and mostly relates to a situation of wellbeing. Specifically, these decisions refer to the idea of having a choice. For instance, Markus and Schwartz (2010, p. 344) arrive at the syllogism that "The more freedom and autonomy people have, the greater their well-being. The more choice people have, the greater their freedom and autonomy. Therefore, the more choice people have, the greater their well-being". Many studies have examined freedom, choice, and autonomy (Deci & Ryan, 2000, 2002; Murray & Häubl, 2011; Riemer & Filius, 2009), and these factors enable and allow people to control situations or get what they want (Markus & Schwartz, 2010).

Against this background, we contextualize choice self-efficacy as a specific type of computer self-efficacy with a particular emphasis on individuals' belief that they can choose suitable technology. As we propose above, we define choice self-efficacy as individuals' perceptions of their own ability to choose technology that best fits their idiosyncratic needs in order to accomplish a task. Thus, individuals with a high level of choice self-efficacy can choose technologies that suit their own preferences. Therefore, our understanding differs from previous conceptualizations because choosing a suitable technology requires a different skill set than using mobile phones (Keith et al., 2015) or computer systems in general (Marakas et al., 1998).

10.4 Hypothesis Development

Previous literature has applied self-efficacy in different ways. On the one hand, research has used it as as an antecedent to behavior. For instance, Agarwal and Karahanna (2000) conceptualize self-efficacy as a predictor of behavior intention. On the other hand, research has conceptualized self-efficacy as a successor of use behavior. For example, Wei et al. (2011) conceptualize school IT resource use as an antecedent of computer self-efficacy. This study, follows a similar approach, conceptualizing BYOD as a specific type of IT resource. Therefore, we assume we will find similar effects in our research. Specifically, we assume that IT resources (such as private IT resources) have the potential to significantly influence computer self-efficacy because they fundamentally

allow individuals to perform actions and to experience mastery (Wei et al., 2011). With regard to the prevalence of consumer technologies such as smartphones, tablets, or wearables in private environments, IT resources have become virtually ubiquitous. Therefore, we can assume that consumer technology has a similar effect on self-efficacy. Furthermore, researchers have stressed that individuals need peers to have rich experiences because they can observe and learn from other people's behavior (Wei et al., 2011). Due to IT consumerization, individuals today will likely observe others' (bring-your-own) behavior. Condensed innovation cycles, ubiquity of technology (Ransbotham, Fichman, Gopal, & Gupta, 2016), and an increasing number of digital natives (Wang et al., 2013)mean that individuals can scarcely avoid observing and analyzing other people's technology use behavior. This proposition goes hand in hand with prior research insights on self-efficacy. For example, Compeau and Higgins (1995) provide evidence that other people's use behavior has an influence on an individual's self-efficacy. IT consumerization means that individuals can choose from a vast number of technological alternatives (Köffer, Ortbach, et al., 2015). To find technology that suits their idiosyncratic needs and preferences, individuals need to be able to choose their technology. Therefore, individuals who bring their own technology (e.g., to their workplace) do not only provide self-efficacy in terms of technology use but self-efficacy in terms of choosing their technology. Combining the above arguments, we hypothesize:

H1: Bring-your-own behavior is positively linked to choice self-efficacy.

Previous literature has tested numerous individual factors that influence technology acceptance with mixed results (Venkatesh, Thong, & Xin, 2016); however, self-efficacy has received consistent support. For instance, in a study on the relationship between general and specific computer self-efficacy, Agarwal, Sambamurthy, and Stair (2000) found that computer self-efficacy had a significant effect on ease of use. Researchers report similar results in the context of autonomous workers (Lewis, Agarwal, & Sambamurthy, 2003), in digital libraries (Hong, Thong, Wong, & Tam, 2001), and in experimental studies (Venkatesh & Davis, 1996). In addition to research on computer self-efficacy, previous studies have acknowledged the importance of self-efficacy with regard to mobile technologies. In the context of location-based services and mobile apps, Keith et al. (2015) provide evidence that self-efficacy plays a vital role when it comes to mobile devices. Since IS research has extensively used computer self-efficacy in general and mobile self-efficacy in particular, choice self-efficacy obviously has similar effects on technological perception. Again, choice self-efficacy refers to individuals' perceptions of their own ability to choose technology that best fits their idiosyncratic needs in order to accomplish a task. Additionally, and in accordance with the choice literature, choice relates to the idea of freedom and autonomy, which, in turn, relates to wellbeing (Markus & Schwartz, 2010). Against this background, we hypothesize:

H2a: Choice self-efficacy increases perceived usefulness.

H2b: Choice self-efficacy increases perceived ease of use.

Existing literature has provided comprehensive evidence that perceived usefulness and perceived ease of use are antecedents to use intention (Ajzen, 1985; Davis, 1989; Fishbein & Ajzen, 1975; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh et al., 2016). At the same time, researchers have widely discussed the relationship between perceived ease of use and perceived usefulness (Hess, McNab, & Basoglu, 2014). In this study, we deliberately chose to look at satisfaction instead of use intention because one can consider BYOB as post adoption. Since satisfaction is an affective factor (Bailey & Pearson, 1983), we chose it over use intention (Devaraj et al., 2002; Yajiong et al., 2011). Since the relationship between technology attitudes and satisfaction has solid ground in existing literature (Davis, 1989; Venkatesh et al., 2003, 2016), we hypothesize:

H3a: Perceived usefulness increases satisfaction with IT.

H3b: Perceived ease of use increases satisfaction with IT.

H3c: Perceived ease of use is positively related to perceived usefulness.

10.5 Methodology

10.5.1 Research Design and Procedure

To test the research model, we collected data from 400 participants via a computer-assisted telephone interview (CATI) in order to reduce the "digital divide" (Fricker, Galesic, Tourangeau, & Yan, 2005) and to ensure a high degree of complete answers. On average, one interview took 15 minutes. We recruited the participants from 400 different local administrations in Germany that ranged from fewer than 50 employees up to 10,000 (see Table 10.2). We randomly selected the administrations from the overall population in order to have a representative sample.

Size	Amount	%
Less than 50 employees	248	62.0
51-250 employees	122	30.5
251-500 employees	14	3.5
501-1000 employees	10	2.5
1001-5000 employees	4	1.0
5001-10000 employees	1	.3
not specified	1	.3
Total	400	100

Table 10.2 Administration Overview

Our participant sample had the following demographic characteristics: 81 percent held a managing position (e.g., mayor, head of the office, or department manager), 19 percent held an employee position (e.g., clerk, spokesperson). Note that German administrations use a hierarchical bureaucratic system, which explains the high number of people with managing positions in our sample (for a comparison, see, e.g., Vandenabeele, Scheepers, & Hondeghem, 2006). Further, 66 percent of the respondents were male, and 34 percent were female. The participants had an average age of 47.5 (SD = 10.72) and an average tenure of 18.81 years (SD = 11.59). Table 10.3 illustrates these demographic characteristics

Position		Gender		Age						Age	Tenure
Manager	81%	Male	Female	21-35	36-45	46-55	> 55	n.a.	M	47.50	18.81
Employee	19%	66%	34%	17.0%	18.5%	33.8%	24.8%	6.0%	SD	10.72	11.59

Table 10.3 Descriptive Statistics

10.5.2 Measurement Instrument

Wherever possible, we used existing measurement items to ensure content validity. We measured BYOB with a three-item scale (Ortbach et al., 2013). We measured perceived usefulness and perceived ease of use based on the original scales (Davis, 1989). We measured IT satisfaction with a four-item scale (Bhattacherjee, 2001). Table 10.9 in the Appendix overviews the empirical correlations.

We contextualized choice self-efficacy in two steps. First, we reviewed existing self-efficacy scales (Agarwal et al., 2000; Brown & Venkatesh, 2005; Marakas, Johnson, & Clay, 2007; Marakas et

al., 1998; Schmitz, Teng, & Webb, 2016). In order to avoid respondent fatigue, we decided to use a parsimonious scale that Brown and Venkatesh (2005) propose, which comprises three items. Other scholars who have successfully applied short-item scales for context-specific self-efficacy constructs have used a similar strategy (Keith et al., 2015).

Second, we adapted the items to our study's context. For example, we changed the original question "I feel comfortable using a computer on my own" (Brown & Venkatesh, 2005) to "I feel comfortable making my own IT choices for work". We adapted all items in this manner. Since literature on IT consumerization indicates that employees eagerly choose their own tools (Harris et al., 2012), we included a fourth item to account for this aspect ("I am the best judge of what IT to use for my work."). Table 10.4 overviews the constructs we measured. All measurement items were measured reflectively.

Since choice self-efficacy is new, we applied established approaches to determine discriminant validity (Gefen & Straub, 2005). First, we investigated the loadings and cross-loadings to ensure that the constructs did not significant overlap (see Table 10.11). Next, we analyzed the square root of the AVE for each construct (see Table 10.6). Since all values were higher than any of the correlations with other constructs (Fornell & Larcker, 1981), we assume that choice self-efficacy had a sufficient degree of discriminant validity.

Construct	ID	Item	Source
Bring-your-own behavior	BYOB1	I use private devices (e.g., laptop computer, smartphone) to perform work tasks.	Ortbach et al. (2013)
	BYOB2	I use private software applications to perform work tasks.	
	BYOB3	I use private Internet accounts (e.g., social media) to perform work tasks.	
Choice self-efficacy	ChoiceSE1	I feel comfortable making my own IT choices for work.	Brown & Venkatesh (2005), Harris et al. (2012)
	ChoiceSE2	If I wanted to, I could easily select IT for my work on my own.	
	ChoiceSE3	I can choose IT for my work even if no one is around to help me.	
	ChoiceSE4	I am the best judge of what IT to use for my work.	
Perceived usefulness	PU1	The IT I use for work enables me to accomplish tasks more quickly.	Davis (1989)
	PU2	The IT I use for work improves my job performance.	
	PU3	The IT I use for work increases my productivity.	
	PU4	The IT I use for work enhances my effectiveness on the job.	
	PU5	The IT I use for work makes it easier to do my job.	
	PU6	I find the IT I use for work useful in my job.	
Perceived ease of use	PEOU1	Learning to operate the IT I use for work is easy for me.	Davis (1989)
	PEOU2	I find it easy to get the IT I use for work to do what I want it to do.	
	PEOU3	My interaction with the IT I use for work is clear and understandable.	
	PEOU4	It is easy for me to become skillful with respect to the IT I use for work.	
	PEOU5	I find the IT I use for work easy to use.	
IT satisfaction	All in all, I am _____ with the technology that I use for work.		Bhattacherjee (2001), Bhattacherjee & Premkumar (2004)
	ITSF1	Very dissatisfied / very satisfied	
	ITSF2	Very displeased / very pleased	
	ITSF3	Very frustrated / very content	
	ITSF4	Absolutely terrible / absolutely delighted	

Table 10.4 Measurement Items

10.6 Data Analysis and Results

10.6.1 Method Selection

Since the model comprises common factors, we used consistent partial least square (PLSc) path modeling for the analysis. PLSc extends the traditional PLS algorithms and corrects for attenuation (Dijkstra & Henseler, 2015). Therefore, PLSc addresses the estimation bias of the traditional PLS algorithm and promises more accurate estimations. We used ADANCO (2.0.1) for the subsequent analysis (Henseler & Dijkstra, 2015).

10.6.2 Model Fit

We analyzed the goodness of model fit for the saturated and estimated model (see Table 10.5). The results indicate that, with regard to the SRMR and d_{ULS}, the model had an adequate fit in both models (saturated and estimated). D_G was not as ideal as estimated. It had a higher value than the .95 confidence interval. Since the SRMR and d_{ULS} were acceptable the d_G indicator was only slightly not ideal, we can assume a suitable fit of the model (Byrne, 2006; Henseler, Hubona, & Ray, 2016).

Model	**Saturated**			**Estimated**		
fit indicator	Value	HI95	HI99	Value	HI95	HI99
SRMR	0.0438	0.0460	0.0550	0.0467	0.0496	0.0576
d_{ULS}	0.4441	0.5342	0.7642	0.5522	0.6236	0.8390
d_G	0.2777	0.2886	0.3845	0.3107	0.2884	0.3766

Table 10.5 Model Fit

10.6.3 Internal Consistency Reliability and Convergent Validity

We analyzed the internal consistency reliability using three different estimates (see Table 6): Dijkstra-Henseler's rho (ρA), Jöreskog's rho (ρc), and Cronbach's alpha (α). According to these indicators, all constructs provided a sufficient degree of reliability (ρA > 7; ρc > .7; α >.7). As the average variance extracted (AVE) values show, each construct also met the requirements for convergent validity (Fornell-Larcker Criterion). The Heterotrait-Monotrait ratio (HTMT) of correlations also indicates a high reliability because all indicators were significantly below 1 (see Table 10.10). Finally, we analyzed the cross-loadings and found that the loadings exceeded the cross-loadings (see Table 10.11).

Construct	α	ρ_A	ρ_c	BYOB	ChoiceSE	PU	PEOU	ITSF
BYOB	0.7379	0.7947	0.7461	0.5065				
ChoiceSE	0.8717	0.8789	0.8706	0.0498	0.6295			
PU	0.9076	0.9107	0.9074	0.0121	0.0677	0.6215		
PEOU	0.9089	0.9093	0.9088	0.0068	0.1292	0.4699	0.6660	
ITSF	0.8882	0.8899	0.8885	0.0028	0.0768	0.3018	0.3806	0.6662

α = Cronbach's alpha, ρ_A = Dijkstra-Henseler's rho, ρ_c = Jöreskog's rho. Squared correlations; AVE in the diagonal.

Table 10.6 Internal Consistency Reliability and Convergent Validity

10.6.4 Structural Model

To evaluate the structural model, we considered the coefficients of determination (R^2) and the significance level of path coefficients via bootstrapping method (4,999 bootstrap samples). Concerning R^2, the results show perceived usefulness and perceived ease of use explained 41.1 percent of the variance of satisfaction. Furthermore, the model explained 47 percent of the variance of perceived usefulness and 12.9 percent of perceived ease of use. Finally, BYOB explained 4.9 percent of choice self-efficacy (adjusted R^2, see Table 10.12).

The path coefficient between BYOB and choice self-efficacy was significant. Furthermore, the path between choice self-efficacy and perceived ease of use was significant. We did not find a significant relationship between choice self-efficacy and perceived usefulness. Moreover, perceived ease of use had a significant relationship to perceived usefulness. Both perceived ease of use and perceived usefulness had a significant effect on IT satisfaction (see Figure 10.2).

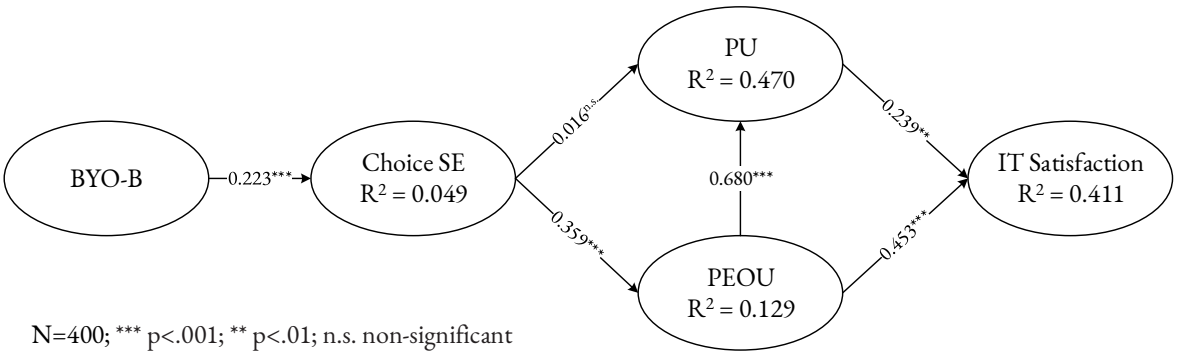

Figure 10.2 Structural Model

10.6.5 Effect Analysis

In order to compare the effects, we calculated the direct and indirect strength of each relation's effect (see Table 10.7). According to the analysis, choice self-efficacy did not have an effect on

perceived usefulness. The relationship between perceived usefulness and IT satisfaction was significant at a p-value smaller than 0.01. The path coefficients from BYOB to choice self-efficacy, choice self-efficacy to perceived ease of use, perceived ease of use to perceived usefulness, and perceived ease of use to IT satisfaction were significant at a level below 0.001. Cohen's f^2 shows that perceived ease of use had a strong effect on perceived usefulness and a moderately strong effect on IT satisfaction. Choice self-efficacy did not have an effect on perceived usefulness and a weak effect on perceived ease of use. Finally, we observed indirect effects from choice self-efficacy to IT satisfaction and to perceived usefulness.

Independent	Dependent	Beta (β)	Indirect effects	Total effect	Cohen's f^2	Effect size†
BYOB	ITSF		0.0503	0.0503		
ChoiceSE			0.2251	0.2251		
PU		0.2385		0.2385	0.0512	weak
PEOU		0.4535	0.1621	0.6156	0.1850	medium
ChoiceSE		0.0159	0.2444	0.2603	0.0004	no
BYOB	PU		0.0581	0.0581		
PEOU		0.6798		0.6798	0.7593	high
ChoiceSE	PEOU	0.3595		0.3595	0.1484	weak*
BYOB			0.0803	0.0803		
BYOB	ChoiceSE	0.2233		0.2233	0.0525	weak*

† We interpret the effects sizes as follows: weak effect: 0.02 ≤ f2 < 0.15; moderate effect: 0.15 ≤ f2 < 0.35; strong effect: f2 ≥ 0.35 (Chin, 1998; Cohen, 1988)

* We note that, in cases of a single antecedent, we cannot report a genuine effect size. Instead, we calculated this indicator assuming that the R2 (excluded) equaled 0.

Table 10.7 Effect Size

10.6.6 Post Hoc and Mediation Analysis

We analyzed perceived ease of use to see whether it mediated the relationship between choice self-efficacy and perceived usefulness. Since the results do not support H2a (β = 0.016, non-significant), we carried out a post hoc analysis and followed existing guidelines on mediation analysis (Aguinis, Edwards, & Bradley, 2016; Baron & Kenny, 1986; Zhao, Lynch, & Chen, 2010). We found that perceived ease of use did determine whether choice self-efficacy had an indirect effect on perceived usefulness (Nitzl, Roldan, & Cepeda, 2016). As Table 6 illustrates, choice self-efficacy had an indirect effect on perceived usefulness (the path coefficient was β = 0.205 with bootstrapped p-value = 0.000). Additionally, a Sobel test (Preacher & Hayes, 2004; Sobel, 1982, 1986) confirms the result that perceived ease of use fully mediated choice self-efficacy. As Zhao et al.

(2010) argue, one needs to investigate the role of omitted mediators. To do so, we conducted a detailed analysis following Aguinis et al. (2016). Specifically, we removed mediator variables (i.e., perceived ease of use) to investigate how the relationship between choice self-efficacy and IT satisfaction changed. We found that, without perceived ease of use, a significant path between choice self-efficacy and IT satisfaction remained (β = 0.236, p value = 0.000), which concurs with our results from analyzing indirect effects (see Table 6 (indirect effect = 0.2251)). Hence, we conclude that perceived ease of use fully mediated the relationship between choice self-efficacy and IT satisfaction. Additionally, we conducted a mediation analysis that excluded perceived ease of use. Again, the results suggest a mediation (partial mediation of PU) between choice self-efficacy and IT satisfaction (β = 0.143, p-value = 0.016).

10.6.7 Control Variables

We included several control variables in our model that similar studies have also used (Keith et al., 2015; Wei et al., 2011), such as demographics (gender, age) and organizational and professional characteristics (organizational size, tenure, and computer skills). Table Table 10.8 overviews the influence of the control variables on the proposed variables.

	Construct			
Control variable	ChoiceSE (β, f^2)	PU (β, f^2)	PEOU (β, f^2)	ITSF (β, f^2)
Gender	-0.1215* (0.019)	-0.0456n.s. (0.003)	0.1780** (0.039)	0.0576n.s. (0.005)
Age	-0.0061n.s. (0.000)	0.0743n.s. (0.006)	-0.0376n.s. (0.001)	0.0724n.s. (0.005)
Organizational size	-0.1617** (0.0315)	0.0007n.s. (0.000)	0.0157n.s. (0.000)	0.0066n.s. (0.000)
Computer skills	0.4550*** (0.245)	-0.0531n.s. (0.003)	0.2164** (0.042)	0.1537** (0.032)
Tenure	-0.1096n.s. (0.009)	0.092n.s. (0.009)	-0.0766n.s. (0.004)	0.0461n.s. (0.002)

Significance levels: *** p < 0.001; ** p < 0.01; * p < 0.05; n.s. = non-significant

Table 10.8 Influence of Control Variables

10.7 Discussion

10.7.1 Major Findings

The proposed results show the impact that perceived usefulness (β = 0.239, p < 0.01; $f^2 \geq 0.051$ weak effect) and perceived ease of use (β = 0.453, p < 0.001; $f^2 \geq 0.185$ medium effect) had on IT satisfaction. As one can see, perceived ease of use had a higher impact on IT satisfaction (i.e., the contentedness, satisfaction, pleasure, or delight of using technology for work). Further, perceived

ease of use strongly predicted perceived usefulness (β = 0.680, p < 0.001; $f^2 \geq 0.759$ high effect). In addition, we found that our model explained more than 40 percent of the variance.

In this study, we examined antecedents to the original constructs in the technology acceptance model. First, we found that BYOB explained a small but significant amount of variance in choice self-efficacy (β = 0.223, p < 0.001). Therefore, other impact factors that include different technologies may also affect choice self-efficacy. For instance, other technologies and their corresponding use behavior (e.g., corporate-owned privately enabled (COPE)) may affect choice self-efficacy.

Second, choice self-efficacy refers individuals' perceptions of their own ability to choose technology that best fits their idiosyncratic needs in order to accomplish a task. The analysis shows that choice self-efficacy predicted perceived ease of use (β = 0.359, p < 0.001; $f^2 \geq 0.148$ weak effect). We can conclude that individuals who choose their own IT judge themselves to be confident in performing particular tasks, which affects their belief in their skills. As a result, they find working with (their own) IT easier. Moreover, the significant relationship between choice self-efficacy and PEOU might also indicate that individuals with a high degree of choice self-efficacy are more likely to choose technology that they find easier to use. For example, individuals that are loyal to a specific system are more likely to choose those technologies since they find them easier to use[1].

One cause-effect relationship (i.e., the relationship between choice self-efficacy and perceived usefulness) was not significant (β = 0.016, non-significant; $f^2 \geq 0.000$ no effect). Two possible reasons may explain this finding. The first reason concerns context: since perceived usefulness of information technology is linked to specific technologies, participants in this study may have related to their technology in a rather narrow sense. Second, in terms of choice, perceived usefulness could be too broad for a generalizable statement to reveal a significant cause-effect relationship. However, our post hoc analysis results show that perceived ease of use fully mediated between the relationship between choice self-efficacy and perceived usefulness (i.e., a 0.2444 indirect effect; see Table 6). Further, a Sobel test and the mediation analysis confirmed the full mediation. However, we found that choice self-efficacy did not have a direct effect (Cohen's f^2) on perceived usefulness. A further post hoc mediation analysis revealed a non-hypothesized but significant and fully mediated path between choice self-efficacy and IT satisfaction.. As such, investigating the role that choice self-efficacy has on technology-related beliefs, it could provide important insights into the actual use behavior.

In order to investigate the effects of control variables, we included gender, age, organizational size, computer skills, and tenure. The results show that tenure and age had no significant effect in our

[1] We thank one anonymous reviewer for this suggestion.

proposed model. In contrast, gender, organizational size, and computer skills had a significant effect. Firstly, gender had an effect on choice self-efficacy (β = -0.1215, p-value < 0.05) but a weak Cohen's f^2 effect ($f^2 \geq 0.019$ no effect), while perceived ease of use (β = 0.1780, p-value < 0.01; f^2 0.039 weak effect) had a significant relationship and a weak effect. These results reflect the gender bias known from existing acceptance literature (e.g., Venkatesh et al., 2003). Second, organizational size had a negative impact on choice self-efficacy and a weak effect (β = -0.1617, p-value < 0.01; $f^2 \geq 0.031$ weak effect). Against the background of choice self-efficacy, this negative relationship could have resulted from differences in terms of organizational culture or training opportunities. Third, the control variable computer skills (which reflects how individuals perceive their IT knowledge) had three positive and significant relations: 1) choice self-efficacy (β = 0.455, p-value < 0.001; $f^2 \geq 0.245$ moderate effect), 2) perceived ease of use (β = 0.2164, p-value < 0.01; $f^2 \geq 0.042$ weak effect), and 3) IT satisfaction (β = 0.1537, p-value < 0.01; $f^2 \geq 0.032$ weak effect). As for the first relationship, people with a lot of IT knowledge can typically better choose technology that fits their needs. Similarly, for the second relationship, people who have a lot of knowledge on IT perceive the IT they use as easier to use. Alternatively, these people find it easier to learn to use technology. The third relationship may result from people's beliefs that they are more satisfied with a technology when they think they have good knowledge about IT in general.

10.7.2 Implications for Theory and Practice

We examined the relationship between BYOB and IT satisfaction and emphasized the importance of choice self-efficacy. We found a relationship between BYOB and IT satisfaction and that choice self-efficacy and technological beliefs (perceived usefulness and perceived ease of use) mediated the relationship. Our findings have several theoretical and real-life implications.

First, our insights contribute to previous literature on IT satisfaction. Whereas previous literature has primarily focused on confirmation and disconfirmation of technologies (Bhattacherjee & Premkumar, 2004), we specifically investigated the relationship between privately owned technologies and their influence on IT satisfaction. According to our results, the use of privately owned technologies has a small but significant influence on IT satisfaction. Hence, our results encourage further research on IT satisfaction and privately owned technologies.

Second, our study contributes to the existing body of knowledge in the domain of IT consumerization. Apart from several practitioner studies, which have only postulated that BYOB might influence IT satisfaction, we empirically analyzed the relationship based on theory. Thus, we not only verify postulations in existing practitioner studies but also theoretically explain the relationship between BYOB and IT satisfaction. As such, we deliver a theoretical foundation that researchers can use to further advance theory in the IT consumerization domain. For instance, one

could use the initial model to build theories by adding other constructs. Given the theoretical void in existing literature, this model can contribute to strengthening future endeavors for theorizing IT consumerization.

Third, existing IS research has provided extensive evidence to support self-efficacy's importance (Agarwal et al., 2000; Compeau & Higgins, 1995; Marakas et al., 1998). We contribute to existing literature by providing further evidence that one can conceptualize self-efficacy in a way other than as a precursor to use behavior (e.g., Agarwal & Karahanna, 2000): that is, that one can conceptualize it as a successor to use behavior (e.g. Wei et al., 2011). Furthermore, we contextualize self-efficacy in a new way and provide initial insights into its performance in the IT consumerization domain. As the portfolio of technological alternatives continues to increase, we can expect that choice and choice self-efficacy will gain in importance..

Fourth, this study indicates that choice self-efficacy has a relationship with technology-related beliefs (perceived ease of use and perceived usefulness). Therefore, we can assume that a high degree of self-efficacy also has a relationship with technology use (or intention to use technology). This logic agrees with previous research that has focused on IT satisfaction instead of use intention (Devaraj et al., 2002; Yajiong et al., 2011). From a theoretical perspective, this logic implies that acceptance and adoption research should consider using choice self-efficacy.

Since we address a highly relevant phenomenon for practitioners in this study (Niehaves et al., 2012), our findings also have implications for practice. Most importantly, we found a relationship between BYOB and IT satisfaction. Therefore, in order to improve IT satisfaction, organizations can consider establishing BYOB policies. Especially with tasks and processes that data security issues do not affect, promoting the use of privately owned devices and software may prove a promising strategy. Furthermore, since we consider IT satisfaction to predict employees' performance (Judge et al., 2001) and since it strongly relates to employees' technology use (Devaraj et al., 2002; Yajiong et al., 2011), companies can now efficiently influence and customize employees' IT satisfaction. As a result, they can increase employee performance and degree to which they use technology.

10.7.3 Limitations and Future Research

As with all research, our study has several limitations that provide promising avenues for future research. Future studies should look at choice self-efficacy in other contexts to stabilize its reliability and usefulness. We propose choice self-efficacy as an important construct for IS research. However, we could only show its significance in a nomological net and not comprehensively explore its antecedents in this study. Consequently, further research may address this shortcoming

by including other variables to explain the construct in more detail. In addition, we did not consider what influence IT strategies that govern use behavior such as bring your own device (BYOD) or COPE have on individual use behavior. Since structures such as rules or norms influence behavior (Giddens, 1984; Jones & Karsten, 2008; Mokosch, Klesel, & Niehaves, 2015), future research could include its influence and possible effects. Because this study evidences a relationship between BYOB and IT satisfaction, future research could build on this insight by including further variables.

Additionally, our sample also had some limitations. Most importantly, a significant number of employees in our sample held some kind of managerial position. Although the hierarchical structure in German governmental organizations explains this occurrence (Vandenabeele, Scheepers, & Hondeghem, 2006), it may bias our sample. Therefore, more research needs to investigate our insights.

From our perspective, hedonic variables such as enjoyment with devices (van der Heijden, 2004), or work-place variables such as autonomy or work-life conflict (Ahuja, Chudoba, Kacmar, McKnight, & George, 2007) may also present a promising avenue to investigate. In any case, to conclude, we propose and test choice self-efficacy as a new construct. Our findings suggest that it represents a relevant variable for explaining the relationship between BYOB and IT satisfaction.

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10.10 Appendix: PLSc Results

Indicator		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	BYO1	1	.42	.41	.13	.06	.14	.10	.15	.07	.13	.16	.10	.09	.04	.11	.06	.09	.04	.06	.01	.04	.01
2	BYO2	.42	1	.62	.12	.09	.11	.08	.01	.03	.08	.04	-.03	-.01	.03	.05	.03	.03	.00	.07	.00	.03	.02
3	BYO3	.41	.62	1	.22	.13	.19	.09	.05	.07	.07	.08	.02	.03	.04	.06	.06	.04	.05	.07	.00	.04	.03
4	Choice SE1	.13	.12	.22	1	.67	.68	.50	.24	.17	.17	.19	.20	.14	.28	.25	.20	.23	.16	.13	.15	.16	.20
5	Choice SE2	.06	.09	.13	.67	1	.70	.58	.17	.12	.14	.13	.08	.07	.31	.20	.17	.26	.14	.14	.15	.18	.21
6	Choice SE3	.14	.11	.19	.68	.70	1	.66	.24	.19	.17	.20	.18	.12	.32	.25	.19	.29	.19	.15	.12	.17	.19
7	Choice SE4	.10	.08	.09	.50	.58	.66	1	.21	.17	.14	.19	.14	.11	.30	.28	.19	.27	.20	.20	.20	.26	.30
8	PU1	.15	.01	.05	.24	.17	.24	.21	1	.52	.57	.59	.62	.51	.43	.47	.46	.44	.45	.32	.34	.36	.34
9	PU2	.07	.03	.07	.17	.12	.19	.17	.52	1	.73	.69	.60	.52	.31	.42	.38	.35	.39	.24	.30	.31	.30
10	PU3	.13	.08	.07	.17	.14	.17	.14	.57	.73	1	.80	.66	.61	.39	.50	.48	.44	.49	.36	.41	.42	.40
11	PU4	.16	.04	.08	.19	.13	.20	.19	.59	.69	.80	1	.68	.57	.37	.52	.44	.42	.46	.35	.38	.38	.38
12	PU5	.10	-.03	.02	.20	.08	.18	.14	.62	.60	.66	.68	1	.64	.41	.49	.52	.45	.52	.32	.41	.36	.37
13	PU6	.09	-.01	.03	.14	.07	.12	.11	.51	.52	.61	.57	.64	1	.36	.46	.48	.40	.49	.34	.36	.38	.32
14	PEOU1	.04	.03	.04	.28	.31	.32	.30	.43	.31	.39	.37	.41	.36	1	.64	.70	.69	.63	.34	.39	.43	.41
15	PEOU2	.11	.05	.06	.25	.20	.25	.28	.47	.42	.50	.52	.49	.46	.64	1	.62	.60	.61	.39	.35	.41	.40
16	PEOU3	.06	.03	.06	.20	.17	.19	.19	.46	.38	.48	.44	.52	.48	.70	.62	1	.66	.77	.43	.46	.44	.44
17	PEOU4	.09	.03	.04	.23	.26	.29	.27	.44	.35	.44	.42	.45	.40	.69	.60	.66	1	.73	.38	.43	.40	.42
18	PEOU5	.04	.00	.05	.16	.14	.19	.20	.45	.39	.49	.46	.52	.49	.63	.61	.77	.73	1	.42	.45	.43	.42
19	ITSF1	.06	.07	.07	.13	.14	.15	.20	.32	.24	.36	.35	.32	.34	.34	.39	.43	.38	.42	1	.67	.63	.62
20	ITSF2	.01	.00	.00	.15	.15	.12	.20	.34	.30	.41	.38	.41	.36	.39	.35	.46	.43	.45	.67	1	.65	.65
21	ITSF3	.04	.03	.04	.16	.18	.17	.26	.36	.31	.42	.38	.36	.38	.43	.41	.44	.40	.43	.63	.65	1	.77
22	ITSF4	.01	.02	.03	.20	.21	.19	.30	.34	.30	.40	.38	.37	.32	.41	.40	.44	.42	.42	.62	.65	.77	1

Table 10.9 Empirical Correlation Matrix

Construct	BYO	ChoiceSE	PU	EOU	ITSF
BYO					
ChoiceSE	0.2198				
PU	0.1161	0.2577			
EOU	0.0847	0.3618	0.6827		
ITSF	0.0564	0.2797	0.5472	0.6169	

Table 10.10 Heterotrait-Monotrait Ratio of Correlations (HTMT)

Indicator	BYO	ChoiceSE	PU	PEOU	ITSF
BYO1	0.6111	0.1364	0.1492	0.0823	0.0354
BYO2	0.5666	0.1265	0.0262	0.0344	0.0387
BYO3	0.9082	0.2028	0.0674	0.0606	0.0408
ChoiceSE1	0.2280	0.8487	0.2346	0.2742	0.1963
ChoiceSE2	0.1372	0.6669	0.1495	0.2636	0.2084
ChoiceSE3	0.2072	0.8697	0.2308	0.3024	0.1903
ChocieSE4	0.1257	0.7726	0.2018	0.3026	0.2933
PU1	0.0889	0.2726	0.8040	0.5486	0.4152
PU2	0.0863	0.2047	0.6647	0.4548	0.3514
PU3	0.1211	0.1991	0.8409	0.5624	0.4891
PU4	0.1285	0.2235	0.8100	0.5422	0.4556
PU5	0.0423	0.1943	0.8323	0.5868	0.4469
PU6	0.0530	0.1376	0.7649	0.5391	0.4301
PEOU1	0.0514	0.3775	0.4803	0.7765	0.4816
PEOU2	0.0977	0.3105	0.6043	0.8349	0.4729
PEOU3	0.0671	0.2377	0.5855	0.8379	0.5408
PEOU4	0.0710	0.3271	0.5309	0.8040	0.4972
PEOU5	0.0471	0.2211	0.5908	0.8254	0.5243
ITSF1	0.0897	0.1944	0.4084	0.4796	0.7624
ITSF2	0.0040	0.1912	0.4699	0.5062	0.8359
ITSF3	0.0540	0.2406	0.4674	0.5164	0.8432
ITSF4	0.0295	0.2770	0.4455	0.5114	0.8210

Table 10.11 Cross Loadings

Construct	Coefficient of determination (R2)	Adjusted R2
ChoiceSE	0.0498	0.0473
PU	0.4701	0.4672
PEOU	0.1292	0.1269
ITSF	0.4108	0.4076

Table 10.12 Endogenous Variables

11 Psychological Ownership of IT

Title	**Exploring Psychological Ownership of IT: An Empirical Study**
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Table 11.1 Fact Sheet Publication

Exploring Psychological Ownership of IT: An Empirical Study

Abstract. Psychological ownership of Information Technology (POIT) is becoming an increasingly relevant phenomenon in theory and practice since privately-owned consumer technologies and bring-your-own-device (BYOD) strategies effectively shaping today's workplaces. While Information Systems (IS) research is in the beginning to explore POIT, the full complexity of the ownership phenomenon has not yet been understood. Here, we draw on psychological ownership theory to propose an extended view on POIT. Choosing a grounded theory methodology, we gathered original data (20 expert interviews, 5 and more years of work experience) and discovered "Appreciation of Technology" as a key characteristic of psychological ownership which has not been considered so far. Additionally, we identified three new antecedents ("Freedom of Choice", "Multi-Context Use" and "Surveillance") and one new effect ("Exception Handling") of psychological ownership of IT. Along with previous studies, our extended view provides a new lens through which ownership and technology acceptance can be viewed and BYOD phenomena better understood. Based on these new insights, we derive several implications for theory and practice.

Keywords: Psychological Ownership of IT, Theory Development, IT Acceptance, System Use.

11.1 Introduction

Technological advancement has led to significant changes in how technologies are used in organizations. These advancements have facilitated diverse use patterns such as collaboration in groups (Desanctis and Gallupe, 1987), computer mediated communication (Wasko et al., 2011) and new workplace characteristics such as mobile work (Ahuja et al., 2007). Consumer technologies have come with increased computing power, convenient and easy-to-use interfaces and are able to handle a multitude of applications and functionalities due to technology convergence. These factors have led to changes in use patterns and reformation of the IT organization.

With information technology becoming ubiquitous (Lyytinen and Yoo, 2002), it is common place to find employees using both enterprise and private technology in whichever ways that suit their work purposes. As a result of these changes, Information Systems (IS) researchers have investigated various affective aspects of technology use such as enjoyment (Igbaria et al., 1995), absorption (Agarwal and Karahanna, 2000), playfulness (Hackbarth et al., 2003), intrinsic motivation (Venkatesh, 2000), and psychological ownership (Barki et al., 2008) to explain and predict

how these psychological factors influence technology use and the ultimate outcomes of technology use.

Ownership of technology is one of the factors that has been shown to have significant influence on technology use (Köffer et al., 2015b). Two conceptualizations have emerged in IS research; legal ownership and psychological ownership. Legal ownership (Brynjolfsson, 1994) is anchored on a socio-legal system which attributes rights and responsibilities. The Bring-Your-Own-Device (BYOD) strategy is based on legal ownership that is completely in hand of the employee. On the other hand, psychological ownership (Pierce et al., 2001, Pierce et al., 2003) refers to a state of mind in which individuals feel as though the target of ownership or a piece of it is "theirs" (i.e., "it is MINE"). This feeling of possessiveness and being psychologically tied to an object has implications for technology adoption and use.

BYOD leverages ownership to offer distinct advantages in terms of some user behavior such as usability, self-efficacy and emotional attachment. However, security and control concerns are major hurdles from an organizational perspective. To counter these, companies have changed tact to pursue the Company-Owned, Personally-Enabled (COPE) strategy (BlackBerry, 2013). The success of this strategy is hinged on the organizations ability to manipulate employees' psychological ownership to attain positive outcomes. In order to adopt the concept of psychological ownership in the IT context, Barki et al. (2008) introduced psychological ownership of IT (POIT) which is defined as '*the sense of ownership an individual feels for an IT or IS'* (p. 270). To further analyze the extent to which POIT can be manipulated and what outcomes to expect, a deep conceptual understanding of the construct is necessary. Barki et al. (2008) note that *"[...] much still needs to be done to explore the POIT construct's potential role in varied contexts and to further explicate its relationships with other implementation and acceptance constructs*" (p. 278).

We carefully note that some work has been done in extant literature as there are studies of the effects of POIT that explain user behavior in relations to information system security (Anderson and Agarwal, 2010), acceptance of IT (Barki et al., 2008) and use intention in virtual worlds (Lee and Chen, 2011). However, a comprehensive exploration of the construct POIT is still missing (Barki et al., 2008) as there is a dearth of literature that explores the concept itself to understand more of its antecedents and what it predicts.

As such, we seek to bridge that gap by undertaking an explorative study whose objective is to uncover and to a lesser extent corroborate some antecedents of the POIT construct. We build on the foundation laid by Pierce et al. (2001), Pierce et al. (2003) and extend current research as we expound on the predictors, and outcomes of psychological ownership. The research question central to this study is, what are the antecedents of psychological ownership?

The significance of seeking to pursue this research question is two-fold; first, the key studies in IS that focus on POIT (Barki et al., 2008, Lee and Chen, 2011) have managed to explain only 49% and 30% of POIT respectively. This is an indication that there are aspects of POIT that need to be explained. Secondly, we respond to calls made in extant literature to enhance knowledge about psychological ownership of IT because it is a complex phenomenon. Although further theory testing has been done, little has been done to build theory around POIT.

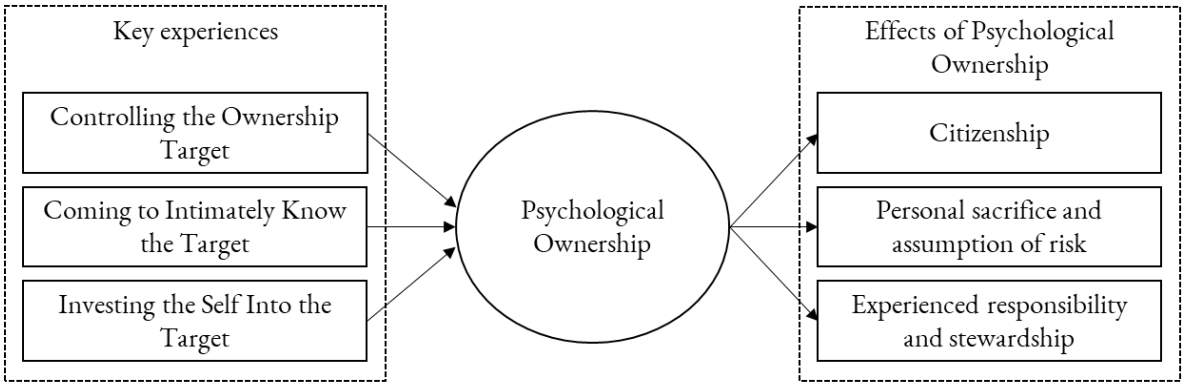
By answering this research question, we contribute to the current body of knowledge in psychological ownership of information technology literature by proposing an integrated and comprehensive explanation of POIT that supplements extant literature. We also contribute to practice by offering practical implication of the findings from this study.

The remainder of the paper is structured as follows: Section two (section 11.2) include the related work on psychological ownership and its use in information systems research. Chapter three (section 11.3) describes our research method. The findings are shown in section Four (11.4). We will integrate our findings with existing literature (Section 11.5). We discuss our findings with implications for theory and practice (Section 11.6) and conclude by propounding the limitations of our research and giving an outlook for future research.

11.2 Related Work

The concept of psychological ownership (PO) refers to a state of mind in which an individual perceives a target of ownership as "theirs" (Pierce et al., 2003). It is defined as the "psychologically experienced phenomenon in which an employee develops possessive feelings for the target" (Van Dyne and Pierce, 2004). Isaacs (1933) explains that psychological ownership emerges when "what is mine becomes (in my feelings) part of me". As such, it has important implication on behavior and therefore has found wide spread application in various research areas, including management science (e.g. Pierce et al., 2001), consumer behavior (e.g. Belk, 1988) and Information Systems (e.g. Barki et al., 2008).

Pierce et al. (2003) propose three motives upon which psychological ownership is rooted: *efficacy and effectance*, *self-identity* and *having a place*. Efficacy and effectance constitute the individuals' need to be in control of objects. Self-identity reflects the individuals' need to extend their self-identity to others, for example having a place reflect the individuals' need to possess a place which they refer as 'home'. Based upon this general assumption Pierce et al (2003) identify three key experiences, which enable the rise of PO (Figure 3.1): *controlling the ownership target*, *coming to intimately know the target* and *investing the self into the target*. Control of target ownership is considered a key experience that precedes psychological ownership.

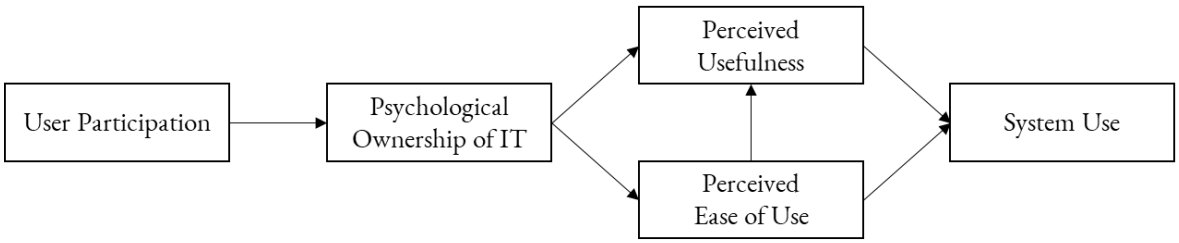


Source: Pierce et al. (2003)

Figure 11.1 Psychological Ownership

McClelland (1951) asserts that control over material possessions can lead to self-attribution much like the ownership that people feel because they can control their body parts. Intimate knowledge of the target emerges when people develop feelings for objects. Finally, investing the self into the target of ownership can be described as the result of when people "*create, shape, or produce*" objects (Pierce et al., 2003 p. 93).

Psychological ownership has been operationalized in various IS contexts such as system design (Barki et al., 2008), system use (Lee and Chen, 2011), social media (Karahanna et al., 2015), and user security behavior (Anderson and Agarwal, 2010). Barki et al. (2008) call it the Psychological Ownership of Technology (POIT); which in their model influences the users' acceptance and use of the system (see Figure 11.2). POIT is defined as '*the sense of ownership an individual feels for an IT or IS*" (p. 270). Since IT as an object is able to satisfy all three motives (i.e. *efficacy and effectance*, *self-identity* and *having a place)* Barki et al. (2008) adapted the general definition of PO for IT. They posit that participation leads to the development of POIT because by being actively engaged, the users feel that the resultant solution embodies approaches or solutions that reflect their assumptions and objectives. Accordingly, that sense of inclusion is likely to enhance their feelings of control, intimate knowledge, and investing oneself.



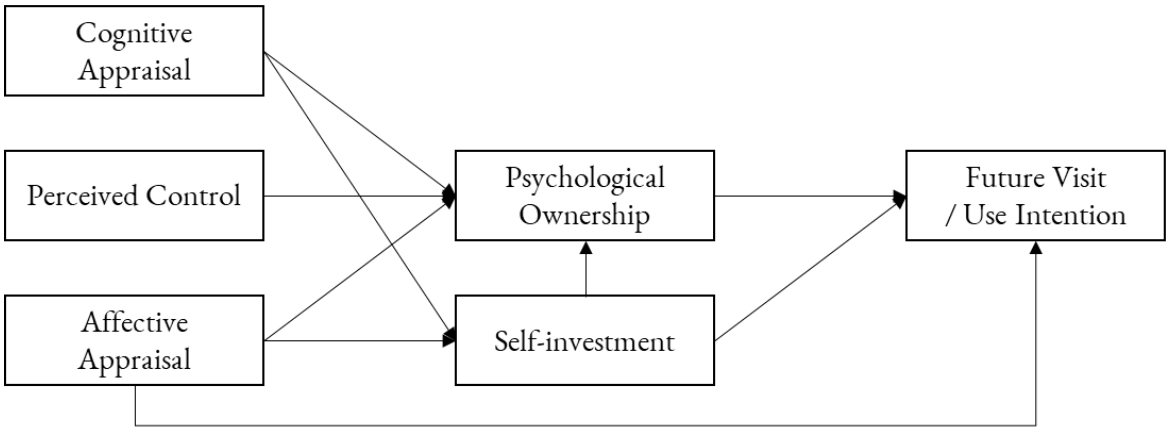
Source: Barki et al. (2008)

Figure 11.2 Psychological Ownership of IT

The sense of ownership described by POIT can exist without formal ownership. Karahanna et al. (2015) advance this aspect of POIT in social media as they explain that social media users don not have to own the social media infrastructure in order to have a sense of connection to their virtual belongings, contributions, and communities within the platform. They invoke two natural senses; that humans want "to have" because growth of possessions produces a positive and uplifting effect (James, 1890), whereas the loss of possessions leads to "shrinkage of our personality" (Formanek, 1994). These two fundamental assumptions behind psychological ownership are similar to the basic tenets of endowment effect (Loughran Dommer and Swaminathan, 2013) and loss aversion dimensions of prospect theory (Kahneman and Tversky, 1979). We make further contribution to this notion in our theory development section (section 11.5)

In the context of user security behavioral intentions Anderson and Agarwal (2010) use PO to better understand security related behavior, whereby the efficacy/effectance and self-identify motives are the focus of their study. They found a positive correlation between psychological ownerships and the intention to perform security-related behavior. Internet users who felt a sense of ownership towards the internet exhibited more "conscientious cybercitizenship"; a phenomenon that Anderson and Agarwal (2010) attribute to the level of closeness (psychological ownership) which affects their security behavior.

Similar results are reported by Lee and Chen (2011) who study the influence of PO within the context of virtual worlds. Activities such as developing sharable artifacts, "attending" social gathering/meetings, casting votes, and decorating avatars, require frequenting a virtual world site. Lee and Chen (2011) found that establishing PO towards a certain virtual world site led to more participation with these activities (see Figure 3). They therefore concluded that there is a positive relationship between PO and future visit / use intention of a virtual world. In this study, cognitive appraisal, perceived control and affective appraisal were considered significant precedents of psychological ownership.



Source: Lee and Chen, 2011

Figure 11.3 Psychological Ownership

It is also worthwhile to distinguish psychological ownership from some closely related concepts such as extended self as advanced by Belk (1988) and legal ownership. Extended self is anchored on the primacy of an atomized individual self who radiates out through tangible possessions and other people who one feels connected to. While psychological ownership lays primacy on the connection between a person and a target, extended self focuses on the self whose identity is transmitted through the target and the connection is secondary.

There is a distinct differentiation between legal ownership and psychological ownership. Legal ownership is mainly recognized by the society and is part of a legal system whereby the latter one is primarily perceived by individuals. Therefore, psychological ownership relates to individuals and exist without the existence of a legal system (Pierce et al., 2003, Furby, 1980). Furthermore, Pierce et al. (2001) indicate that these might be related but are distinctly different.

11.3 Methodology

Method selection. The objective of this paper is to further understand the concept of psychological ownership of information technology by revealing new antecedents and identifying overlaps with existing theories. Strong arguments have been made that grounded-theory approach is suitable (Glaser and Strauss, 1967, Corbin and Strauss, 1990, Urquhart et al., 2010) for explorative research. Studies abound in IS that propound an explorative approach (see for instance Orlikowski, 1993, Gregory et al., 2015) Adopting a grounded theory approach is most promising for at least two major reasons: first, it fits well with the overall explorative objective of our research and second, to ground our research specifically in the IS context (Birks et al., 2013). This is also in line with Urquhart et al. (2010) who stated that "grounded theory has proven to be extremely useful in developing context-based, process-oriented ... explanations" (p. 358).

Data collection. We conducted 20 interviews for the conceptualization of POIT. We collected the data in two phases. In the first stage, we had a convenient sample of interviewees (Patton, 2005) including eight interviews. In this first step, we developed an initial conceptualization of POIT. We used an open-ended questionnaire including questions about what role technology plays and when they would consider technology as 'theirs'. In response, we obtained further directions to explore POIT. Built on these initial insights we developed a more comprehensive interview guide in a semi-structured way. For example, we include a question asking to what extend these people appreciate technology beyond a functional tool. In order to capture business-related aspects, we exclusively interviewed industry experts with at least 5 years work experience. To further include data from all hierarchies we asked both manager and employees. For the purpose of this study, we considered employees who are provided with technology by their organization (i.e. the organization is the legal owner of the technology). Following snowball sampling (Patton, 2005) we asked the interviewees at the end of the official interview to refer their colleagues who are provided with technology by the organization. In our sample we included interviewees from manufacturing industry and service industry (including high-tech, government and health service). An overview of the interviewees is given in Table 3.2.

Industry	**Position**	**Number of Interviewees**	**Average age**
Manufacturing	Manager	7	51.2
	Employee	6	40.5
Service	Manager	3	42.6
	Employee	4	27.5
Overall		20	42

Table 11.2 Overview of Interviewees

The forms and types of information technology provided to employees varied significantly. Some employees were provided with a smartphone / tablet or a computer (laptop), others with both. The following table (Table 3.3) summarize interviewees by type of information technology they received from their employers.

Information Technology	**Industry**	**Interview (Employee)**	**Interview (Manager)**
Smartphone/Tablet and Computer (Laptop)	Manufacturing	3,11,18,19	2,7,10,12,20
	Service	1,8,9	4,16
Smartphone/Tablet or Computer (Laptop)	Manufacturing	13,15	14,17
	Service	6	5

Table 11.3 Overview of Provided Technologies

Data analysis. In line with our grounded theory-approach, we analyzed the data following general principles of grounded theory. Two researchers started the analysis simultaneously with open coding (Corbin and Strauss, 1990, Glaser and Strauss, 1967) identifying concepts. Similar codes in terms of their meaning were grouped into categories (axial coding). In the second step, we interpreted the identified categories through a process known as selective coding. At this point, we continuously interplayed between the phase of open coding and selective coding (Urquhart et al., 2010). We stopped our process of analysis when all researchers agreed that we achieved a point of saturation and there is only little chance that new essential concepts emerge. Since our data only highlights key aspects of POIT and their importance, we further enrich our findings with insights from literature. To ensure a theoretical integration of our findings we relate our results with existing literature. The integration is shown in the discussion part (section 11.6).

11.4 Findings

Based on the insights we gained through the interviews, we outline the emerged concepts. More specifically, we first describe the concept and how it can be defined. We then underline this concept by offering representative vignettes from our data. Finally, we integrate our findings with existing theories on psychological ownership in the discussion section.

11.4.1 Psychological Ownership of IT

The feeling of psychological ownership, i.e. the feeling of "this is mine!" (Pierce et al., 2003) can also exist for technology since three motives of PO can be satisfied through technology (Barki et al., 2008). One employee literally adopt this attitude:

> *"Well, I do feel, that this is my notebook. If someone would drop it, I would say: 'Hey! That's my notebook" [Interview 15]*

The most important characteristic of POIT is the "possessive feeling" (Pierce et al., 2003). Beyond this feeling, our data also reveal that the feeling of ownership can also be characterized in terms of appreciation towards technology. The general nature of appreciation towards technology is illustrated in the following:

> *"Well, I think that's a basic human behavior. You appreciate everything you own more than what the company provides you for work." [Interview 11]*

That people also appreciate technology is illustrated in the next extract:

> *"I appreciate [my technology] very much, especially the value it comes with. Within a defined scope I was allowed to choose my notebook on my own. I paid attention to certain*

> *things such as battery runtime and others. That was crucial for me that I get exactly what I want. That's my laptop and I appreciate and value it." [Interview 15]*

The appreciation of technology comes with the feeling of ownership and can be used to further describe PO and POIT. This emergence of appreciation can be understand as a concrete characteristic based on the endowment effect (Beggan, 1992, Beggan and Brown, 1994).

11.4.2 Antecedents of Psychological Ownership of IT

Freedom of Choice is the ability that employees are able to choose their own technology. This might be enabled by the organization by offering a variety of devices and software from which employees are able to choose or by allowing them to use their own IT (i.e. Bring-Your-Own-Device Strategy). Our data suggest that freedom of choice is an important antecedent of POIT. One employee explains:

> *"I see a phone as mine if I can choose it myself. For example, if I wanted an IPhone 6, however, the company wouldn't want to give me that IPhone but instead got me another phone, I would not see it as mine." [Interview 9]*

Although the freedom of choice is a central aspect, the interviewee also explains that:

> *"On the other hand, if I bought a phone that I liked and I plugged my company's sim card in it, then, of course, I would call it mine."[Interview 9]*

We reviewed the literature to find additional insights towards the affection of freedom of choice. In fact, Murray and Häubl (2011) analyzed the freedom of choice in the interaction with the website. Although they do not include PO in their study, it shows a positive relationship towards the users' perception of efficiency.

Multi context use arises when technology is used within different context such as private and business. Multi contextual use comes with the Dual Use of Technology which is defined as „the use of a single IT device or application for both private and work activities" (Köffer et al., 2015a p. 4). Either people use private technology to fulfill business tasks (e.g. sending emails with private device) or using business technology for private purposes (e.g. using company notebook for private purpose), we refer to dual use of technology. As suggested by our data this dual use has an influence on the perception of ownership. One interviewee state that:

> *"[The sense of ownership] is paradoxical, not true for my laptop, because this device is not portable enough. Further, I use my laptop primarily for business purposes. This is different with my cell phone, which I have with me every day. It accompanies me always. Another reason is that I am responsible for our Facebook editing. If there are questions when I am on the way, I have my device [cell phone] ready on hand, whereby the laptop is either at*

> *home or at work. [...] I use Facebook for both private and for business and there is a blurring between both." [Interview 1]*

Although existing literature already provides insights with regard to dual use of technology (e.g. Köffer et al., 2015a), we did not find a study relating POIT with multi context use.

Surveillance is the degree toward which employees' use of technology is tracked by the organization (e.g. D'Arcy et al., 2009, Stanko and Beckman, 2015). Common examples include the record of itemized bills or the record of the internet access. The amount of control influences the behavior of the employees and the perception of ownership. One employee explained:

> *"[...] For me it is still a company device. Of course, I set the device up myself, but you never know what the employer installed on the device before in the background. I am very careful with bank account information." [Interview 9]*

"It might be the case that I have to leave the company from one day to the next or I have to return my cell phone and there is private data on the phone, which is not the company's concern. That's why I do not install private things on my cell phone." [Interview 2]

The degree of monitoring does not only influence the feeling of ownership itself but also has a more direct effect on the use:

> *"I would say that I handle it completely differently, maybe more freely. For a phone provided by a company, I get the feeling that I have to comply with the company's standards, and every time my usage is recorded. Given that, I cannot use my company device as freely as my private device." [Interview 8]*

The amount of control by the organization also influences the dual use of technology as one employee explained:

> *"I like to divide work and private matters and I would never rely on a company phone, because I always have the feeling that the information transferred through my company device runs through the company's networking system." [Interview 6]*

Control[2] can be described as the freedom to adapt and adjust technology to his personal preferences. With regard to technology control is mostly perceived if new software can be installed (e.g. new apps on a cell phone) without a formal process with the IT department. The amount of control has a link towards ownership as one employee states:

> *"I can install every app [on my cell phone] in contrast to my laptop. [...] I have even more control than my organization has [...] If I did not have the freedom [to install apps] and*

[2] Consistent with prior literature (Lee and Chen 2011), we do not distinguish between perceived control and actual control, we use both terms interchangeably in this study.

> *I had to ask an administrator then [the sense of ownership] would not be there. I am much more free to install, uninstall [on my cell phone] than I am on my notebook." [Interview 1]*

In contrast, where this control is missing, it influences the feeling of ownership. One employee states:

> *"That means in terms of applications for example, I want to download them or conduct modification at the hardware and software, as I imagine and as I would do with my private technology. And there are good reason why I cannot do this with company owned technology." [Interview 20]*

Self-investment is the amount of time people spend with technology. Pierce et al. (2001) define self-investment as the "investment of an individual's energy, time, effort, and attention into objects" (p. 302). We adapt this definition whereby the object of interest is any kind of Information Technology such as cell phones or software. One employee describes his investment as follows:

> *"Yes, I use a smartphone on a day to day basis. In other words, I look at my cell phone often, even if I am not at my work place. I check my emails or my appointments, because all that information is available on my cell phone. Especially because I am traveling a lot and I do not stay at one work place, I consider the smartphone as my [preferable] device. In fact, I have two work places and the other electric devices stay at these places, thus, I would not consider them as mine." [Interview 7]*

11.4.3 Effects of psychological ownership of IT

Exception Handling denominates the employees capability to handle malfunctions or misbehavior of technology (e.g. Perrow, 1967, Strong, 1997, Klein and Dellarocas, 1999). This might either occur based on technical or functional issues. As our data suggest the feeling of ownership has an effect on how people behave with their technology in terms of exception handling. Meaning, they invest more time and energy to find solutions. One employee describes the general perception as follows:

> *"If you choose the technology yourself, then the complications that sometimes occur are taken with more calmness. On the other hand, if I get a machine [from my employer] and I do not like its operating system and it is also erroneous, then the factor of angriness will be very big." [Interview 4]*

The perception of ownership not only influences the emotional state such as angriness but also enables proactive behavior such as trying to fix an issue. One employee explains his behavior:

> *"I would not tolerate as many mistakes with my private phone than with the phone provided by my company. At least I would deal with fixing the problems differently. For my private phone I would do everything to get it repaired; whereas repairing the company*

> *phone is not much of my concern, I would most likely give it to a helpdesk and tell them to take over the problem of fixing the phone." [Interview 8]*

Use is the actual use of technology. As the central construct in technology acceptance literature, use and intention to use has gained a lot of attention in the past two decades (e.g. Davis, 1989, Venkatesh et al., 2003). The degree of POIT does influence the actual use of technology. The feeling that someone owns technology psychologically stimulates the use of technology, which the following excerpts illustrate:

> *"Well, if I have the feeling that this is my device, I also have the feeling that I can use it. I would say that I use my smartphone much more intensively, also in my daily life, in contrast to my notebook." [Interview 1]*

> *"You have a different expectation and identification to the device which you chose yourself, which you consider your own. There is a higher motivation to cope with the device in contrast to a device which is not yours or you did not consider it yours, because you have a longer inner distance to it." [Interview 12]*

11.5 Theory Development

Markus and Robey (1988) poignantly highlight the prominence of theory in research by stating that, "Good theory guides research, which, when applied, increases the likelihood that information technology will be employed with desirable consequences for users, organizations, and other interested parties." (p. 583). Accordingly, this section expounds on how the current study advances IS theory by integrating our contribution with existing literature.

Theory serves different purposes in information systems research; it can be used to describe, explain, predict, or design actions (Gregor, 2006). Psychological ownership theory is used to explain and predict behavior related to human interactions with technology and therefore our development of an extended view of the psychological ownership include new constructs that advance theory in IS. With this extended view, more constructs are availed for theory testing. Theory development should explicate three components; "the what", "the how" and "the why" (Whetten, 1989), and theory testing focus on temporal and contextual factors which set the limits of generalizing the theory. "The what" component refers to the focal factors – variables, constructs or concepts – which logically provide an explanation of the phenomenon of interest. "The how" deals with the relationship between these focal factors and deals with causalities. And "the why" component addresses the rationale or underlying dynamics which explain the logic behind the theory/model.

We use a concept that is explained in extant literature - psychological ownership of IT construct - as a pivot, to extend how psychological ownership theory is applied in information systems research and enhance its power to describe, explain, and predict IS phenomena. We leverage the findings presented by Barki et al. (2008) because they adopted PO for IT and thus perfectly fits to our objective. Furthermore, we integrate the study by Lee and Chen (2011) because they also operationalize PO for information systems research.

Data was collected qualitatively because that is the appropriate strategy for exploration and theory development (Anderson and Miller, 2003, Morrison and Teixeira, 2004). After analysis and processes discussed in section 11.4, we identify existing, and some new POIT constructs; three new antecedents (freedom of choice, multi-context use and surveillance), and one new outcome (exception handling). This addition advances scientific knowledge (Straub et al., 1994) and provides new lenses through which information systems phenomena can be viewed. Karahanna et al. (2015) reports that the antecedents and outcomes presented by Pierce et al. (2001), (Pierce et al., 2003) and have been studied over time and found to be stable. We therefore heed to the call for new constructs that are closely related to the existing set but provides further explanation about psychological ownership.

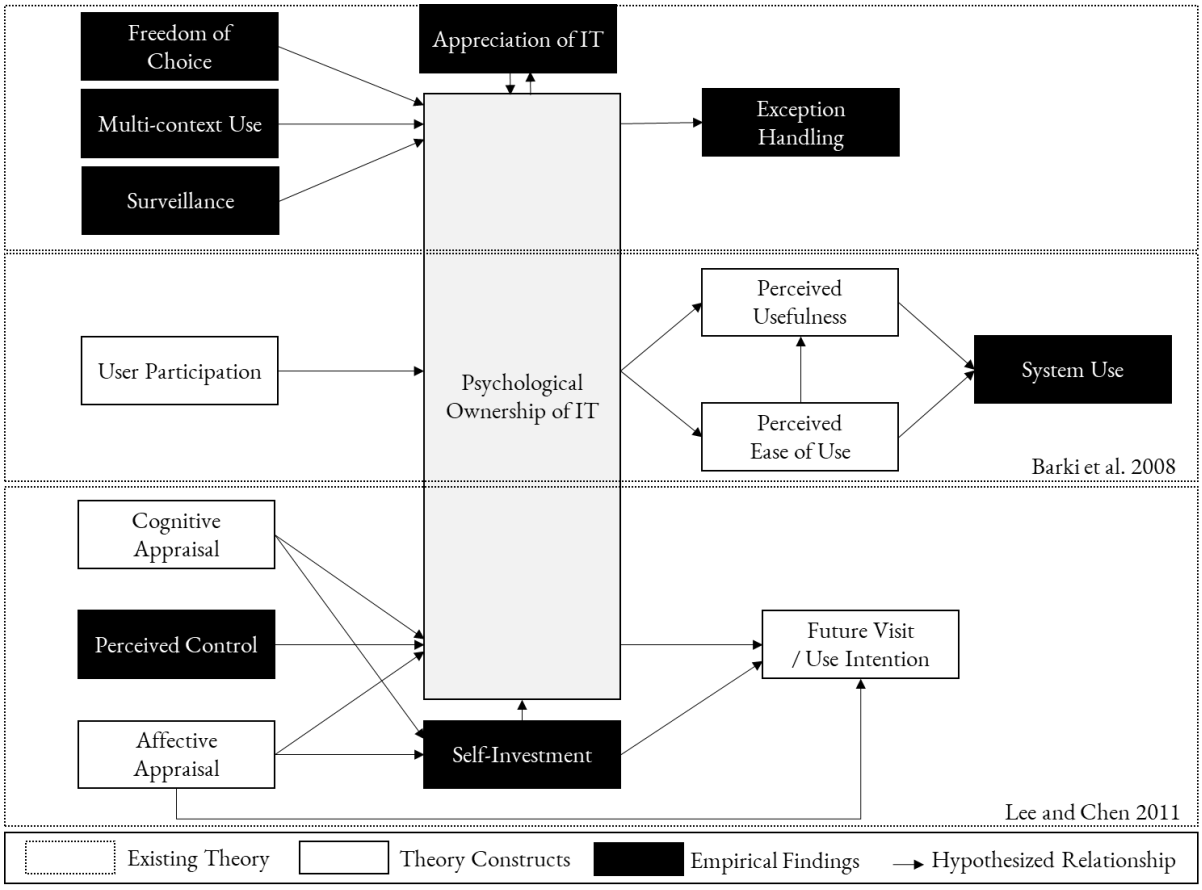


Figure 11.4 Extended View on Psychological Ownership

Figure 3.4 shows models in existing literature (Barki et al; 2008 and Lee & Chen; 2011) and the results of this study – separated by the dotted lines. POIT is at the center of these models, and the constructs that emerged from this study are marked with a dark background.

11.6 Discussion

In this paper, we aim to extend the conceptualization of psychological ownership of IT. By using a grounded theory methodology, we found three new antecedents of POIT and one new effect. Moreover, our data reflect several constructs that have been already used in existing theories. Based on our findings we derive implications for theory and practice and conclude with limitations and future research.

Implications for Theory. Our study expands the findings of Barki et al. (2008) who focused on POIT as a mediator of system use. Furthermore, we contribute to the conceptualization of POIT by adding the characteristic of appreciation of technology. Based on this study, appreciation of technology can be understand as a side benefit of psychological ownership. Therefore, the development of a possessive feeling towards ownership also evolves in terms of appreciation. However, it cannot be excluded that appreciation of technology is either an antecedent of ownership or an effect. It is also possible that there is a reciprocal effect between ownership and appreciation. Meaning that the increase of POIT has a positive effect on appreciation of technology, which vice versa influences POIT. Since we did not ask the interviewees for that kind of relationship, further investigation is necessary.

Our study revealed three new constructs (Freedom of Choice, Multi-context use and Surveillance). Pierce et al. (2003) argue that "build an object" is the most obvious appearance of "Investing the Self Into the Target". It is even suggested that buying an object is also a form of creating an object (Sarte, 1943). We argue that the freedom of choosing a device has a similar effect and can be interpreted as part of "Investing the Self Into the Target". Therefore, this construct is in line with the conceptualization by Pierce et al. (2003). With regard to the multi context use, we argue that this is in line with more intense use of the technology. As such we argue that it can be referred to "Coming to Intimately Know the Target" (Pierce et al., 2003). Finally, we revealed surveillance as an antecedent of POIT. Since it reduces the control of an object, meaning it is controlled by someone else, it can be interpreted as part of "Controlling the Ownership Target" (Pierce et al., 2003). In summary, all of the identified antecedents can be assigned to the key experiences of the ownership theory. With regard to exception handling, which we identified as an effect, it can be classified as "experiences responsibility and stewardship" (Pierce et al., 2003) because individuals take responsibility to fix issues or maintain hardware.

Since we applied psychological ownership within the context of IS, our study contributes to the original theory of ownership as proposed by Pierce et al. (2003). For each of the proposed experiences offered by ownership theory, this study provides examples for IS specific constructs. This has implications in both directions: it further strengthens the theory of ownership and it also strengthens the findings of this study. However, our study should be only be seen as a point of departure for future research to explore more constructs and apply them in various scenarios.

Moreover, this study extends the findings by (Barki et al., 2008) because it demonstrates existing knowledge, i.e. the relationship between POIT and system use and it further enriches existing knowledge by adding new constructs. The same applies to the study of Lee and Chen (2011) since two central antecedents of their theory (Perceived Control and Self-Investment) were highlighted.

Finally, this study opens the door for more research on psychological ownership of IT since it provides new constructs which needs to be further validated. Especially the role of 'Appreciation of IT' might be a strong characteristic to better understand IS phenomena. Particularly with regard to IT acceptance and adoption this might be an important aspect.

Implications for Practice. Ownership is gaining importance since BYOD is progressively utilized. Due to the fact that employees increasingly use technology for multiple purposes and in various contexts (Köffer et al., 2014) ownership has an effect on the individuals' behaviour. Based on our study organizations are able to influence the ownership of IT in various aspects: First, freedom of choice as an antecedent of POIT can mostly be influenced by the organizations IT department. A suitable approach to expand the freedom of choice is the implementation of a Choose-Your-Own-Device (CYOD) strategy.

Second, as multi context use is relevant for the emergence of psychological ownership as organizations allow the dual use of technology. As a matter of fact, implementing a CYOD strategy in conjunction with a set of rules for dual use, the multi context use can be encouraged. However, this also raise concern with regard to work-life-balance which should not be ignored (Cousins and Robey, 2015, Köffer et al., 2014).

Third, surveillance has also a major influence on how employee perceive ownership. Surveillance is primarily in the sphere of responsibility of the organization, because they can control the degree of surveillance. At this point, we note that surveillance only includes actions of control by the organization and not with regard to individuals' perceived surveillance. Based on our findings, it can be assumed that surveillance has a strong effect on POIT (c.f. Interview 8, p. 9). Therefore, organizations should consider to reduce their surveillance activities. Based on the data we gathered, it seems that the organizations' surveillance activities are not comprehensible communicated

to the employees. Therefore, organizations could take a first step and reveal their surveillance activities.

Limitations and Outlook. We acknowledge that there are naturally limitations of this qualitative research such as a limited number of interviewees. Unlike quantitative research, qualitative research will have a low number of respondents and may present generalizability challenges. However, our findings lay a foundation for further quantitative analysis.

The perspective taken in this study is that individuals are provided with technology by the organization. Although this is a common practice today, other concepts like BYOD are gaining attention in both practice and research. In this regard, we could not further analyze the differences of the effects with regard to private owned technology and psychological owned technology. However, the analysis of different effects of these competing approaches opens the door for future research. Furthermore, we did not separate between the ownership of hardware and software. For example, an individual can evolve a feeling of ownership to a smartphone (hardware), whereby under the same conditions no feelings emerge in terms of a software. Finally, in terms of the exploration of the POIT construct, we focused on positive outcomes (i.e. positive effects). However, as Pierce et al. (2003) note there are also negative effects related to psychological ownership such as a rejection of sharing objects. This might be also critical for technology and should be addressed in future research.

Besides addressing the aforementioned limitations other fruitful approaches for future research include a further evaluation of the identified constructs within a quantitative study to validate the new constructs.

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12 IT Mind Wandering

Title	**Where Are Your Thoughts? On the Relationship between Technology Use and Mind Wandering**
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Table 12.1 Fact Sheet Publication

Where Are Your Thoughts? On the Relationship between Technology Use and Mind Wandering

Abstract. Mind wandering is an important brain activity that fosters creativity and productivity. Research suggests that individuals spend up to 50% of their waking time thinking about things that are unrelat-ed to the present situation or task. Previous litera-ture has acknowledged the importance of mind wandering in technology-related contexts by investigat-ing its mediating role between task and individual performance. In this study, we go one step further and investigate the direct relationship between technology use and mind wandering. In particular, we investigate if different types of technology use (hedonic use vs. utilitarian use) have an impact on mind wandering. Results from a factorial survey study (n=90) suggest that there is a significant dif-ference between hedonic use and utilitarian use when it comes to mind wandering. Based on these insights, we discuss the role of mind wandering for IS research and potentials for future research.

12.1 Introduction

Every day, our thoughts trail off up to 50% of our waking time (Smallwood et al. 2015). This mind wandering occurs in various situations such as driving a car, doing work-related tasks, or reading a book. Smallwood and Schooler's (Smallwood et al. 2015) compelling review shows, that despite the high price of losing touch with the environment, there are distinct benefits letting your mind wander. For example, research shows that mind wandering enhances creativity (Baird et al. 2012) or contributes to better productivity and problem solving skills (Smallwood et al. 2015; Sullivan et al. 2015). Therefore, the concept of mind wandering is important for many fields of research and for practice

Similarly, it is most likely that our mind wanders when using technology. Since technology is increasingly becoming a part of our daily lives, this aspect becomes more relevant. Today, technology is used for both hedonic purposes (e.g., gaming or social media) and utilitarian purposes (e.g., E-mails or scheduling). In fact, current studies suggest that our use behavior is intense. In total, an average person uses her mobile phone for various purposes for about 150 minutes per day (cited in Soror et al. 2015). Hence, mind wandering is increasingly relevant when it comes to technology use.

Information Systems (IS) research has recently acknowledged the relevance of mind wandering and has started to investigate technology-related mind wandering (e.g., (Sullivan et al. 2015; Wati et al. 2014)). However, it has been primarily used as a moderating effect. With the increasing use of technology in various domains (e.g., private or organizational domain) and based on various systems (e.g., hedonic or utilitarian), there is reason to believe that technology use also has a direct effect on mind wandering. Hedonic usage is pleasure-oriented and provides self-fulfilling value to the user (van der Heijden 2004). On the contrary, utilitarian usage is productivity-oriented and provides instrumental value (ibid.). Since hedonic usage is closely connected to leisure activities and fun, a user is not tied to instrumental goals. Hence, we expect hedonic usage to lead to a higher level of mind wandering. This is also in line with previous literature demonstrating that different forms of technology use lead to different outcomes (e.g., (Wu and Lu 2013)). Consequently, we argue that it is of crucial importance to further investigate a direct relationship between technology use and mind wandering. Through an experimental design with 90 participants, we provide evidence that the use of a specific type of system (hedonic / utilitarian (van der Heijden 2004)) has an impact on the degree of mind wandering.

Our contributions are likewise theoretical and practical. From a theoretical perspective, we contribute to existing literature on technology use by clarifying the relationship between different types of technology and mind wandering. We approach this topic in an exploratory manner and draw a link between psychological, neuroscientific and IS research. For practitioners, we provide further insights on the role of mind wandering in terms of technology use which in turn can be used to enhance productivity and creativity for knowledge workers. Moreover, our work can be of guidance when it comes to technology design that seeks to enhance creativity and problem-solving. In addition, we encourage future research to minimize disruption (Galluch et al. 2015) and to focus on potential negative consequences regarding technology use.

To address our objective, this paper is organized as follows: First, we investigate the literature on mind wandering in psychology, neuroscience, and IS research. Next, we propose our research model that hypothesizes that there are differences in the relationship between use and mind wandering. Then, we describe our research methodology and present the results. We conclude with a discussion of the results and suggest potential areas for future research.

12.2 Theoretical Background

Studying daydreaming has ignited research on the exploration of the mind's capacity to wander (Antrobus et al. 1964, 1967, 1970; Giambra 1989, 1993, 1995; Klinger 1966, 1973), yielding in a new research area on mind wandering (Choi et al. 2017; Gilbert et al. 2007; Gruberger et al. 2011; Kane and McVay 2012; Schooler et al. 2011; Smallwood 2013; Smallwood and Schooler 2006).

This increasing interest was accompanied by new measurement techniques. For instance, functional magnetic resonance imaging (fMRI) visualizes how the default mode network (DMN) engages during mind wandering (Andrews-Hanna et al. 2014; McKiernan et al. 2003, 2006; Raichle and Snyder 2007). Consequently, various neuroscientific studies have emerged (Christoff et al. 2016; Fox et al. 2015; Hawkins et al. 2015). As a consequence, psychologists nowadays agree that unconstrained mental processes are the norm rather than the exception: Between one third and half of our daily mental activity is unrelated to our external environment and off-task (Smallwood et al. 2015). Mind wandering is commonly defined as "a shift of executive control away from a primary task to the processing of personal goals" (Smallwood and Schooler 2006, p. 946) and as the mind's capacity to move away aimlessly from external happenings and tasks (Giambra 1989).

The current state of research illustrates that mind wandering mostly occurs during the resting state, in non-demanding circumstances and during task-free activity (Buckner and Vincent 2007; Smith et al. 2009). Attention drifts from a current task to mental content (Posner and Petersen 1990; Schooler 2002; Schooler et al. 2011) and shifts from an external thought generated by the environment to an internal, task-unrelated idea (Giambra 1995). Such a state of decoupled attention is characterized by thinking exclusively about internal notions and feelings and by the temporal inability to process external information (Smallwood, Fishman, et al. 2007).

Mind wandering is often perceived as cumbersome and prejudicial (Smallwood, Fishman, et al. 2007; Smeekens and Kane 2016). First, it is enhanced by stress as well as alcohol and substance abuse (Epel et al. 2013; Sayette et al. 2012; Smallwood, O'Connor, et al. 2007). Second, it stands for a lack of awareness and consequently a cause of poor performance, errors, disruption, disengagement, carelessness and unhappiness (Baldwin et al. 2017; Drescher et al. 2018; Zhang and Kumada 2017). For example, research shows that it becomes apparent in situations where it is not necessarily desirable, for example, when driving a car (Baldwin et al. 2017; Zhang and Kumada 2017). Nevertheless, mind wandering also correlates with creativity and a positive mood (Baird et al. 2012; Franklin et al. 2013; Mooneyham and Schooler 2013; Wati et al. 2014). It helps give significance to personal experiences and facilitate future planning (Mooneyham and Schooler 2013; Smallwood et al. 2015). Furthermore, it can provide mental breaks and helps relieve boredom. In summary, literature shows that mind wandering seems to offer both risks and opportunities.

In IS research, the topic of mind wandering has mainly been neglected notwithstanding its increasing relevance in a time where we are always connected and online without switching to effortless thinking. Always being alert was found to increase psychological distress (Beranuy et al. 2009), anxiety and insomnia (Jenaro et al. 2007), work overload and reduced organizational commitment (Ofir Turel et al. 2011; O. Turel et al. 2011; Turel and Serenko 2010, 2012). Although

IS research offers established knowledge on task performance (e.g., (Delone and McLean 2003; van der Heijden 2004; Burton-Jones and Straub 2006; Petter et al. 2013)) and attentional shifts (e.g., (Speier et al. 2003)), it lacks exhaustive findings on the correlation between technology use and task unrelated thought (Sullivan et al. 2015). Thus, various authors publishing in high-ranking journals have called for a more fine grained view on both technology use behavior and mind activity in IS (Dernbecher and Beck 2017; Smallwood et al. 2015; Sullivan et al. 2015; Sun et al. 2016). Assessing the state of research shows that there has been both an increasing interest and an important gap to fill.

In IS research, Sullivan et al. suggest mind wandering to be both task-related and technology-related, defining technology-related mind wandering as "task-unrelated thought which occurs spontaneously and the content is related to the aspects of computer systems" (Sullivan et al. 2015, p. 4). Wati and her colleagues, who introduced the concept of mind wandering to our domain, devote their pertinent research to this area of research, as they demonstrate that user performance is influenced by an individual's focus ability and mind wandering (Wati et al. 2014). Having assessed different levels of task complexity, the authors call for taking into account the characteristics of technology use in greater detail in the future. At a later stage, the authors focus on the content of thought during mind wandering technology-related and non-technology-related settings (Sullivan et al. 2015). They provide further empirical evidence that mind wandering moderates the relationship between on-task thought with creativity and knowledge retention. Their research repeatedly demonstrates that mind wandering has a significant impact on crucial aspects such as task performance.

Although previous research acknowledged the role of the mind and its impact on outcome variables such as performance, there is little research available that investigates the role of IT mind wandering. Against this background, we seek to shed further light on this research area in order to understand the relationship between technology use and IT mind wandering.

12.3 Research Model

External variables such as technology characteristics or use behavior have a significant impact on outcome variables such as mind-related concepts (e.g., (Burton-Jones and Hubona 2006)). Therefore, a relationship between technology-related aspects and mind wandering is most likely. Since current literature primarily investigated the indirect effects of mind wandering on its outcomes, we focus on the direct effects of use behavior on the mind wandering experience itself. In doing so, we aim to a better understand mind wandering in the context of IS.

There are two important types of systems (e.g., (Lowry et al. 2013)). Literature on technology acceptance (Davis 1989; Venkatesh et al. 2016) widely focuses on utilitarian use to shed light on individual factors that influence technology use and adoption. With the rise of mobile technologies, hedonic factors have become increasingly important. This is most notable with regard to social media and mobile games. To that end, previous literature suggests that hedonic use differs from utilitarian use. For instance, Lowry et al. (2013) indicate that cognitive absorption is more important when it comes to hedonic use. In the context of the problem at hand, we argue that the use of a hedonic system is expected to be a strong determinant of mind wandering, because it is closely related to activities we do in our leisure time. Here, people are primarily interested to enjoy using a system instead of following instrumental goals. Moreover, hedonic usage can be considered as an almost non-demanding and effortless activity, and consequently invite the user to let her mind wander. Thus, we assume that the type of system (hedonic / utilitarian) and its corresponding use affects the degree of mind wandering. Against this background, we propose the following hypothesis (H).

H: *The use of hedonic systems leads to a higher degree of mind wandering compared to the use of utilitarian systems.*

12.4 Methodology

Method Selection. To explore variances in terms of mind wandering, we used an experimental design with a strong internal consistency. In particular, we applied a factorial survey methodology (Rossi and Nock 1982) that has been successfully applied in similar research endeavors (e.g., (Vance et al. 2015)).

Experimental Procedure. The scenario-based experiment covered four phases: First, participants were informed about the general setting and the goal of the study. Second, the circumstances and initial situation were presented by a short description underlined with an appealing image. Third, the participants were randomly assigned to one of four scenarios and watched a video (about 30 seconds long). Each scenario had been recorded on a mobile phone and followed the same procedure. To ensure a high level of involvement, we invited the participants to refer to the following situation based on what kind of technology they use on a daily basis (e.g., smartphone, tablet, or laptop). The participants were asked to fill out a questionnaire at the end.

Context. We introduced the participants to a workplace situation around 10 o'clock in the morning where employees usually enjoy a coffee break. Since a previous task took longer than expected, the participant started her/his break a little later and started paying attention to her/his mobile phone.

Experimental scenarios. After the contextual introduction, each participant watched one of the following videos, which are described briefly in the following (more details for each scenario, including screenshots of the movie, are attached in the appendix):

Scenario 1 ("Gaming"): a common type of hedonic use of technology is playing (mobile-) games (e.g., (Lin et al. 2012)). To mimic this type of use, we showed the game "Froggy Jump" by Invictus Games Limited. It is a popular mobile game where the goal to navigate a jumping frog through obstacles to gain points.

Scenario 2 ("Facebook"): another important type of hedonic use relates to social media use. To imitate this type, we selected Facebook and showed a video where the participant navigates quickly through commercials, comments, and postings.

Scenario 3 ("Booking"): to represent utilitarian use of technology, we provided a video that shows a booking process for a railway ticket. Here, the participant saw subsequent steps of booking a ticket, starting with entering the point of departure and destination and ending with paying and skipping the tickets.

Scenario 4 ("E-mail"): finally, to represent a second example of utilitarian use, we showed a video of writing an E-mail to a professor to register for a workshop. In this scenario, the participant saw a complete composition of a short E-mail that was sent to the professor at the end.

Participants. We collected data from 105 participants. We included complete data and excluded observations with less than 3-minutes participation time resulting in 90 observations in total. The participants average age was 29.72 (SD = 12.10), 48 were male (53.3%), 42 female (46.7%), and have an average tenure of 8.37 years (SD = 10.26).

Measurement. Mind wandering is an internal mental experience and can be measured based on self-reports (Smallwood et al. 2015). In the literature, mind wandering is often measured by means of a single item, which prevents a further analysis of psychometric attributes. Since there are several multi-measures available (Mrazek et al. 2013; Wati et al. 2014; Sullivan et al. 2015; Seli et al. 2016) we selected four items (c.f. Table 12.2). To ensure content validity, we translated each item from English to the participants' first language and back. We investigated the internal consistency (based on Cronbach's alpha), which suggests a good reliability (α = .81). We conclude that the measurement instrument is well suited for the subsequent analysis.

	In this situation...
WAND1	my mind wandered.
WAND2	I thought about something, which was not related to the situation.
WAND3	I was daydreaming.
WAND4	I did not concentrate on the situation.

Table 12.2 Measurement Items

Convergent and discriminant validity. In order to assess the convergent and discriminant validity, we investigated the correlations matrix between the mind wandering items and the control variables (age, gender, job, tenure). As shown in Table 12.3, there are significant correlations between all items that measure mind wandering and non-significant correlation between the control variables and mind wandering. Therefore, we assume a sufficient degree of convergent and discriminant validity. Note, that there are significant correlations between age and tenure as well as job and tenure, which is, however, common for this set of demographic variables. We also investigated the Variance Inflation Factor (VIF). Since all values are below the threshold of 10 (1.1 < VIF < 5.7) (Hair et al. 2014), we conclude that multicollinearity is not a major issue here.

Manipulation Checks. We measured perceived usefulness as suggested by Agarwal and Karahanna (2000) to check if our intended manipulation (i.e., hedonic use versus utilitarian use) was successful. Sum scores were computed to carry out an analysis of variance (ANOVA) between all groups. The results indicate that there is a significant variation in terms of perceived usefulness $F(3, 82) = 7.337$, $p < .000$. A post hoc analysis (Tukey's HSD) shows that all manipulations worked as intended.

	1	2	3	4	5	6	7
1	-						
2	-0.04	-					
3	-0.18	0.14	-				
4	**0.90**	-0.16	-0.26*	-			
5	-0.13	0.05	-0.17	-0.17	-		
6	0.01	0.05	-0.19	-0.02	**0.72**	-	
7	-0.14	0.08	-0.09	-0.16	**0.83**	**0.59**	-
8	0.17	0.10	-0.11	0.12	0.29**	**0.40**	0.32**

1. Age, 2. Gender, 3. Job, 4. Tenure,
5. WAND1, 6. WAND2, 7. WAND3, 8. WAND4
Note: **p < .001**, ** p < .01; * p < .05

Table 12.2 Correlation Matrix

Scenario 1 ("Gaming") differs significantly from scenario 3 ("Booking") and scenario ("E-Mail"). Scenario 2 ("Facebook") differs significantly from scenario 3 ("Booking") and scenario 4 ("E-Mail"). Therefore, we conclude that all scenarios reflect utilitarian and hedonic use as intended. An overview is given in Table 12.3.

				Tukey's HSD Comparisons		
Scenario	*n*	M	*SD*	(1)	(2)	(3)
(1) Gaming	22	2.39	1.41			
(2) Facebook	25	2.73	1.53	.852		
(3) Booking	27	3.78	1.35	.007	.055	
(4) E-Mail	16	4.27	1.61	.001	.008	.716

Table 12.3 Post Hoc Analysis Perceived Usefulness

5. Results

We carried out an analysis of covariance (ANCOVA) to identify group differences and possible covariates at the same time. For that purpose, sum scores were used for mind wandering. The results are summarized in Table 12.4. The results indicate a significant variation among the scenarios, $F(3, 82) = 5.769$, $p = 0.001$. Moreover, this shows that, apart from "job", there is no significant influencing factor.

Variable	*df*	F	*P*
Scenario	3	5.769	.001**
Age	1	0.934	.336
Gender	1	0.615	.434
Job	1	5.012	.028*
Tenure	1	1.112	.295

Note: **p < .01; *p < .05

Table 12.4 ANCOVA Results

Since the overall test is significant, we investigated the descriptive statistics and carried out a post hoc analysis using Tukey's HSD. The post hoc analysis indicates that group 1 ("Gaming") differs significantly ($p < .05$) from group 4 ("E-mail"). Moreover, we found a significant difference ($p < .05$) between group 2 ("Facebook") and group 3 ("Booking") and a significant difference ($p < .01$) between group 2 ("Facebook") and group 4 ("E-Mail"). All other groups, are somewhere in the middle. An overview of the post hoc analysis is presented in Table 12.5 and in Figure 12.1.

				Tukey's HSD Comparisons		
Group	*n*	M	*SD*	(1)	(2)	(3)
(1) Gaming	22	4.06	1.37			
(2) Facebook	25	4.45	1.52	.806		
(3) Booking	27	3.19	1.69	.194	.017	
(4) E-Mail	16	2.73	1.28	.042	.003	.765

Table 12.5 Post Hoc Analysis Mind Wandering

12.5 Discussion

This study seeks to shed further light on the relationship between technology use and mind wandering. Therefore, it expands on previous efforts that have investigated the intermediate role of mind wandering and put emphasis on wandering in terms of hedonic and utilitarian use of technology.

Discussion of results. In most cases, the results confirm our proposed hypothesis. In fact, three out of four group-wise comparisons are significant. In terms of the considered scenarios, the results indicate that writing an E-Mail shows the lowest level of mind wandering (M = 2.73, SD = 1.28). In contrast to the booking scenario (M = 3.19, SD = 1.69), this difference is significant. It seems that the autonomy that is related to a task may have a pertinent role. This insight is related to previous findings that indicate that the complexity of a task significantly impacts mind wandering. Assuming that writing an E-mail allows a high degree of freedom compared to a structured booking process, it is also more complex to fulfill this task.

Both hedonic scenarios do not differ significantly. Still, we observe a difference in a direct comparison with scenario 3 ("Booking") because only Facebook use differs significantly. We conclude that other factors such as the degree of cognitive absorption may also play a major role when it comes to mind wandering. Specifically, the results may indicate that playing a game requires the same degree of engagement or cognitive focus as a booking process, which in turn might explain a non-significant relationship between those groups.

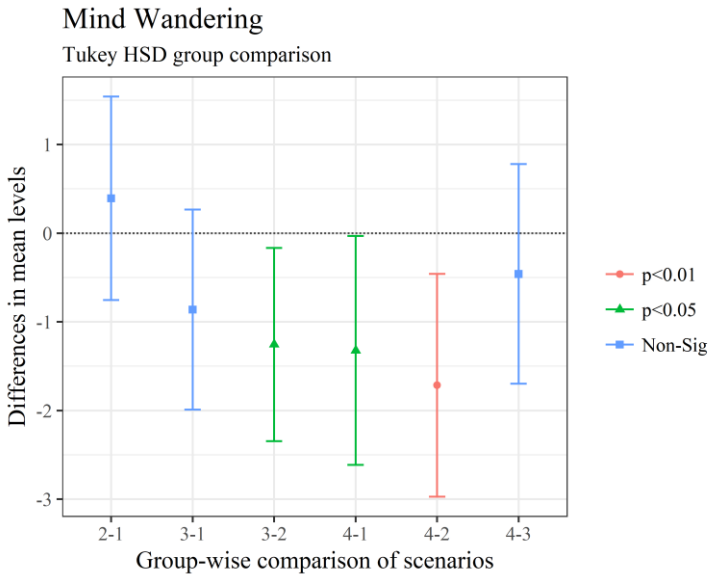

Figure 12.1 Group Differences

Implications for theory. Despite the fact that individuals spend up to 50% of their waking time letting their mind wander, IS research has only spent little effort acknowledging related effects. Therefore, future research can benefit from this exploratory study as a point of departure for further research on mind wandering. In specific, it provides initial evidence that the use of hedonic systems has a higher impact on mind wandering which in turns open the door for further research that can investigate what type of aspects are most relevant in this regard. Moreover,, with a rising interest in IT mindfulness (Dernbecher and Beck 2017; Sun et al. 2016; Thatcher et al. 2017), IS research can benefit from a more holistic perspective on mental activities. As neuro science suggests that the state of mind is likely to have an affect technology-related behavior, the field of NeuroIS opens the door for future research in various directions (Dimoka et al. 2011; Riedl et al. 2017).

This research suggests that technology-related variables such as technology use or a technological artifact have a significant impact on the state of mind and can thus be understood as an important stimulus of mind activity. Distinguishing between hedonic systems and utilitarian systems, our research also contributes to existing literature on technology use and user acceptance. The increasingly hedonic nature of information systems, where the majority of websites and applications aim at being user-friendly, implies the need to also assess a person's motivation not to use a hedonic system (van der Heijden 2004) or the danger of using hedonic systems in a dysfunctional manner (Soror et al. 2015). With the ubiquity of technology, many potential drawbacks including addiction, work overload, disrupted work-life-balance, technostress can occur (e.g., (Turel and Serenko 2010; Ayyagari et al. 2011; Yun et al. 2012; Soror et al. 2015)). Therefore, it remains important to

examine different facets of the nature of technology use and the implication for individual well-being and productivity.

For research on 'the dark side' of technology on the other hand, mind wandering might also be an important aspect to consider because it allows individuals to detach and 'dream away' from (possible stressful) situations. Even though this might only happen for a limited amount of time, it might support buffering negative events. Moreover, by following a balanced view on both the benefits of technology use and the implications of mind wandering, this paper can help understand how to maximize positive results while reducing negative consequences of both phenomena at the same time. Those insights offer guidance for academia, managers, organizations, and society.

In summary, we put forward good reasons to further investigate the role of mind wandering in relation to technology. Based on this argument, we also offer new insights into how a primarily psychological state is related to IS. Based on our experimental study, we present implications on how the mind drifts away from current situations and tasks and present a point to connect alternative scenarios or replications near the mark. Considering mind wandering research, we also find links to the dual system theory, which is at the core of Kahneman's canonical work on "thinking fast and slow" (Kahneman 2011). In particular, mind wandering can be related to System 1 (automated, effortless thinking) in contrast to System 2 (controlled and focused thinking).

Implications for design. Although this piece of research primarily seeks to understand the relationship between technology use and mind wandering, it is also beneficial to design-related research. Most importantly, it indicates that, apart from the characteristic of a specific task, the design and the corresponding use experience might also affect mind wandering. Specifically, we assume that specific designs or design elements invite individuals to let their thoughts drift off. Consequently, an IT artifact designed for utilitarian purposes (e.g., an Enterprise Resource Planning system) should consider this aspect in order to decrease mind wandering because it negatively impacts productivity (Wati et al. 2014; Sullivan et al. 2015). In contrast, artifacts that are designed to accelerate creativity should in turn stimulate mind wandering because it significantly increases creativity (Baird et al. 2012). We thus encourage future research to develop and test design theories in light of mind wandering.

Implications for practice. Our research has also implications for practice. It highlights the relationship between use behavior and mind wandering. Therefore, organizations that seek to enhance mind wandering (e.g., creative environments) might investigate where specific types of use behavior might be useful. In contrast, domains in which mind wandering interferes with productivity, hedonic-based use behavior could be reduced. Within the context of managing and using IT,

mind wandering has an impact on performance and is consequently important to consider when designing IT artifacts.

12.6 Limitations and Outlook

This study comes with some limitations that open the door for future research. First, since we investigate the relationship between use behavior and mind wandering, we do not distinguish between task-related wandering and technology-related wandering (Sullivan et al. 2015). Hence, future research could include this. Second, structural relationships, i.e., the impact of mind wandering on enjoyment or creativity, are not included here. Third, environmental factors including job characteristics may also play a crucial role when it comes to mind wandering. For example, individuals who are involved in very intense professions may have a more limited opportunity for mind wandering than others. In contrast, individuals who are involved in scheduled work may perceive a higher level of mind wandering. Finally, future research should triangulate the measurement of IT mind wandering using additional techniques such as eye tracking, or brain imaging. Therefore, research on Neuro IS (Dimoka et al. 2011; Riedl et al. 2017) could provide further insights into the role of mind wandering.

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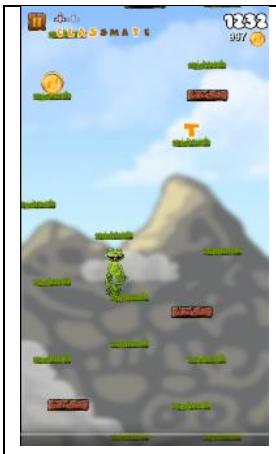
12.8 Appendix A

A1 Gaming (scenario 1)

To simulate the use of a game, we used the mobile game "Froggy Jump". The main objective is to navigate a frog and jump as high as possible. The higher you get the more points you score. Screenshots from the short movie is shown in Figure 12.2.

Facebook (scenario 2)

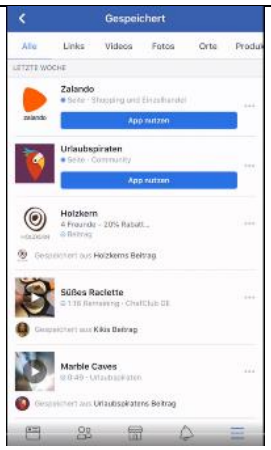
Facebook was used to simulate social network use because it is widely used and offers a great variety of additional resources that can be queried by the user. The main objective was to simulate a user who goes over several pages (e.g., shopping pages, holiday pages, etc.). Screenshots of three different point that represent the movie are illustrated in the following Figure (c.f. Figure 12.3).



after 9 sec

after 15 sec

Figure 12.2 Screenshot Gaming Scenario



after 3 sec

after 28 sec

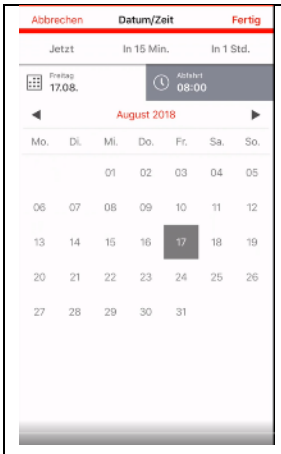
Figure 12.3 Screenshot Facebook Scenario

Booking (scenario 3)

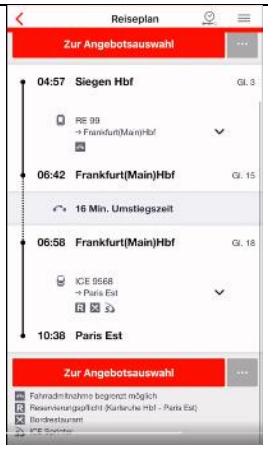
To mimic utilitarian use, we provided a booking process in a national railway company. The movie covered all important phases of a booking process: choosing a date, select an appropriate connection, and finally pay the ticket.

E-Mail (scenario 4)

A second utilitarian vignette was designed that shows composition and sending of an E-mail. To mimic a utilitarian context, a university professor was chosen as a recipient. An excerpt of the movie is shown in the following figure (c.f. Figure 12.5).



after 7 sec



after 18 sec

Figure 12.4 Screenshot Booking Scenario

after 3 sec

after 37 sec

Figure 12.5 Screenshot E-Mail Scenario

13 Individual Boundary Management

Title	**Individual Boundary Management: An Empirical Investigation on Technology-Related Tactics**
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Table 13.1 Fact Sheet Publication

Individual Boundary Management: An Empirical Investigation on Technology-Related Tactics

Abstract. Elevated through the increasing digitalization, employees are expected to be available always and everywhere. According to boundary theory, individuals can manage their boundaries between work and private life on a continuum of integration and separation. As individuals have different preferences for integration or separation, they are implementing IT tactics to meet their preferences. However, there is a lack of research addressing this topic. Therefore, we used an exploratory approach using tools from grounded theory in order to detect IT-related tactics which employees use to manage their boundaries between work and private life in a way that is in line with their preferences. We identified six tactics that varied in their ability to foster integration or separation and could be administered either manually or automatically. These tactics ranged from physical detachment in which employees separate work and private life manually through creating distance between the device and themselves up to dynamic filters with which the device automatically filters messages from different people and lets only relevant messages come through.

Keywords: Boundary Theory, Boundary Management, Individual IT Tactics

13.1 Introduction

Due to the technological evolution of mobile technologies including smartphones, tablets and wearables, job-related tasks can be performed nearly anywhere and anytime (Karanasios & Allen 2014; Reyt & Wiesenfeld 2015). According to a forecast from the International Data Corporation (IDC) in 2015, mobile worker population will grow steadily in the next years, increasing from ca. 96 million in 2015 to over 100 million mobile workers in 2020 – only in the U.S. By the end of the forecast period, mobile workers will account for almost three quarters of the total U.S. workforce (IDC 2015). Key drivers behind the growth of mobile workers includes reduced prices of smartphones and tablets combined with the growing acceptance of corporate bring your own device (BYOD) programs in organizations (IDC 2015). Additionally, technological innovations such as wearables, near-field communications (NFC), voice control and augmented reality are enabling workers to increase their productivity by optimizing communication along organizational workflows (IDC 2015).

Based on the technological advancement, there is a fundamental change with regard to workplace design, i.e. working times are getting more flexible and workplaces are getting location-independent. Therefore, organizations are facing new demands, norms and a cultural change. Concepts like BYOD ("Bring Your Own Device") and IT-Consumerization (Köffer, Ortbach, Junglas, Niehaves, & Harris 2015) are well-known examples and force organizations to rethink their policies and cultures with regard to the organizational use of technology.

Previous research on the use of mobile technologies has found both positive and negative effects on an individual's work and private life domain (Allen, Cho, & Meier 2014). Besides positive effects (e.g. increased productivity in business tasks (Cecchinato, Cox, & Bird 2015; Cousins & Robey 2015; Duxbury, Higgins, Smart, & Stevenson 2014; Fleck, Cox, & Robison)), tensions between work and family domains (Kreiner et al. 2009) can have a negative impact on an individual, resulting in stress or work and private domain overload (Kreiner, Hollensbe, & Sheep 2009). Individuals may lose control over their boundaries between work and private life domains (Jackson et al. 2006) resulting in a change from "work anytime and anywhere" to "work all the time and everywhere" (Cousins & Robey 2015; Davis 2002).

In the last decades, researchers have used boundary and border theory to analyse how individuals manage boundaries between work and family domains. Different boundary management tactics, styles and strategies have been developed (Allen et al. 2014). For example, Kreiner et al. (2009) describe different tactics priests use to leverage their technology in order to organize their boundaries within behavioural tactics. Findings of Duxbury et al. (2014) of the adoption and use of Blackberry smartphones indicate that successful boundary management depends on the development of a strategy in order to manage the device prior to adoption. However, research on technology related boundary tactics is sparse. Against this background, the objective of this study is to facilitate greater understanding of individual tactics to manage the boundaries between work and private life domains using information technology.

To answer this objective, the paper is structured as follows. First, we will define and describe the core themes of our study, namely boundary and border theory, and will explain how they have been used in general and in IS literature specifically (Section 13.2). After explaining our methodological approach (Section 13.3), we will present our findings in Section 13.4. In section 13.5, we will conceptualize and integrate our findings and discuss them in terms of potential generalisation beyond our area of interest (Section 13.6). The paper concludes with an outlook, formulating the limitations as well as implications for future research and practice (Section 13.6).

13.2 Related Work

13.2.1 Boundary theory

Boundary theory (Ashforth, Kreiner, & Fugate 2000; Clark 2000; Nippert-Eng 1996; Reyt & Wiesenfeld 2015; Rothbard, Phillips, & Dumas 2005) refers to the way in which people try to create, maintain, change, simplify or order their environment. Specifically, boundary theory focuses on boundaries between roles. Katz and Kahn (1978) outline roles as expectation, placed on an individual in a social system. Therefore, in the context of our study we use the term boundary to describe a limitation of space and edge of a role, varying on a continuum from thin to thick (Allen et al. 2014; Kreiner et al. 2009). Thin boundaries are associated with being weak and open to influence, whereas thick boundaries are supposed to be strong and not influenceable (Ashforth et al. 2000; Hartmann 1991).

Boundary theory has been used in different contexts e.g. psychology, organization theory and political science (Kreiner et al. 2009). Based on a cognitive theory of social classification with the focus on how people prioritize work and home (Allen et al. 2014) boundary theory evolved from sociological work of Nippert-Eng (1996). When applied to the work and family literature, boundary theory describes key challenges individuals face, managing work roles (e.g. as an employee) and family roles (e.g. as a parent) and the transition between those two roles, as they are defined as distinct from one another (Ashforth et al. 2000; Hall & Richter 1988; Kossek & Lautsch 2008; Nippert-Eng 1996). The transition between those roles, as described above, can be of a psychological or physical way and can differ, regarding an individual's preference in terms of their flexibility and permeability (Ashforth et al. 2000). Due to the variance of transitions a continuum of border demarcation arises, showing on the one-hand integrators, (individuals, drawing a thin line between work and family roles) and on the other-hand separators (individuals, drawing a thick line between work and family roles) (Nippert-Eng 1996). Ashforth et al. (2000) further distinguish between macro (infrequent, involving permanent change) and micro transitions (frequent, involving routine activities).

13.2.2 Boundary management – preferences, tactics and styles

Research of boundary theory states that there is a difference between boundary preferences, tactics and styles. Kreiner (2006) describes boundary preferences as an individual's preferences of either implementing or segmenting aspects of work and private life domains. An important aspect is that an individual's preference describes the wish of an ideal boundary management. Therefore, individuals use tactics to create their preferred style of segmentation or integration (Kreiner et al. 2009). Whereas the boundary preferences refer to the integration or segmentation preference, the

boundary styles refer to the actual enactment of integration or segmentation (Kossek, Rudermann, Braddy, & Hannum 2012).

Kossek and Lautsch (2008) identified three different boundary management styles: integrators (blending work and family domains), separators (dividing work and family domains) and volleyers (switching between those two strategies). In order to define boundary management in more detail, different frameworks developed over time (Allen et al. 2014). Allen et al. (2014) identified two lines of research that arose based on Kossek and Lautsch (2008). One line identifies specific boundary management tactics (Kreiner et al. 2009; Sturges 2012) whereas the other line analyses boundary management styles (Ammons 2013; Kossek et al. 2012).

Kossek et al. (2012) defined six different clusters that can be used to classify individuals that describe how an individual manage its personal preferences of boundary styles. These six clusters ("work-warriors", "overwhelmed reactors", "family guardians", "fusion lovers", "dividers" and "nonwork-electrics") differ regarding their control of demarcation, focus on work or family domains and break-behaviour of boundaries (e.g. "fusion lover" and "nonwork-electrics" have a high control in contrast to "work warriors" and "overwhelmed reactors", whereas "fusion lovers" and "overwhelmed reactors" both focus on both work and family and "work warriors" and "nonwork-electrics" describe the ends of boundary continuums) – focusing on either work for "work warriors" or maintaining a small identification with their family for "nonwork-electrics". Break-behaviour of "work warriors" is defined by a high permeation from work to private, whereas "overwhelmed reactors" are described by a break-behaviour in both directions – work and family. "Fusion lovers" and "nonwork-electrics" tend to integrate both break-behaviour patterns allowing work permeation during family time and the other way around (Kossek et al. 2012).

Since individuals are able to actively change their boundary style, Kreiner et al. (2009) describe tactics individuals use in order to design their preferred living of work-home integration and segmentation in daily life. These tactics can be of behavioural (e.g. involving other people), temporal (e.g. controlling work time), physical (e.g. managing separate artifacts for work and family domains) or communicative style (e.g. confronting boundary violaters either during or after a violation (Kreiner et al. 2009).

We carefully note that some work has been done in extant literature describing boundary management tactics using information technology. For instance Kreiner et al. (2009) describe a micro-category called "leveraging technology" which is a sub-category of behavioural tactics. This micro-tactic is linking directly to the use of information technology to manage boundary strategies. In his comprehensive study with Priests, they identify the use of voice-mail, caller ID, e-mail and the

Palm Pilot Calendar as technologies that help them to facilitate their boundary management. Similarly, Duxbury et al. (2014) discovered individuals as not being able to segment between the two domains due to a lack of self-discipline and self-control when using smartphones (e.g. Blackberry). Köffer et al. (2015) found six technology-related aspects (dual use of company IT for private task, dual use of private IT for work tasks, remote access to work data, distinct devices for private and work purposes, separate private and business accounts and quality of company provided IT), explaining the intensified professional use of IT. They concentrate on IT which was originally developed for the consumer market to manage boundaries between work and private life domains. Cecchinato et al. (2015) observe the use of e-mail accounts across devices to manage boundaries in more detail, finding micro-boundary strategies in e-mail management.

Although there has been significant research in the field of boundary management so far, only limited research addresses technological aspects on boundary management. Against the background of technological advancement including the emergence of IT Consumerization previous research show that technology influence boundary management (Köffer et al. 2015). Consequently, more research is needed to shed light on technology related boundary management.

Therefore, we want to bridge this gap by further differentiating information technology micro-tactics. In order to identify these tactics, we conduct an explorative study with the objective to uncover IS tactics used by individuals to manage their boundary styles. Taking a qualitative approach, we build on the foundation of Kreiner et al. (2009), Kossek et al. (2006), Köffer et al. (2015) and Cecchinato et al. (2015) and extend current research by including technology related aspects. In order to address our aim, our research is guided by the following research question:

RQ: How do individuals use IT in order to manage their boundaries between work and private life?

13.3 Research Method

Method selection. Although various studies from psychology and organizational science already explored and analysed individual tactics and strategies to maintain boundaries, information systems research did not exploit the full potential of boundary theory so far. Therefore, this research pursues an explorative approach, to gain insights on how individuals use information systems to implement boundary management tactics. Based on the explorative nature of this study, we made use of tools from grounded theory methodology (Glaser & Strauss 1967; Urquhart, Lehmann, & Myers 2010) which is explained next.

Data collection. We conducted a total of 15 interviews (10 males, 5 females). The participants were selected out of different organisations including industrial sector, financial sector, IT-business and public sector. An overview of the interviewees is presented in Table 13.2.

Position	No of Interviewees	Average work experience in years	Number of the interviews
Employee	9	6	1, 2, 3, 4, 5, 7, 8, 11, 13
Manager	6	14	6, 9, 10, 12, 14, 15

Table 13.2 Overview of Interviewees

We conducted a two-step approach to conceptualize individual tactics. First, we conducted four semi-structured interviews. We included open questions like "*Do you separate private and business technology?*" or "*What are technological approaches to meet your boundary preferences?*" In this first round, we interviewed doctoral students from the business faculty (employees), because they are provided with mobile technologies and they have a great degree of freedom on how, when and where they work since they are generally managed by objectives.

Based on this first step, we further adapted our questions. We continued by interviewing another eleven individuals from industry. To get insights from different hierarchies, we included both employees and manager. Furthermore, we particularly included practitioners with working experience (9.2 years of working experience in average) to capture individual strategies that have been already implemented.

Data analysis. Following the grounded theory approach, we analysed the data beginning with open coding (Corbin & Strauss 1990; Glaser & Strauss 1967). Three of the researchers implemented the procedure of *open coding* independently. They read the transcribed interviews and proposed codes that represent the content. Afterwards, similar codes were collected out of the interviews and grouped as a common denominator what is known as *axial coding*. For instance, for the subsequent citation "*I own an IPhone and it is equipped with the tool to only permit phone calls from people which I chose, at the times which I selected."* (Interview 1), three independent codes ("filtering", "manage communication", and "automatic filtering") were found. Finally, "filtering" was used as an axial code. Disagreements were discussed with the remaining researchers and settled by a mutual agreement.

We finished our process when all researchers agreed that there is only little chance that new essential concepts would emerge. Since our data highlights key aspects of the integration or separation between work and life, we finish our analysis by relating our results with existing literature (theoretical coding, Section 5).

13.4 Findings

Physical detachment. Kreiner et al. (2009) analysed physical tactics describing dismantling local boundaries between work and private life domains. However, Kreiner et al. (2009) did not link physical tactics to IT. When looking at the interviews, we noticed that employees, having two devices, for example a private device and a corporate device, tend to separate between those two devices. Most commonly, they separate based on the ownership. Therefore, the corporate owned one is exclusively used for work and the private device in exclusively used for private purposes. The following excerpt illustrates this behaviour:

"Ultimately, that's why I own two smartphones, one for work and one for my private matters. The same for computers. Generally, I respect the separation to use the company device only for work related issues and my private phone or laptop for everything else. [...] Well, that means, I keep the usage of my private device for company matters to the minimum. I would glance at emails via a SharePoint, but I would never download an Outlook Client to have fully access to my company emails." (Interview 12)

For example, when looking at the private life domain, ways to foster separation using mobile devices could consist of leaving the corporate device at work, switching it off or to turn it to a silent mode. The following quote shows an individual separating using two ways. First, the silent mode is used in order to prevent interruption. Second, he puts the corporate smartphone aside in order to prevent a confrontation with checking it for notifications:

"After my working time, when I am at home or in the gym, I put my phone away – in silent mode- then I don't realize that a message or a call came in and I won't answer it." (Interview 15)

Automatic notification. As technology enables the automatization of processes, it also opens the door for the individual boundary tactic, especially, in terms of communication applications there are prevailing ready-to-use configurations to define automatic notifications for instance in terms of absence times. A common use of automatic notifications can be found in E-Mail applications. The following excerpt describe how one employee use automatic E-Mail notifications.

"I assigned my email account to automatically answer received emails with the message "Thank you very much for your email, however right now I am unable to answer it, I will be back on XY-day." Obviously, after this email is sent and I return, I will check back to answer it appropriately. Then, of course, it will be my problem." (Interview 13)

Although this excerpt illustrates how automatic notifications can be used, it also emphasize the importance of individual behaviour. Conclusively, if an individual uses that tactic to separate, at this point, technology does not enforce a strict separation.

Pull information. There are different ways of getting access to phone calls, e-mails and further information and notifications. Pulling information describes an individual's behaviour to inquire their current notifications. One way is described as choosing where and when to get access to information and notifications. One employee describes his preference to pull e-mails from web account browser in order to be able to decide when and where to check e-mails:

"I determine the time. [...] That's why I usually use the browser to access my emails. Using the online account, I decide when to check work emails." (Interview 13)

Another employee states his preference on pulling information as viewing notifications on his smartphone, when turned on the silent mode, anytime and anywhere he prefers to:

"Most of the time, my private phone is in silent mode. Now and then, I would check if someone texted me and I would answer, although I am at work. It also depends on the moment, if I am very busy or if I have a little downtime to check my messages." (Interview 9)

Pulling information is described by another employee as a routine defining when and where to check e-mails regarding, working together across different time zones: As different time zones implicate the possibility to get e.g. e-mails anytime, anywhere from everywhere, the employee talks about a routine behavior in order to cope with this permanent flow of information. He talks about a routine describing to pull information when you want to but to answer only if you need to:

"As I said, the time in China is 4 am when it is 10 pm here. On the other hand, it is 10 pm here in Germany when it is afternoon in the U.S.. Since my company has offices everywhere, I could receive an email in the middle of the night. The message will be read, but by now, the routine is there." (Interview 10)

Push Information. Another way on getting information is not to decide when and where to access these information but rather just let these information go through anywhere and to anytime. In temporal intervals, e.g. e-mails being automatically queried, an individual gets to know new notifications using vibration or sounds to signalize these. An employee illustrates below how his e-mails are pushed anywhere at anytime:

"I receive every message. I don't block out any notification. The internet on my phone is not shut down and I don't disable private accounts, which I administer with my MacBook.

That means, I am available all the time. However, whether I react to the notifications depends on the problem at hand." (Interview 7)

Another employee states how she decided to get e-mails pushed at an interval of 30 minutes in order to be up to date with her notifications:

"Every half an hour I receive a notification. I assume half an hour is enough time, it doesn't have to be adjusted to a minute-by-minute routine." (Interview 3)

Different employees confirm that setting an automatic interval in order to get notifications about received e-mails is helpful to be all the time informed about work and private life domains happenings. It is also described as easier due to not to have to log in every time in order to be able to check for example their e-mails. An interviewee states below:

"I think that the email account is updated every 30 minutes. [...] I would have adjusted the settings similarly, to avoid logging in every time. However, this setup allows the emails to refresh automatically and I would have a look at the new emails." (Interview 4)

Dynamic filtering. Employees who want to be available only for important issues when they are at work or at home have the opportunity to filter their incoming messages dynamically. When applying dynamic filtering, only messages or phone calls from specific individuals are received in a set time frame. For example, one employee explained that he told his smartphone to only let through phone calls from his family when he is at work.

"I own an IPhone and it is equipped with the tool to only permit phone calls from people which I chose, at the times which I selected. For example, from 10 am until 8 pm, only my family can reach me and they only call when it is important. All other callers are blocked. Like that, I created my own free time." (Interview 1)

When using this tactic, employees mainly separate work and private life. They only want to integrate work and private life when an intrusion from the other domain is important enough for themselves.

Boundary App. Technology can enable employees to manage their work life balance in helping them to focus on their currently active role. When employees are engaged in their work, technology prevents interruptions from family and private life. Similarly, when employees want to have private time, technology inhibits work related interruptions. Therefore, employees can integrate and separate to a certain degree to their own preferences. One employee illustrated this with a setting in his smartphone that enabled him to switch either to work or to private life:

"The new Blackberrys have a feature where you are able to separate work and your private information. That means, on one device you can switch between a work mode and a private mode. The private mode is used for private emails, WhatsApp, Facebook, etc. whereas work related emails can be checked using the work mode of the phone." (Interview 14)

However, this technology might have both positive and negative effects. The advantage of a boundary app is that one can use the same device for multiple purposes without being interrupted from another life domain. Therefore, they can integrate their work and life at whatever time they like to but still keep this time free from interruptions because they separate. As a downside, at least in the context of our interviewee, there is the risk of invading users' privacy:

"The advantage is that I only have one device. However, the downside is that I give my employer information about my private life." (Interview 14)

13.5 Conceptualization of Individual Tactics

The maturity of technology use is an important aspect with regard to our research question, because it has a major influence on how individuals implement boundary tactics. Maturity in general has been addressed in various IS studies for instance as an overall technological maturity (e.g. Karimi, Gupta, & Sommer 1996) or on an individual level based on self-efficacy (e.g. Venkatesh, Morris, Davis, & Davis 2003). Since we focus on individual tactics, self-efficacy and individual maturity in terms of technology use is most relevant. Automatization of business processes can be understood as a high level of maturity, whereby manual processes can be considered as low maturity (Dumas, La Rosa, Mendling, & Reijers 2013). Based on this distinction we propose four different domains of individual boundary tactics which are summarized in the following table.

Boundary Preference	technological maturity	Implementation Tactic
Integration	High (automatic process)	Integration is integrated by automatic mechanisms (e.g. dynamic filtering)
	Low (manual process)	Integration is conducted loosely through manual mechanism (e.g. manual procurement of information)
Separation	High (automatic process)	Separation is implemented by automatic mechanisms (e.g. automatic response notifications)
	Low (manual process)	Separation is conduced manually (e.g. physical detachment)

Table 13.3 Four Domains of Individual Boundary Tactics

Our findings suggest that there are various approaches to comply with the individual tactic. Since automatization of IT is often on a continuum (ranging from manual to full-automation), a strict separation is of these tactics is rarely possible. For instance, the configuration of a communication filter (e.g. disable phone-calls after 8 pm) has both manual and automatic parts. In that case, we would argue that the core mechanism, namely the filtering, is mainly automatic. Conclusively, we propose a matrix including a continuum from integration to separation (Ashforth et al. 2000) and a continuum describing the technological implementation from manual to automatic. Building on this framework, the domain-affiliation of the different tactics are summarized in Table 13.4.

Individual tactic	**Primary objective**	**Examples for technological implementation**
Physical detachment	separation	Leaving technology at work when at home; turning work-related technology off when at home or turning technology silent or on vibration.
Automatic response		Using an answering machine; sending e-mail-notifications for e-mails that arrive after hours or on vacation.
Pull Information	mediation between integration and separation	Actively looking up new messages and phone calls without being informed just in time.
Boundary App		Possibility to change actively within the same technology between home and private life domains.
Push Information	integration	Being informed just in time about incoming messages and phone calls.
Dynamic Filtering		Setting up filters that let notifications of specific individuals come through.

Table 13.4 Overview of Individual Tactics

In summary, we identified six major IT tactics that allow individuals to maintain their boundary preferences. As they are located on a continuum (Ashforth et al. 2000), we recapitulate them in the following figure.

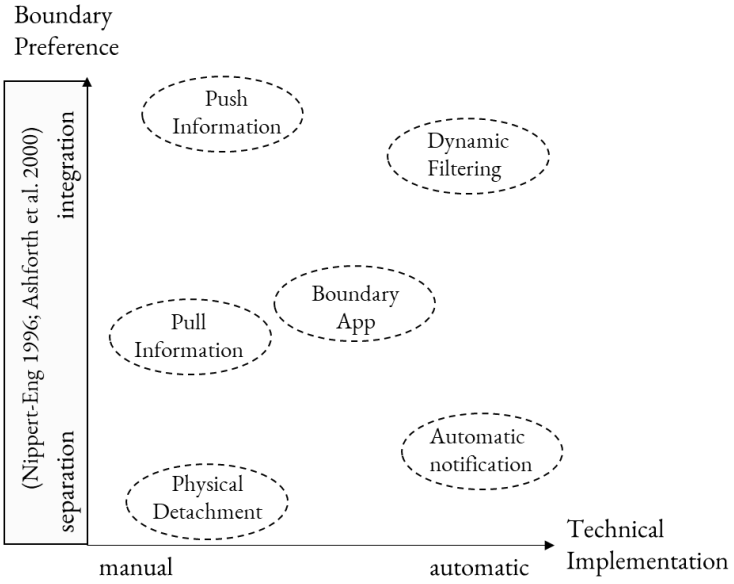

Figure 1: IT-related boundary tactics

13.6 Discussion

Summary. Information technology fundamentally influences all aspects of our life. It is therefore not surprising that IT enables a multitude of possibilities to implement and maintain individual tactics to meet one's preferences. In order to answer our research questions, we identified six different individual tactics (physical detachment, automatic notification, pull information, boundary app, push information, and dynamic filtering) and systematically categorized them with regard to boundary preferences and technical implementation (see Figure 1).

Implications for theory. As our findings propose a more granular distinction of technology-related tactics, they enrich the findings of previous studies. By exploring individual boundary tactics, our research primarily contributes to boundary theory (Ashforth et al. 2000; Nippert-Eng 1996). In particular, our findings enrich the boundary tactics from Kreiner et. al. (2009) by differentiating technology-related tactics. As such we added another continuum dimension besides integration and separation, namely technological implementation, to include technology-related aspects based on their automatization level.

We also contribute to the study of Duxbury et al. (2014) who describe the complex relationship between mobile technologies and individual boundaries. Their results show that developing a strategy to manage the use of mobile devices across work and private life domains is essential for reducing conflicts between work and private life domains. Our findings can be further used to analyse the relationship between mobile technologies and boundary preferences against the background of the identified technological tactics (see Figure 1).

Köffer et al. (2015) suggest that there are six aspects related to the consumerization of IT that influence work-life balance. They propose that the allowance or the permission of these aspects leads to work-life balance and conflict. With our findings, we further develop this idea by proposing a set of alternatives that can be used to improve individuals balance (for instance by offering a "boundary app").

Finally, we also contribute to Cecchinato et al. (2015) who put emphasize on micro-boundary strategies related to e-mail accounts. By extending our research beyond e-mail communication, we further identified technology related aspects that are relevant for individual boundary management. Specifically, the use of a mobile "app" that is used for a broad variety of scenarios (e-mail, phone, text message etc.) allows valuable insight into individual strategies, that can be used to further develop the device management as proposed by Cecchinato et al. (2015).

Implications for practice. Based on our findings, we can derive implications for practice regarding the autonomy and the knowledge of the employee as well as the possibilities of the organization to influence an employee's boundary management. First, since individuals have different preferences in general and in terms of boundary management it is recommended that organizations try to offer enough freedom to implement them. Related to technology this can be done by offering chances to adapt and personalize technology.

Second, an individual's knowledge on technology is a main aspect on implementing boundary preferences. Without sufficient capabilities to adapt technology, individuals are not able to meet their preferences. According to person-organization fit (Chatman 1989; French, Caplan, & Van Harrison 1982; Kristof 1996) organizations are encouraged to further train their employees on how to use (mobile) technology with a focus on individual adaptation.

Finally, organizations can easily influence an individual's boundaries by setting defaults. For instance, when using a pull mechanism as default for e-mail communication, it is most likely that a great number of employees do not change to push (Thaler & Sunstein 2009). Therefore, the organization can facilitate separation between private and work life.

Limitations and Outlook

Limitations. Besides common limitations of qualitative research, this study has limitations that are worth mentioning. First, we asked the interviewees about general tactics related to IT. However, in specific scenarios, for instance employees using wearables or augmented reality technologies which can be even less separated in terms of boundaries than mobile technologies, there might be more tactics which we did not cover so far.

Furthermore, using the level of technology automation is only one possible dimension with regard to technology. Others could be mobility, complexity or ubiquity. Therefore, our findings are limited to only one specific dimension. However, our findings are well suited to transfer to other dimensions as well.

Outlook. As our study explored general tactics with regard to boundary management, our findings propose a sound foundation for future research. Especially with regard to design science, experimental research could further explain various effects by matching individual preferences and the design of IT artifacts. Furthermore, affective technologies can be included in order to be able to identify individual's preferences.

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14 IT Resilience

Title	**Conceptualizing IT Resilience: An Explorative Approach**
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Table 14.1 Fact Sheet Publication

Conceptualizing IT Resilience: An Explorative Approach

Abstract. Modern technologies such as mobile phones and wearables are increasingly em-bedded in our daily life which makes detachment almost impossible. Therefore, understanding personal characteristics that allow individuals to buffer negative ef-fects is an important tool to reduce negative consequences of technology use. Ex-tant literature on technostress provides initial insights into how individuals are able to handle stressors. However, important constructs have not yet been inves-tigated. We contribute to existing literature on technostress by proposing IT resil-ience as a new construct that can be considered a coping mechanism for tech-nostress. We present the results of an explorative factor analysis (n=80), which suggest that IT resilience is a multi-dimensional construct with three sub dimen-sions: bounce back, self-efficacy, and coping. We conclude with a discussion on how to include IT resilience in theory development and human centric design.

Keywords: IT Resilience, Technostress, Explorative Factor Analysis

14.1 Introduction

Information Technology (IT) is a fundamental part of our daily life and is integrated into our daily routine. Mobile technologies such as mobile phones or tablets in particular are widely used and are, thus, object to a great number of research (Sørensen and Landau 2015). Emerging technologies including affective technologies (Calvo et al. 2015), wearables (Barfield 2016), or smart textiles (Stoppa and Chiolerio 2014) are further contributing to the omnipresence of IT.

As a consequence of this development, Information Systems (IS) research has not only recognized positive aspects of IT but also revealed potential pitfalls. In this vein, the 'dark side of technology' (D'Arcy et al. 2014) has emerged as an important research area within the (IS) discipline. Within this movement, technology-induced stress (i.e. technostress) has been introduced and analyzed from various perspectives (Ayyagari et al. 2011; Maier et al. 2015; Tarafdar et al. 2010) in order to investigate causes and consequences of technology-related stress and its outcome.

Despite the increasing efforts to understand technostress both research and practice see a high number of individuals that are affected by technology-induced stress. The impact of technostress becomes visible with regard to mobile phone use (Lee et al. 2014; Soror et al. 2015). The prevalence of technostress is unfortunate because it has a negative influence on productivity (Tarafdar et al. 2007), job satisfaction (Tarafdar et al. 2010), and job performance (Tarafdar et al. 2010). Therefore, both organizations and individuals can benefit from avoiding technostress.

Since technology is a growing aspect of our daily life, individuals rely on effective strategies in order to reduce negative influences such as technostress. Therefore, it is imperative to investigate individual characteristics that are effective tools to counteract technostress and can later be used to design technology. However, current literature only provides initial insights into individual characteristics in the context of technostress (Srivastava et al. 2015). Without investigating potential characteristics, it is difficult to reduce technology-induced negative consequences.

In this context, the purpose of this study is to expand the current body of knowledge by conceptualizing a new individual characteristic, namely IT resilience. Resilience has gained a lot of attention in stress-related domains (see for instance (Kossek and Perrigino 2016)). Unfortunately, it has not yet been adapted for the IS domain. In this paper, we present the results of an Exploratory Factor Analysis (EFA), which provides evidence that IT resilience reflects three dimensions: bounce back, self-efficacy, and coping. Taking all of these into account, this paper seeks to adopt resilience for the IT domain.

This paper is structured as follows. First, we review existing literature on resilience and provide an overview of its central characteristics and demonstrate the relationship between resilience and the IT domain (section 14.2). Next, we summarize our scale development procedure (section 14.3). In section 14.4, we present our research methodology and the results of an EFA. This paper concludes with a discussion of the results, its implications on theory and technology design, and provides fruitful avenues for future research by taking into account current limitations.

14.2 Related Work

The term resilience originates from material sciences to describe the property of an object (Sherrieb et al. 2010). It is especially used to describe how an object behaves under pressure and whether it is able to "bounce back" into its original state. The concept of resilience can easily be observed in mattresses. Putting a mattress under pressure deforms its shape (usually into a U-form). Due to its design, however, a mattress is able to "bounce back" into its original form.

This example can be applied to how an individual perceives stress. In other words, a high degree of resilience enables an individual to return to an initial state (i.e. a balanced state). Since being resilient is an important aspect of modern life, psychology and sociology have already adopted this notion and defined it as the ability or the measure of coping with stress to support resistance or bounce back in stressful situations (Connor and Davidson 2003; Smith et al. 2008). Note that resilience as a concept is not about being invulnerable to negative effects but the ability to overcome and manage stress (perception).

Despite numerous attempts to conceptualize resilience (in psychology and sociology) a common definition does not yet exist. Therefore, we refer to a widely adopted notion (e.g. Sharma and Sharma 2016) that can be adopted for IS literature (Luthans et al. 2007) and which summarizes core aspects used in other studies (e.g. Connor and Davidson 2003). Accordingly, resilience can be defined as "an individual's positive psychological state of development that is characterized by the following (a) having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks; (b) having a positive attitude (optimism) towards succeeding now and in future; (c) keeping track of goals and when necessary, readjusting paths to achieve goals (hope) in order to succeed; and (d) when faced with problems and adversity, sustaining and bouncing back (resiliency) to attain success." (Luthans et al. 2007, p. 3). In the following, we refer to this notion acknowledging that resilience is related to self-efficacy, a positive attribution, focus on goals and the ability to bounce back.

Themes	**Resilience**	**IT Resilience**
Self-Efficacy	"having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks" (Luthans et al. 2007)	confidence (self-efficacy) in working with **(mobile) technologies** regardless of the situation (stress, challenging tasks, errors), respectively the ability to adapt to these situations-
Positive attribution	"making a positive attribution (optimism) about succeeding now and in future" (Luthans et al. 2007)	being optimistic about finding solutions for problems as well as being adaptable towards **technology-induced** stress, problems or tight deadlines
Preserving towards goals	"preserving towards goals and when necessary, redirecting paths to goals (hope) in order to succeed" (Luthans et al. 2007)	Keeping track of **technology-related goals (e.g. use behavior)** and if necessary readjusting paths to achieve goals by having structured plans
Bounce back	"when beset by problems and adversity, sustaining and bouncing back and even beyond (resiliency) to attain success."	when faced with **technology-related problems (e.g. technostress)** and adversity, sustaining and bouncing back to succeed as well as cultivating social contacts and keeping a work-life-balance.

Table 14.2 Resilience and IT Resilience

As described above, resilience refers to a set of individual features that are relevant when dealing with environmental stress-related effects. For the IS discipline, the most important environmental aspects are technology-related. Therefore, technology use as well as technological characteristics can trigger stress perception. Based on this notion, we define IT resilience as follows: IT resilience is a set of individual features that allows an individual to absorb negatively perceived external influence factors that are induced by information technology and allows returning to an initial state.

We refer to Luthans, Youssef and Avolios (2007) definition (Luthans et al. 2007), to juxtapose resilience with IT resilience.

14.3 Scale Development Procedure

14.3.1 Review of existing scales

Previous literature has provided numerous measurement scales for resilience that have been established for specific targets (c.f. Table 14.2). Resilience has its root in (clinical) psychology to understand how individuals and groups are dealing with diseases. Therefore, it is not surprising that a great number of scales are focusing on clinical aspects (e.g. Smith et al. 2008; Windle 2011). Existing scales are also diverse with regard to its target group. For example, measurement scales have been specifically developed for adults (e.g. Connor and Davidson 2003; Sixbey 2005), children (e.g. Oshio et al. 2003; Sun and Stewart 2007) or the elderly (e.g. Windle 2011). Similarly, the scales are targeting different domains including workplaces (e.g. Winwood et al. 2013) or clinical applications (e.g. Smith et al. 2008). There are also different scales with regard to the underlying unit of analysis. Some scales have been developed to assess the individual (e.g. Connor and Davidson 2003; Friborg et al. 2003), others for group evaluations (e.g. Leykin et al. 2013; Sixbey 2005) and organizations (e.g. Winwood et al. 2013).

	Name	*(number of) dimensions*	
Individual	CD-RISC (Connor and Davidson 2003)	(5)	personal competence, trust / tolerance /strengthening effects of stress, acceptance of change and secure relationships, control, spiritual influence
	Dispositional resilience scale (Bartone 2007)	(3)	commitment, control and challenge
	RSA (Friborg et al. 2003)	(5)	personal competence, social competence, family coherence, social support, personal structure
	RS (Wagnild and Young 1993)	(2)	personal competence, acceptance of life and self
	Brief Resilience (Smith et al. 2008)	(1)	ability to bounce back or recover from stress
	Ego Resilience (Bromley et al. 2006)	(4)	confident optimism, productive activity, insight and warmth, skilled expressiveness
	READ (Hjemdal et al. 2006)	(5)	personal competence, social competence, structured style, family cohesion, social resources
Group	FRAS (Sixbey 2005)	(6)	family communication and problem solving, utilizing social and economic resources, maintaining a positive outlook, family connectedness, family spirituality, ability to make meaning of adversity
	CCRAM (Leykin et al. 2013)	(5)	leadership, collective efficacy, preparedness, place attachment, social trust
Organizational	BRT-53 (Stephenson 2010)	(2)	planning, adaptive capacity
	BRT-13B (Whitman et al. 2013)	(2)	planning, adaptive capacity
	RAW (Winwood et al. 2013)	(7)	living authentically, finding your calling, maintaining perspective, managing stress, interacting cooperatively, staying healthy, building networks
	Team Resilience Scale (Sharma and Sharma 2016)	(4)	group structure/enabling structure, mastery approaches, social capital, collective efficacy
			adopted and extended from (Sharma and Sharma 2016) and (Windle et al. 2011)

Table 14.3 Overview of Existing Scales

Although various scales have been developed for resilience, none of them acknowledges the role of IT. Against this background, we develop a new scale for IT resilience in the following.

14.4 Preliminary Measurement Instrument for IT Resilience

Since resilience has already been established in other domains, our scale development procedure does not start with a blank slate. In other words, we adopt items from existing instruments. For

this preliminary study, we identified 30 items from existing scales to cover all dimensions of resilience as proposed earlier. More specifically, we included existing items for self-efficacy. Since previous literature considers self-efficacy to be a core aspect (e.g. Luthans et al. 2007), there is no available scale on the individual level. In order to maintain content validity, we therefore adopt an IS-specific scale (2011) to capture this aspect. In the context of resilience, being able to rely on one's instinct is related to self-efficacy. Therefore, we included another five items from an existing scale to capture this specific aspect as well (Connor and Davidson 2003). Next, we adopted nine items from the brief resilience scale (Smith et al. 2008) and from the RAW scale (Winwood et al. 2013) in order to cover the ability to "bounce back". Then, we included three items from the resilience work scale (Winwood et al. 2013) to include coping. Since literature in this context often refers to hardiness (e.g. Kobasa 1979; Windle 2011), we also included four items to include this aspect of coping. To include the ability to focus on goals, we included items proposed by Friborg et al. (2003). After identifying the relevant constructs and items, the sentences were adapted for the IT context by introducing sentences as well as slightly adopting the measurement items. We particularly paid attention to simplifying the questions to avoid misunderstandings. To ensure that the participants understand the context, we ask them to imagine situations from work where IS use has caused problems. An overview of all measurement items used in this study can be found in the following table (Table 3).

ID	Adapted item	Reference
In situations where stress is caused by technology in general or technology use, ...		
RES1	... I tend to bounce back quickly.	(Smith et al. 2008)
RES2	... I have a hard time making it through those situations.	
RES3	... It does not take me long to recover.	
RES4	... It is hard for me to snap back.	
RES5	... I usually come through those times with little trouble.	
RES6	... I tend to take a long time to get over it.	
When using my technologies, ...		
CP2	...I make sure I take breaks to maintain my strength and energy.	(Winwood et al. 2013)
CP3	...I am careful that they do does not dominate my personal life.	
HD1	...I am able to adapt to changes.	(Connor and Davidson 2003)
SE1	...I am confident in working with them.	(Wei et al. 2011)
SE2	...I feel comfortable with them.	
SE3	...I am sure I can work with them.	
SE4	...I can work with them even if no one tells me how to do it.	
SE5	...I can handle them better than most.	
When things go wrong or I have problems in using technologies, ...		
BB1	...they usually overshadows the other parts of my life.	(Winwood et al. 2013)
BB2	...they don't ever "faze me" for long.	
BB3	...they drag me down.	
CP1	...I have developed some reliable ways to relax.	(Winwood et al. 2013)
HD2	...I can deal with whatever comes.	(Connor and Davidson 2003)
HD3	...past success gives me confidence for them.	
HD4	...I have close and secure relationships.	
INST1	...I can make unpopular or difficult decisions.	(Connor and Davidson 2003)
INST2	...I prefer to take the lead in problem solving.	
INST3	...I see the humorous side of things.	
INST4	...coping with this stress strengthens me.	
INST5	...under this pressure, I focus and think clearly.	
SST1	...I prefer to have structured plans.	(Friborg et al. 2003)
SST2	...I maintain daily rules even in difficult situations.	
SST3	...and I have a goal, I do my best to attain it.	
SST4	...regular rules make my daily life easier.	

Table 14.4 Measurement Instrument

14.5 Research Methodology

14.5.1 Data collection and descriptive statistics

The data was obtained via an online questionnaire shared on different social media platforms like WhatsApp and Facebook. The survey was accessible for two weeks and a total of 177 people participated. Since technology induced stress is not limited to defined working hours, we excluded participants that are not using their mobile technologies outside their regular working hours for work-related purposes (45 participants). After removing incomplete observations as well as outliers, the final sample yielded 80 observations. Hence, the sample size exceeds the suggested requirements for an EFA (Hair et al. 2014). An overview of the descriptive statistics is provided in Table 14.5.

Age	n	%	Working Hours	n	%	Gender	n	%
18-30	58	74,3	<30	33	42,8	male	38	48,1
31-40	10	12,8	31-40	24	31,2	female	41	51,9
41-50	8	10,3	>41	20	26,0			
> 50	2	2,6						

Table 14.5 Descriptive Statistics

Data analysis

We used an EFA in order to address our research objective. Both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (.693) as well as the Barlett test of sphericity ($\chi^2 = 760{,}49$, $p < .000$) support the use of an EFA. Since the objective of this research is the development of an IT resilience scale with few meaningful components, we used a principal component analysis (PCA) for this purpose (Netemeyer et al. 2003).

We analyzed the item correlations in order to reveal non-correlated (< .3) or too highly correlated (>.9) items. As a result, we dropped items with correlations that are too low (SST3, INST2). No items were excluded due correlations that are too high. Next, we analyzed the anti-image matrix and excluded all items that are below .5. To that end, we further dropped ADP4 (.467), SST1 (.421), SST4 (.398), and CP1 (.487). Therefore, 24 items remained for further analysis.

The results of the EFA (24 items, KMO = .780, Barlett test of sphericity ($\chi^2 = 816{,}323$, $p < .000$), Eigenvalue ≥ 1) indicate that out of seven factors, only four factors explain more than ten percent of variance. Therefore, we decided to continue our analysis with four factors.

Next, the EFA was conducted with a pre-defined number of four factors. Again, we analyzed the anti-image matrix and excluded items with loadings below .6. As a consequence, we dropped CP3

(.561). Furthermore, we dropped HD2 due to cross loadings on two factors. As a consequence, only three factors remained explaining more than ten percent of variance. This step is also supported by the results of the scree plot. Finally, we dropped INST1, INST5, ERS1, and CP2 due to too low factor loadings (<.5). Our final scale includes three factors with 17 items. The construct correlations of the identified constructs are shown in Table 14.7. All constructs have a significant correlation between .3 and .5.

ID	Factor 1	Factor 2	Factor 3	Cronbach's α	IT Resilience
RES2	,752				
RES3	,708				
RES4	,653				
RES5	,776			.846	
RES6	,633				
BB1	,590				
BB2	,554				
BB3	,644				
HD1		,586			.859
ADP1		,804			
ADP2		,698		.808	
ADP3		,854			
ADP5		,661			
HD3			,709		
HD4			,609	.676	
INST3			,728		
INST4			,698		

Table 14.6 Measurement Instrument

	Factor 1	*Factor 2*	*Factor 3*
Factor 1	1	,316**	,437**
Factor 2	,316**	1	,344**
Factor 3	,437**	,344**	1

Table 14.7 Correlations between the Constructs

Interpretation of the identified factors

Factor 1 describes the ability to bounce back when technostress occurs. Consequently, we label this factor "bounce back". This dimension of resilience is in line with previous literature (e.g. Smith et al. 2008; Winwood et al. 2013) describing one of the most discussed aspects of resilience:

the ability to recover from technology induced stress (Sharma and Sharma 2016; Smith et al. 2008; Windle 2011). At the heart of this construct is the ability to survive this adversity and return to the previous level of functioning. The bounce back factor has a reliability of α=.846 and consists of eight items. These eight items make the most extensive factor of the IT-resilience measurement scale proposed here.

Factor 2 describes the ability to believe in one's own skills and to work with (mobile) technology in every situation. In line with related IS literature, this factor is labeled as "self-efficacy". The second factor has an α = .808 and includes five measurement items. Most items used here are adopted from the self-efficacy scale (Wei et al. 2011) and the CD-RISC scale (Connor and Davidson 2003), which is in line with other operationalizations of resilience.

The last factor (factor 3) describes the ability to handle negative aspects and problems of technology use by seeing things in a humorous way and having social support. Therefore, we label this factor as "coping". The factor has an internal consistency of α=.676 and uses four measurement items. Since this is an explorative study, the value of α is sufficient (e.g. Robinson et al. 1991) and allows for further interpretation. Note that the number of items is imbalanced. Since each item loading is above .4, the distribution of items is not an issue (e.g. Guadagnoli and Velicer 1988).

The results of our factor analysis suggest that IT resilience has three dimensions: bounce back, self-efficacy and coping. The results highlight the fact that a positive attitude and social support have a positive influence on resilience. Furthermore, the results in table 7 emphasize that this attitude can support the ability to bounce back. This is in line with previous (non IS) literature that has conceptualized resilience in a similar way (Sharma and Sharma 2016; Smith et al. 2008; Windle 2011).

14.6 Discussion

The research objective of this paper is the conceptualization of resilience for IS research. The results of the survey data indicate that IT resilience can be conceptualized with three dimensions: bounce back, self-efficacy, and coping.

The dark side of technology is increasingly acknowledged in IS research (D'Arcy et al. 2014; Tarafdar et al. 2013). This paper contributes to that research stream by providing a new construct – IT Resilience – that can be used to explore negative consequences of technology use. Existing literature has already investigated the role of coping mechanisms (Galluch et al. 2015; Srivastava et al. 2015). IT resilience is able to extend these insights and expand on previous literature.

With the individualization of IS (Baskerville 2011a, 2011b) technology use is becoming omnipresent. This development has caused a movement towards the conceptualization of new constructs. For example, IT identity has been proposed (Carter 2013; Carter and Grover 2015) to capture the omnipresent, inseparable interaction with IT. Similarly, psychological ownership of technology has been proposed (Barki et al. 2008; Klesel et al. 2016; Lee and Chen 2011) to explore what happens when technology is used beyond specific boundaries. With this development, negative consequences are inevitable. In this light, new constructs are needed that allow the analysis of contemporary use behavior. Promising constructs that have the potential to do so have been proposed (see for instance mindfulness (Dernbecher and Beck 2017; Thatcher et al. 2017)). IT resilience expands existing efforts by offering a new lens to analyze use behavior in light of negative consequences. Therefore, it is can be used in combination with related constructs such as IT identity (Carter 2013; Carter and Grover 2015) or psychological ownership (Barki et al. 2008; Klesel et al. 2016; Lee and Chen 2011).

Note that IT resilience as introduced here is multi-dimensional. Therefore, it shares the common characteristic of multi-dimensional constructs, including the ability to explain phenomena of interest more comprehensively. Against this background, IT resilience a promising candidate for a multi-dimensional construct that can be adopted for existing as well as future research areas. For example, studies that have already looked at coping mechanisms (Galluch et al. 2015) can refer to IT resilience to gain deeper insights.

Although IT resilience is a primarily psychological construct, it is an appropriate perspective to enhance human centric design. Existing literature points out that psychological and biological aspects are important aspects when it comes to technostress (Riedl 2013). On a conceptual level, extant literature proposes the notion of an Explanatory Design Theory (EDT) (Baskerville and Pries-Heje 2010; Niehaves and Ortbach 2016) to investigate such relationships, i.e. the relationship between design features and effect variables such as technostress. Acknowledging that technology design is a potential cause for negative consequences (Singer 2015), IT resilience as proposed here is an important aspect that can be included in design theories (on the effect side). IT resilience can also inform a designer on how to design an IT artifact. For example, bounce back mechanisms can be included in technology design to enhance the overall IT resilience of a user. We can find related examples in e-mail systems that employ automatic answer mechanisms. In summary, design theories can draw from IT resilience to either build design features or to include the construct on the effect side, which makes this construct relevant for design science.

14.7 Outlook and Limitations

Just like every piece of research, this study has limitations that pave the way for future research. Because IT resilience has not yet been adopted for the IS domain, this research is exploratory in nature. Therefore, future research can draw from these insights to go one step further by means of confirmatory investigations such as confirmatory factor analysis or embedding IT resilience in IS theories. Moreover, future research may further investigate IT resilience by analyzing the concept of coping from an emotional and problem-focused point of view. In the same vein, future research needs to investigate IT resilience within different groups. This research builds upon a sample with a high number of young people. However, previous literature has shown that IS-related phenomena such as IT resilience can differ between groups. With regard to IT resilience, this heterogeneity might also become relevant for different age groups for example.

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14.9 References

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15 How to Design Information Technology to Detach from Work

Title	**How to Design Information Technology that Facilitates Detachment from Work: An Empirical Investigation of Work-Discontinuance Intention**
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Table 15.1 Fact Sheet Publication

How to Design Information Technology that Facilitates Detachment from Work

Abstract. Information Technology (IT) becomes more and more part of our lives both at home and at work. However, theory-based research concerning the question how information technology can be designed to facilitate employees' work-life-balance is scarce. We fill in this gap building upon boundary theory to identify design-relevant constructs in the context of work-life-balance. As boundary theory suggests that holding up strong boundaries between work and private life is beneficial for health and well-being, we focused on the design of IT that supports employees' discontinuance of work when reaching the end of their working time. We used nudge theory to derive 14 possible design options for the IT artifact, including one non-nudge design option that represents the enforcement of work discontinuance. Based on survey data from 67 industry employees, we tested how the design options influenced the work discontinuance intention of employees compared to enforcement. Our results indicate that nudging through disclosure, eliciting intentions and increasing ease has a significantly higher effect on work discontinuance intention than enforcement while nudging through a reminder has a significantly lower impact.

Keywords: Design Science, Boundary Theory, Psychological Detachment, Nudge Theory

15.1 Introduction

The digitalization and the ubiquity of technology (Lyytinen and Yoo 2002) affect both work and private life and changed the modern workplace. Today, individuals are not only using and adopting enterprise technologies but also use their private technology for business purposes. To that end, fixed working environments become rare and new environments such as "home office" are becoming more common.

The omnipresence of technology blurred the boundaries between work and private life (Ashforth, Kreiner, and Fugate 2000; Clark 2000; Köffer, Anlauf, Ortbach, and Niehaves 2015). Technology use at home impedes psychological detachment from work (Park, Fritz, and Jex 2011) and increases work-home-interferences and strain (Derks, van Duin, Tims, and Bakker 2015). One reason for this might be that a lot of technologies generally deny individual needs and instead maintain an ongoing attention of the user. For instance, E-Mail applications often push information, social media continuously sends notifications about updates and Youtube is automatically playing one video after the other (Sadler, Robertson, and Kan 2006; The New York Times 2015). This leads to continuous use of technology and a constant occupation with technology brings the risk

of negative effects such as stress, strain, or overload. Related psychological effects, such as stress or meaningfulness of work has been part of well-known theories such as the job demand control model (Karasek and Theorell 1992) or the job characteristic model (Hackman and Oldham 1976) and have been widely used to develop Information Systems (IS) theories (e.g. Ahuja, Chudoba, Kacmar, McKnight, and George 2007). Consequential, building upon these theories, IS research was able to better explain effects like turnover intention (Moore and Benbasat 1991) or job satisfaction (Bala and Venkatesh 2013).

When looking at work related phenomena, there is a great amount of theories available that can be used in the design science paradigm. Using these theories, design-relevant propositions can be generated in order to develop design theories. Particularly researchers in the field of information systems research can benefit from comprehensive discussions about design-relevant research, known as the design science paradigm, that offers a rich toolbox including guidelines (Hevner, March, Park, and Ram 2004), conceptualizations (Baskerville and Pries-Heje 2010; Kuechler and Vaishnavi 2012; Niehaves and Ortbach 2016) and evaluation methods (Venable, Pries-Heje, and Baskerville 2016).

Guided by the design science paradigm, the objective of this study is to design an IT artifact that facilitates detachment from work based on boundary theory (Ashforth et al. 2000) and detachment theory (Sonnentag 2012). Specifically, we analyse how to design IT that facilitates the work discontinuance intention of an employee. In consideration of the increasing autonomy of employees enabled by technology (Mazmanian, Orlikowski, and Yates 2013) and insufficient impact of enforcement strategies as the emergence of Shadow IT suggest (Haag, Eckhardt, and Bozoyan 2015; Zimmermann and Rentrop 2014), we furthermore use nudge theory to implement design options apart from enforcement. In summary, we raise the following research questions (RQ):

RQ 1: How to design an IT artifact that facilitates employee's work discontinuance intention?

RQ2: Which design option, drawing upon nudge theory, has the strongest effect on work discontinuance intention?

To answer the research questions, the paper continues as follows. The subsequent section lays the ground of this work by describing the context. Based on that, we propose our theoretical foundation in Section 15.3. We proceed with describing our methodological approach. In Section 15.5, we present our results. We discuss our findings and conclude by describing contributions, revealing the limitations and by showing promising paths for future research.

15.2 Background

In information systems, widely recognized theories such as the Job Characteristic Model (Hackman and Oldham 1976), the Job Demand Control Model (Karasek and Theorell 1992) or role theory (Katz and Kahn 1978) have been used as a lens to analyse job-related phenomena. In various studies, IS researchers were able to build on these theories to explain IS-related aspects including turnover intention, innovation behaviour, or the change of job characteristics through the implementation of enterprise systems (Bala and Venkatesh 2013). Although IT can enable a broad variety of positive effects such as performance, satisfaction, or innovativeness at the workplace, current research also shows that negative effects can emerge. For example, IT can cause stress that impedes performance and increases role conflict (Tarafdar, Tu, Ragu-Nathan, and Ragu-Nathan 2007). Therefore, finding ways to foster positive effects of IT usage becomes increasingly relevant.

Since previous research has primarily focused on psychological variables (for instance Hackman and Oldham 1976) and individual coping mechanisms (for instance Galluch, Grover, and Thatcher 2015), design-relevant research has received only little attention so far (Bresnahan, Brynjolfsson, and Hitt 1999; White, Hill, McGovern, Mills, and Smeaton 2003). This is unfortunate, as IS research has strong conceptualizations for the design of information technology for specific purposes including workplace design. Indeed, the creation and the design of IT artifacts is at the core of information systems since the beginning of the discipline. In the late 1960s Herbert Simon published his seminal work on "The Science of the Artificial" (Simon 1969) where he points out the distinct characteristics of artifacts and how to address them with knowledge from natural science. Current studies contributed to this body of knowledge by proposing guidelines (Hevner et al. 2004), methods (Peffers, Tuunanen, Rothenberger, and Chatterjee 2007), strategies to positioning design science endeavours (Baskerville, Kaul, and Storey 2015; Gregor and Hevner 2013), and frameworks to evaluate Design Science Research (Venable et al. 2016).

In order to examine design-relevant aspects in the work context, we chose a theory based approach following the design science paradigm (Gregor and Jones 2007; March and Smith 1995; Niehaves and Ortbach 2016). With regard to IT at the workplace and workplace-design, it is particularly interesting to develop theories that explain effects such as stress or overload. For this purpose, different conceptualizations for explanatory theories, i.e. theories that explain the effects of an artifact, have been proposed (see Table 1). For instance, Gregor (2009) uses the notation of an interior mode and an exterior mode, where the first focuses on theorizing about how the design can be implemented and the latter about the effects of the artifact in its environment. To that end she proposes to use propositions such as "A system with feature X will perform better on measure M than a system without feature X" (Gregor 2009, p. 9). A similar conceptualization has been

brought forward by Baskerville and Pries-Heje (2010) who propose the notion of a Design Practice Theory and an Explanatory Design Theory. The former explains how to design an (IT-) artifact and the latter explains why certain features should be included in an artifact. In the same tune, Kuechler and Vaishnavi (2012) suggest the notion of a design relevant explanatory/predictive theory (DREPT) capturing knowledge about why an artifact has certain effects. Most recently, Niehaves and Ortbach (2016) demonstrate how to develop and test explanatory design theories (Baskerville and Pries-Heje 2010) using Structural Equation Modelling (SEM).

Explanatory Design Theory "prescribes principles that relate requirements to an incomplete description of an object" (Baskerville and Pries-Heje 2010, p. 273)
Exterior Mode "Types of theory, which aim primarily at analyzing, describing and predicting what happens as artifacts exist and are used in their external environment." (Gregor 2009, p. 7)
Design relevant explanatory / predictive theory (DREPT) "A type of theory suggested in this paper that augments the "how" information content of the traditional ISDT statement with explanatory information explaining why the artifact has the effects it does." (Kuechler and Vaishnavi 2012, p. 396)
Explanatory Design Theory "An explanatory IS design theory seeks to inform a designer about which features should be included in an artifact and why. Structurally, it consists of two or more connected hypotheses, while a single hypothesis in its basic form describes the relationship between an independent variable (cause) and a dependent variable (effect). To fulfill its informative function for a designer, at least one of the hypotheses of an explanatory IS design theory must include an independent variable that can be systematically manipulated through the design of an artifact. In principle, explanatory IS design theories constitute normative theories, which means that at least one dependent variable is regarded as desirable or undesirable." (Niehaves and Ortbach 2016, p. 4)

Table 15.2 Conceptualization of Explanatory Design Theories

The presented conceptualizations of explanatory design theories are valuable concepts that assist researchers to explain design-relevant effects. For the purpose of this research endeavour, we follow the definition of Niehaves and Ortbach (2016) for the following reasons: First, they most precisely describe how to use dependent and independent variables to build testable hypotheses for design science research. As we want to analyse work discontinuance intention (dependent variable), this conceptualization is helpful to develop a new design theory. Second, as they tend to bring behavioural science and design science together, their conceptualization can guide our work on how to include theories from behavioural science. Finally, since they integrate previous research (Baskerville and Pries-Heje 2010; Gregor 2009; Kuechler and Vaishnavi 2012) it is the most comprehensive conceptualization. As suggested, relevant variables or hypotheses need to be deduced. This process is guided by kernel theories (Iivari, 2007). Therefore, the aforementioned

theories (e.g. job demand control model) are suitable theories to derive variables such as autonomy or overload to develop design theories.

15.3 Theoretical foundation

15.3.1 Boundary Management

Boundary theory (Allen, Cho, and Meier 2014; Ashforth, Kreiner, and Fugate 2000; Clark 2000; Nippert-Eng 1996; Reyt and Wiesenfeld 2015) states that individuals structure their environment through constructing boundaries of different strength between life domains. Boundaries are defined as "lines of demarcation between domains, defining the point at which domain-relevant behavior begins or ends" (Clark 2000). When boundaries are strong, switching from one domain to the other is difficult. In contrast, when there are weak boundaries, individuals can switch easily back and forth through the domains (Ashforth et al. 2000; Clark 2000). In the context of the work domain and the private life domain, separation occurs when boundaries are strong and individuals keep their work and private life strictly disconnected. On the other hand, when boundaries are weak and individuals cross boundaries regularly, integration occurs (Ashforth et al. 2000; Nippert-Eng 1996). Integration and separation have different effects on health and work life balance. Separation seems to be associated with more work life balance while integration seems to result in a higher work-to-family conflict (Kinman and Jones 2008; Kossek, Ruderman, Braddy, and Hannum 2012; Powell and Greenhaus 2010).

A construct that is associated with boundary management is psychological detachment from work (Sonnentag 2012). Psychological detachment is a state of "switching off" (Sonnentag 2012, p. 114) from work, without doing anything that is connected to the job or thinking on work related tasks (Sonnentag 2012). Individuals who have high psychological detachment tend to have a higher psychological well-being and show less symptoms of strain (Moreno-Jiménez, Rodríguez-Muñoz, Pastor, Sanz-Vergel, and Garrosa 2009; Siltaloppi, Kinnunen, and Feldt 2009; Sonnentag and Bayer 2005) than individuals with low psychological detachment. In the context of boundary management, separation of work and private life leads to higher psychological detachment (Sonnentag, Kuttler, and Fritz 2010). In IS research, IS discontinue theory (Furneaux and Wade 2011) addresses a similar aspect, i.e. the detachment of an existing technology towards a new one. Intention to discontinue is similar in respect to the detachment from one system which is similar to the moment when individuals are crossing a boundary from one domain to another as suggested by boundary theory. However, discontinue theory primarily focuses on organizational level and analyses a final discontinuance behaviour. To analyse temporal discontinuance behaviour, as

needed in this study, an adaption of discontinuance is needed that conceptualize a temporal intention to stop work. However, to the best of our knowledge, a construct that covers a temporal work discontinuance intention has not been conceptualized so far. Therefore, we define work discontinuance intention as "the conscious decision to temporarily stop work against the background of individual preferences or in order to prevent negative consequences (such as stress or overload)." For instance, when an employee suffers of too much work, he or she can aim to do the work at another time and plan to finish the work for this moment.

15.3.2 Nudge Theory

Emerging from the field of behavioural economics, nudge theory suggests that individual behaviour can be influenced ("nudged") without the use of regulations, enforcement, or economic incentives (Sunstein 2014; Thaler and Sunstein 2008) only by the way of presenting choices. For instance, the arrangement of food in a cafeteria or in a grocery store can be either presented to increase the purchase of healthy food by putting fresh vegetables at eye height or to increase profit by putting products with a high margin there (Thaler, Sunstein, and Balz 2014).

Nudge theory can be described as a form of soft paternalism which means that an individual is guided in a predetermined direction (Richard H. Thaler and Sunstein 2008) without any enforcement. It is carefully noted that the direction is determined by the choice architect who is able to influence how choices are presented. In the supermarket, for instance, it is the employee who is responsible to arrange the food. The basic principle of nudge is to maintain the individuals freedom of choice at all time (Sunstein 2014). Hence, each individual is able to decide whether to buy groceries at eye level or foot level. Based on the idea that there is always a broad variety of choices to present, Thaler and Sunstein coined the term choice architecture. To classify and operationalize nudge-options, different concepts have been proposed (Johnson et al. 2012; Sunstein 2014). Generally, three different strategies can be distinguished: simplify the desired choice, intensify the tie with desired choice, and impede undesired choices. In order to simplify the desired choice, mechanisms are used to make the decision process more easy and convenient (e.g. by reducing alternatives). Intensifying the tie with desired choices brings out or strengthens choice intentions (e.g. by reminding the individual). The final strategy type is implemented by impeding the undesired choice (e.g. by labelling the undesired choice negatively). Although all three strategy types follow a primary objective, they are interrelated. For instance, by simplifying the desired choice, the undesired one is impeded automatically. Table 15.3 gives an integrated view and the main characteristic of the suggested options.

primarily strategy	Nudge Option		main characteristic
simplify desired choice	default rules[ab] (1. Default)		the desired choice is predefined (default). Therefore, the undesired choice require proactive behaviour and is, thus, more difficult to put into practice.
	reduce number of alternatives[a] / simplification[b] (2. Ease)		increase convenience in making a choice by simplifying choice options
	technology and decision aids[a] (3. Decision aid)		technology aids simplify desired choices
	focusing on satisficing[a]		desired choice is simplified by offering a convenient sufficient solution
	translate and rescale for better evaluability[a] (4. Rescale)		reporting information in a more convenient way to favour the desired choice
	decision staging[a]		choices are presented in sections (i.e. stages) to simplify the desired choice
	partitioning of options[a]		choices are presented in partitions to simplify the desired choice.
intensify the tie with desired choice	Customized information[a]	use of social norms[b] (5. Social)	social norms such as information about the behaviour of your colleagues are used to impede undesired choices.
		precommitment strategies[b] (6. Precommitment)	precommitment is demanded to stick to the desired outcome.
		reminders[b] (7. Reminder)	the individual is reminded of the desired choice
		focus on experience[a] / informing people of the nature and consequences of their own past choices[b] (8. Past Experience)	by revealing the consequences of past choices, the desired choice is encouraged
		focus on experience[a] / eliciting implementation intentions[b] (9. Elicit)	desired choice is intensified by explicitly putting intentions forth.
impede undesired choice	limited time windows[a] (10. Time Window)		by reducing the time window for choice, the undesired choice is impeded.
	Attribute parsimony and labelling[a] (11. Label)		choices are labelled (e.g. by detaching a symbol to the undesired option).
	warning, graphic or otherwise[b] (12. Warning)		choices are influence by warnings (e.g. using warning symbols)
	disclosure[b] (13. Disclosure)		by disclosing background-information the undesired choice can be impeded

[a]: Johnson et al. (2012) [b]: Sunstein (2014)
(nudge): operationalized as a design option in this study (c.f. Section 4)

Table 15.3 Concepts to Build a Choice Architecture

In our day-to-day life, there is a plethora of technology-related nudges already implemented. For instance, notifications that remind you automatically of certain events, health apps that inform you about your current consumption or the automatic extension of your subscriptions (Sunstein 2014). All of them respect the freedom to choose another option (e.g. to cancel a subscription), however, most of the time the former is retained. The fact that individuals do not decide completely rational (Simon 1955; Simon 1972) becomes apparent.

In IS research, nudge theory has been only marginally exploited so far. In the context of gamification it has been proposed as a concept to help people make better decisions (Hamari and Koivisto 2013). Other authors made use of nudge theory to further explore under which circumstances (i.e. choices) users are willing to pay a premium price for privacy (Egelman, Felt, and Wagner 2013). Since nudge theory influences the individual intention which has been broadly used and adapted in information systems research (Ajzen 1991; Davis 1989; Fishbein and Ajzen 1975), it opens the door for a broad variety of applications. To address our research question, nudge theory offers a broad spectrum of design-options to support individuals' intention to discontinue work.

15.4 Methodology

15.4.1 Data collection

Method selection. In order to answer our research questions, we gathered data from an online survey including design options and demographics. Using an online survey for this purpose is most convincing to address our research question because participants can answer these questions at their computer which is close to a working environment.

Participants. We recruited participants by promoting the survey via e-mail and facebook. Therefore, we used convenience sampling. A total of 72 questionnaires were answered completely. After we excluded participants whose answers indicated they only flipped through the questionnaire, 67 participants remained. Out of the participants 37.31% were female, 62.69% were male. The mean age of the participants was 31.11 years, ranging from 20 to 55. Participants worked 39.23 hours on average per week and 25.66 hours on a computer. Further information of the sample is presented in Table 15.4.

	Age (in years)	Working time (in hours per week)	Time on a computer (in hours per week)	Work experience (in years)
M	31.11	39.23	25.66	5.99
SD	9.42	11.42	13.74	6.23

Table 15.4 Overview of the Sample

Measures. Work discontinuance intention was measured with one question that asked whether the participants would stop working for this day. Participants could answer on a 10-point likert scale. Using only one variable to measure the independent variable is common in surveys that present different scenarios that must be rated repeatedly (Trinkle, Crossler, and Warkentin 2014).

Nudge options. Based on the presented nudge options (c.f. Table 15.3), we derived 13 distinct nudge scenarios. Additionally, we designed a non-nudge design option called enforcement that represented the enforced shut down of the computer. In total, we used 14 design options. Since we are interested in the individual work discontinuance intention, we excluded nudge options that addresses more than one decision (i.e. "decision staging", "partitioning of options", "simplification"). We operationalized the 13 nudge design options as messages that were meant to pop up when the employee reaches finishing time (i.e. 5 pm). Examples of the screen captures that were presented can be seen in Figure 15.1 and Figure 15.2. The operationalization of the constructs is presented in Table 15.5.

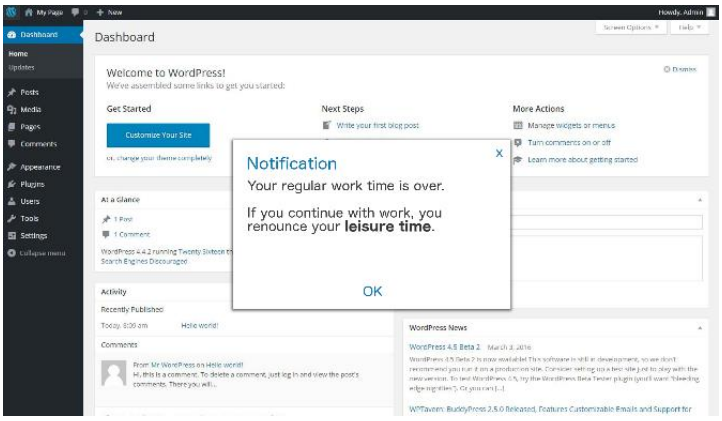

Figure 15.1 Nudge Option "Disclosure"

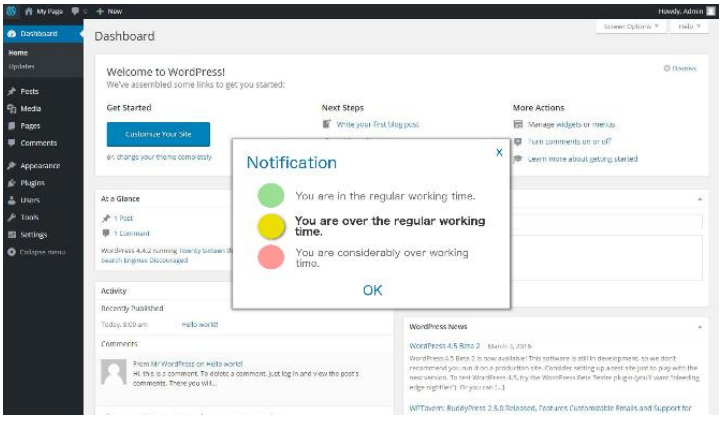

Figure 15.2 Nudge Option "Rescale"

Nudge-Option	Text message	Additional Information
1. Default	E-Mail and Communication from 9 am to 5 pm.	(configured as default)
2. Ease	"Click here, to finish work. Your data will be stored. The system shuts down.	Shut down symbol
3. Decision Aid	Your regular working time is over. Based on your calendar, there is a free timeslot tomorrow to do your work. Do you want to open your calendar to review your appointments?	yes/no button
4. Rescale	[green]: You are in the regular working time. [orange]: You are over the regular working time. [red]: You are considerably over working time.	traffic light working time labelling system
5. Social	80% of your colleagues are already at home.	ok button
6. Precommitment	Do you want that the system will be shut down at 5pm for the rest of the week?	yes/no button
7. Reminder	Your regular working time is over.	ok button
8. Past Experience	You worked for [local norm of working hours + 20%] hours last week.	ok button
9. Elicit	Yesterday, you shut down your system at that time. Do you want to do the same today?	yes/no button
10. Time Window	You have 10 minutes left to finish your work.	ok button
11. Label	Do you want to finish work?	Yes (green symbol), No (red symbol)
12. Warning	Take care of your health! Finish work to prevent negative consequences.	ok button
13. Disclosure	Your regular working time is over. If you continue with work, you renounce your leisure time.	ok button
14. Enforce	Your working time is over. Your work status will be saved. The system shuts down.	ok button

Table 15.5 Operationalization of Nudge-Options

Procedure: After opening the link to the survey, a cover page was provided (De Leeuw and Dillman 2008), including a short introduction that explained the context of the survey and assured privacy for their answers. Next, we asked participants about their average weekly working hours, their average time working at a computer, and how many years they had been working at their current employer. The subsequent section asked them about their boundary management at work and at home. Then, participants were instructed to read the following text before being presented with the design options:

"You are responsible for taking care of your employer's web page. You have to publish a lot of new information on the web page due to the good order situation.

Your regular finishing time is 5 pm. However, you could not finish all your work yet. In the next part of the survey, you will be presented with screen captures at 5 pm."

Thereafter, 7 out of the 14 design options (13 nudge options, 1 enforcement) were presented in random order and each participant had to indicate his or her work discontinuance intention for each design option displayed. Finally, participants were asked about their gender, age, and had the opportunity to give additional comments in a free text field.

15.4.2 Data analysis

In the context of our study, all individuals indicated their work discontinuance intention for several design options. This implies that the response behaviour of the individual can affect the answers for the different design options and that the responses within an individual are not independent from each other. Under these conditions, an approach that can differentiate variability within design options and variability between subjects is required. Therefore, we decided to use multilevel modelling (Snijders and Bosker 1999) and conducted the data analysis with R 3.2.3 (R Core Team 2015). Multilevel modelling considers different levels of analysis. In our study, individual responses to the design options (level 1) are nested in individuals (level 2). Multilevel modelling is recommended for nested data, for example, in vignette studies (Hox, Kreft, and Hermkens 1991).

To test whether the use of multilevel modelling was appropriate for the dataset, intra-class correlations (ICC) were calculated on the basis of the intercept-only model. The ICC estimates how much variance can be attributed to group membership (i.e. different individuals). An ICC greater than zero indicates that some variance can be explained based on differences between individuals and it is, thus, recommended to use multilevel modelling (Kreft and de Leeuw 1998). In our study the ICC indicated that 44.62% of the variance is explained by differences between individuals. Therefore, the use of multilevel modelling is supported by the data. For calculating the models, we first calculated the random intercept model (null model) and added the control variables in the next step (model 2). We used dummy coding for the different design options and added them in the last step (model 3, enforce was used as reference condition).

15.5 Results

15.5.1 Means and standard deviation

Disclosure has the highest mean on work discontinuance intention, whereas nudging through a reminder was the least efficient option to support work discontinuance intention. Ease, eliciting intentions, precommitment, past experience, time window, and warning all had a mean higher than the mean point of the work discontinuance intention scale. All other design options had a mean of 5 or lower. The standard deviations ranged from 2.79 for reminder to 3.28 for decision aid. All means and standard deviations for the different design options are presented in Table 15.6. In order to explore whether these visible differences were significant, we analysed the dataset further using multilevel analysis.

	1. Default	2. Ease	3. Decision Aid	4. Rescale	5. Social	6. Pre-commit-ment	7. Re-minder
M	4.74	5.57	5	4.76	4.5	5.3	3.11
SD	3.15	3.05	3.28	3.01	2.84	3.13	2.79

	8. Past Ex-perience	9. Elicit	10. Time Window	11. Label	12. Warn-ing	13. Dis-closure	14. En-force
M	5.57	5.57	5.48	4.86	5.14	6.29	4.58
SD	3.01	2.89	3.2	3.03	2.98	3.31	3.1

Table 15.6 Means and Standard Deviations for the Different Design Options.

15.5.2 Multilevel analysis

As a first step in the multilevel analysis, we tested whether significant intercept variation (e.g. variation between subjects) in the ratings of work discontinuance intention exists. Thus, we compared the random intercept model with a model without random intercept. The χ^2-test was significant ($p < 0.001$, $df = 1$), suggesting a significant variation between subjects. The results of the subsequent multilevel analysis are presented in Table 6. After adding the control variables age, degree, and gender to the model, we included the variables for the different design options in the model. Results indicate that ease ($\beta = 1.16$, $p = .043$) and disclosure ($\beta = 1.89$, $p = .001$) lead to a significantly higher work discontinuance intention than enforce. Additionally, eliciting intentions ($\beta = -0.96$, $p = .089$) leads to a higher work discontinuance intention on a $p < .1$ significance level. Reminder ($\beta = -0.96$, $p = .094$) and default ($\beta = -0.21$, $p = .703$) were the only design options that were negatively related to work discontinuance intention. However, this relationship was

only significant for reminder, with a significance level of p < .1. No other design options were significantly related to work discontinuance intention.

	Null model			**Model 1**			**Model 2**		
	β	Std. Error	*p*	*β*	Std. Error	*p*	*β*	Std. Error	*p*
Intercept	5.02	0.27	.000***	9.56	2.18	.000***	8.82	2.23	.000***
Age				0.03	0.02	.267	0.03	0.02	.264
Gender				0.46	0.54	.393	0.52	0.54	.342
Degree				-1.12	0.36	.003**	-1.08	0.36	.004*
1. Default							-0.21	0.57	.713
2. Ease							1.16	0.57	.043*
3. Decision Aid							0.22	0.61	.717
4. Rescale							0.05	0.57	.934
5. Social							0.36	0.55	.514
6. Precommitment							0.64	0.59	.282
7. Reminder							-0.96	0.57	.094†
8. Past Experience							0.46	0.59	.436
9. Elicit							0.97	0.57	.089†
10. Time Window							0.78	0.59	.189
11. Label							0.21	0.56	.703
12. Warning							0.31	0.56	.583
13. Disclosure							1.89	0.57	.001**
-2 logLik	2238.2			2232.5			2192.1		
Df	3			6			19		

N = 469 (design options), *N* = 67 (individuals), † *p* < .1, * *p* < .05, ** *p* < .01, *** *p* < .001

Table 15.7 Multilevel-Analysis for Work Discontinuance Intention.

15.6 Discussion

15.6.1 Discussion of the results

Our results indicated that disclosure, ease, and eliciting intentions lead to a higher work discontinuance intention than enforce, while reminding participants of their finishing time resulted in a lower work discontinuance intention. The other nudge variations did not significantly differ from enforcing work discontinuance. In the following section, we extract three relevant aspects

from these findings, answering our research questions on how IT can be designed to evoke work discontinuance.

First, disclosure, ease, and eliciting intentions seemed to have the greatest influence on the intention to discontinue work out of all design options. For disclosure, this might be the case because it was the only option which associated a positive outcome (leisure time) with the discontinuance of work. This is consistent with the propositions of prospect theory (Kahneman and Tversky 1979). The loss of leisure time through overtime seems to be worse than the additional gain of money or self-actualization that is associated with overtime. For ease and eliciting intentions, there weren't any outcomes for work discontinuance that could be directly associated with a gain or a loss. Instead, we used a purely technological approach for designing ease by simplifying the path to work discontinuance. In the case of eliciting intentions, we additionally reminded participants of the previous day and explicitly asked them if they would like to act in the same way in this moment.

Second, nudging through a reminder resulted in a lower work discontinuance intention than enforcing work discontinuance through a shutdown. This might be because it merely reminded participants of the possibility to discontinue work without giving any additional information about why this might be important or how this was related to a past experience. Therefore, the reason it did not have an additional effect on WDI probably was that the effect of merely reminding was not strong enough. As nowadays almost everyone has multiple access to the current time (watch, smartphone, computer), they are reminded every day at a specific time to finish work. Thus, employees might have already habituated to that kind of nudge because habituation occurs when a stimulus appears repeatedly (Rankin et al. 2009).

Third, the remaining nudge options are not significantly different from the enforce design option. This result is overall in line with nudge theory, as the theory states that nudging is an effective alternative to enforce regulations (Goldstein, Johnson, Herrmann, and Heitmann 2008). However, our findings also brought up some additional questions in this regard. According to previous research in the field of nudge theory, the default option ought to have the greatest effect on shaping behaviour in a desired way (Goldstein et al. 2008; Johnson et al. 2012; Richard H. Thaler and Sunstein 2008). This was not the case with the default option in our study, as it did not show a significant difference to enforcing work discontinuance. This might be because we did not operationalize the default option with a focus on shutting down the computer but decided to focus on stopping the chance to communicate with others instead.

All in all, in regard to our research questions, we can draw the conclusion that nudging employees is a sufficient approach to influence employees' work discontinuance intention. Furthermore, out

of all nudge options, disclosure, eliciting intentions, and ease have the strongest effect on work discontinuance intention.

15.6.2 Contributions for theory

Mobile technologies and mobile work enables the continuous ability to work and are, thus, substantial causes for stress and overload (Ayyagari, Grover, and Purvis 2011; Tarafdar, Qiang, Ragu-Nathan, and Ragu-Nathan 2007). For the same reason, it is becoming increasingly difficult to disconnect from technology. By putting this issue in the focus of this study, we contribute to the research field that is concerned with the "dark side" of technology (D'Arcy, Herath, and Shoss 2014). Specifically, we proposed a design-relevant concept that primarily contributes to reduce overload. Furthermore, in connecting work discontinuance with boundary theory (Ashforth et al. 2000; Clark 2000; Nippert-Eng 1996) and psychological detachment (Sonnentag 2012), we explored how IT can be designed to enhance positive outcomes. To the best of our knowledge, this is a first conceptualization on how to design technology that allows detachment instead of increasing the users' connectivity and loyalty. Our findings can be used to further enrich theory development to negative and positive effects of technology use.

Our research also contributes to design science by offering a new design theory for modern workplaces. Building upon previous research (Baskerville and Pries-Heje 2010; Gregor 2009; Niehaves and Ortbach 2016) we conceptualized an explanatory design theory to support work discontinuance intention. Therefore, we prepared the ground for further design science research in the context of information technology design for modern workplaces. Other researcher can build upon our findings to build new design theories in their context.

Finally, we contribute to nudge theory by operationalizing a broad variety of general nudge concepts for information systems research. Since nudge theory has been successfully used in other disciplines, e.g. policy making (Leggett 2014), we hope that our work encourages other researchers to use nudge theory to design information technology and transfer it to other areas such as e-commerce, social network or decision support research.

15.6.3 Implications for practice

Our research has implications for modern workplace design. Primarily our data suggest that there are at least three superior options (ease, disclosure, elicit) to encourage employees to prevent overwork by nudging them instead of enforcing them. Therefore, it is suggested instead of implementing enforcement-policies in information technology, organizations should consider to implement nudge-options instead. Based on our general findings, commonly used systems such as communication technologies might be well-suited to apply nudge-options.

Our findings also imply that the remaining nudge options did not show significant differences to enforcement. Therefore, based on these findings applying nudge theory and the idea of soft paternalism (Sunstein 2014; Richard H. Thaler and Sunstein 2008) is equally useful to encourage individuals' intention to discontinue work.

15.6.4 Limitations and Outlook

One limitation of the study is that the operationalization was done for a scenario on a personal computer. Therefore, our results may differ in a scenario based on mobile devices such as tablets or smartphones. Furthermore, since dual-use of technology is becoming commonplace it is important to consider that physical detachment is not possible anymore.

A second limitation is that this study is conducted against the background of knowledge work. Therefore, the findings are not transferable to manual labour. However, due to the increasing number of knowledge workers (Thompson, Warhurst, and Callaghan 2001), our findings are relevant for a broad number of employees.

Third, as our sample size was comparably low for multilevel analysis (Hox 1998; Maas and Hox 2005), the power of our data analysis might have led to some effects not being detected. Thus, future studies with larger samples would be preferable.

Finally, conclusions for real work contexts can only partially be drawn from an online survey. It might be that, although participants believed that one nudge option would lead them to discontinuance of work, their reaction in the real work context may be different. Therefore, our study can be regarded as a first step towards getting to know the influence of IT on work discontinuance that has to be supplemented by further research. Laboratory experiments or longitudinal field experiments could especially be beneficial for studying actual work discontinuance in the work context.

Besides addressing the aforementioned limitations this study places a solid foundation for future research on design-oriented research in the context of work. Nudge elements can be used and evaluated for a broader variety of concepts (e.g. to reduce stress, increase satisfaction etc.) to further enhance modern workplaces. Testing nudge options in an experimental setting, for example, to identify potential multiplicative effects between different nudge options, especially between disclosure, ease, and elicit, might be another fruitful approach.

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16 A Test for Multigroup Analysis in PLS-PM

Title	**A Test for Multigroup Comparison in Partial Least Squares Path Modeling**
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Table 16.1 Fact Sheet Publication

A Test for Multigroup Comparison in Partial Least Squares Path Modeling

Purpose – People seem to function according to different models, which implies that in business and social sciences, heterogeneity is a rule rather than an exception. Researchers can investigate such hetero-geneity through multigroup analysis (MGA). In the context of partial least squares path modeling (PLS-PM), MGA is currently applied to perform multiple comparisons of parameters across groups. However, this approach has significant drawbacks: first, the whole model is not considered when comparing groups, and second, the family-wise error rate is higher than the predefined significance level when the groups are indeed homogenous, leading to incorrect conclusions. Against this back-ground, this paper presents and validates new MGA tests, which are applicable in the context of PLS-PM, and compares their efficacy to existing approaches.

Design/methodology/approach – We propose two tests that adopt the squared Euclidean distance and the geodesic distance to compare the model-implied indicators' correlation matrix across groups. We employ permutation to obtain the corresponding reference distribution to draw statistical inference about group differences. A Monte Carlo simulation provides insights into the sensitivity and specificity of both permutation tests and their performance, in comparison to existing approaches.

Findings – Both proposed tests provide a considerable degree of statistical power. However, the test based on the geodesic distance outperforms the test based on the squared Euclidean distance in this regard. Moreover, both proposed tests lead to rejection rates close to the predefined significance level in the case of no group differences. Hence, our proposed tests are more reliable than an uncontrolled repeated comparison approach.

Research limitations/implications – Current guidelines on MGA in the context of PLS-PM should be extended by applying the proposed tests in an early phase of the analysis. Beyond our initial insights, more research is required to assess the performance of the proposed tests in different situations.

Originality/value – This paper contributes to the existing PLS-PM literature by proposing two new tests to assess multigroup differences. For the first time, this allows researchers to statistically compare a whole model across groups by applying a single statistical test.

Keywords: Partial Least Squares Path Modeling, Multigroup Analysis, Monte Carlo Simulation, Permutation Test

16.1 Introduction

The empirical testing of theories requires valid statistical methods to allow researchers to derive reliable implications. In the field of information systems (IS) and Internet research, partial least squares path modeling (PLS-PM) is a widely used composite-based estimator for structural equation models with latent variables to investigate phenomena such as social networks (Cheung et al. 2015), Internet addiction (Lu and Wang 2008) and mobile banking (Tam and Oliveira 2017). It was originally developed by Herman A. O. Wold in the 1970s as an alternative estimator for structural equation models (Wold 1975).

The existing literature on PLS-PM has provided substantial methodological contributions that have increased its application in various disciplines, such as strategic management (Hulland 1999), IS research (Ringle et al. 2012) and tourism research (Müller et al. in press). Notable milestones include the proposal of the confirmatory tetrad analysis (Gudergan et al. 2008) and the heterotrait-monotrait ratio of correlations (Henseler et al. 2015) and the development of consistent PLS (PLSc; Dijkstra and Henseler 2015a), which enhances traditional PLS-PM to consistently estimate structural models containing common factors.

Researchers often assume that datasets in empirical research stem from a single homogeneous population. Contrary to this assumption, datasets used in social sciences are regularly affected by heterogeneity, which implies that the data were collected from different homogenous populations. Ignoring this fact, i.e., not taking heterogeneity into account, leads to questionable conclusions (Jedidi et al. 1997). Hence, a multigroup analysis (MGA) can be conducted to investigate this issue caused by heterogeneity.

Heterogeneity has been recognized in the context of PLS-PM (e.g., Huma et al. 2017), and several approaches have been adopted to define groups in the case of unobserved heterogeneity based on genetic algorithm segmentation (Ringle et al. 2014) and iterative reweighted regression (Schlittgen et al. 2016). Moreover, parametric and non-parametric approaches (Keil et al. 2000; Chin and Dibbern 2010; Henseler 2012) have been proposed to assess parameter differences and, thus, heterogeneity across groups. However, the existing approaches have serious drawbacks. First, they do not compare the whole model but compare only specific parameters, e.g., path coefficients, to investigate heterogeneity. Second, the employed testing procedures rely on distributional assumptions, e.g., normal distributed data, which are often violated in empirical research. Finally, since the existing approaches rely on multiple comparisons, complex models with numerous relationships and more than two groups significantly affect the number of comparisons. Hence, researchers applying current approaches face the risk of a high family-wise error rate (FWER).

Against this background, this paper proposes two tests that allow for comparing a whole model across groups while maintaining the predefined significance level under the null hypothesis. For that purpose, we consider established distance measures, namely, the geodesic distance and the squared Euclidean distance, to measure the discrepancy of the model-implied correlation matrix of the indicators across groups. To obtain the reference distribution of the corresponding test statistic (distance measure) under the null hypothesis of no group differences, we employ a permutation procedure.

This paper is structured as follows: After the introduction, in Section 16.2, we review the existing literature on MGA in the context of PLS-PM and emphasize the importance of having a test that allows the comparison of the whole model across groups. In Section 16.3, we propose two novel MGA tests and show how permutation can be used for significance testing. In Section 16.4, these new tests are evaluated by means of a Monte Carlo simulation. Finally, we extend current MGA guidelines in the context of PLS-PM by proposing a comprehensive test procedure that integrates our proposed test into existing approaches and discuss opportunities for future research.

16.2 Multigroup Analysis in PLS-PM

MGA can be used to explore differences across groups defined by group variables. Heterogeneity across groups in MGA occurs if there are significant differences across at least two groups. To address heterogeneity, researchers can estimate separate models per group by means of a categorical moderator variable (Sarstedt, Henseler, et al. 2011). Regardless of how it is addressed, ignoring heterogeneity affects the complete underlying research model.

In terms of unobserved heterogeneity, cluster analysis such as k-means clustering has been widely used in the context of PLS-PM to identify partitions that are used for group-specific estimations (Hair et al. 2018; Sarstedt and Mooi 2014). A major shortcoming of this approach is that the structural model, which is a major aspect in structural equation modeling (SEM), is not taken into account. To overcome this drawback, the literature provides several approaches, such as finite mixture partial least squares (Hahn et al. 2002; Sarstedt, Becker, et al. 2011), the prediction-oriented segmentation in PLS-PM (Becker et al. 2013), and the iterative reweighted regression segmentation method for PLS-PM (Schlittgen et al. 2016). For a more complete overview of techniques, we refer to Hair et al. (2016).

In addition to uncovering unobserved heterogeneity, the previous literature has also suggested different approaches to test for observed heterogeneity across groups (Hair et al. 2018). For two-group scenarios, a repeated application of unpaired sample t-tests has been proposed to identify differences between groups (Chin 2000; Keil et al. 2000). The test statistic for this approach is

assumed to follow a t-distribution where the standard errors of the parameter estimates are obtained by the bootstrap or jackknife procedure (Keil et al. 2000). To overcome distributional assumptions, the previous literature has also provided a non-parametric approach for MGA (Henseler 2012). Although this approach is similar to the former, it evaluates the bootstrap distribution of each group to analyze whether the estimates statistically differ between groups. Similarly, Chin (2003) and Chin and Dibbern (2010) propose a permutation test to evaluate group differences. Group-specific differences are compared with the corresponding reference distribution obtained by the permutation procedure. Apart from the analysis of two groups, approaches for multiple groups have been suggested, for example, the omnibus test of group differences, which is a combinatorial approach including bootstrapping and permutation to mimic an overall F-test (Sarstedt, Henseler, et al. 2011).

A variety of approaches allow testing heterogeneity across groups. However, these approaches have some significant shortcomings: First, they do not consider the whole model; instead, they focus on only specific parameters, thus excluding information from the model. For instance, the procedure proposed by Chin (2003) and Chin and Dibbern (2010) suggests a simultaneous comparison of path coefficients. We argue that in the early stages of research or in complex models, a researcher might be interested not only in differences between path coefficients but also in comparing whole models across groups. Second, the use of repeated t-tests to investigate differences, e.g., in path coefficients, narrows the relaxation of distributional assumptions, which is considered a major advantage of PLS-PM. To maintain this advantage, a non-parametric approach would be preferable. Finally, the simultaneous comparison of multiple parameters involves the risk of inducing an FWER, which is the probability that at least one single test makes one type I error (falsely rejecting the null hypothesis) (Dudoit et al. 2004). However, for a proper single statistical test, the type I error rate is usually determined by the significance level, and the simultaneous application of multiple tests increases the FWER if not controlled. Hence, the aforementioned testing procedures in MGA face the risk of an FWER that is too high, i.e., the null hypothesis of no group differences is rejected too often. This issue is particularly relevant in scenarios with multiple groups and complex models, as the number of comparisons increases significantly. Let p be the number of parameters and G be the number of models; the number of overall comparisons c is calculated as follows (Equation 1).

$$c = p\binom{G}{2} = \frac{p \cdot G!}{2!\,(G-2)!} \tag{1}$$

For example, investigating whether four groups are heterogeneous with respect to 10 parameters requires 60 statistical tests. Assuming a significance level of $\alpha = 0.05$, the probability of falsely rejecting the null hypothesis of homogeneity across groups (the FWER) is $1-(1-\alpha)^c$. Without any further corrections, there is a 95.39% chance that at least one of the comparisons is statistically

significant when the null hypothesis is indeed correct. This issue is also relevant when few parameters are compared (an overview is given in the Appendix, Table 16.5). Hence, MGA with repeated comparisons is required to take FWER into account.

To show how MGA is used in IS research and how the FWER is controlled, we conducted a literature review. We queried the Web of Science database, including publications from nine leading journals from the information systems domain (European Journal of Information Systems, Information Systems Journal, Information Systems Research, Internet Research, Journal of the Association for Information Systems, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, and Management Information Systems Quarterly). We used "multi group" and "group differences" as keywords and included all articles applying PLS-PM. Since applying MGA is often a partial issue and therefore not mentioned explicitly in the papers' abstract, we also included illustrative examples of references in the pertinent literature (Qureshi and Compeau 2009). For each paper, we identified the grouping variable and its levels, how the significance level was adjusted, and the number of path coefficients relevant for the MGA. Since the considered papers do not report any kind of correction of the significance level, we compute the FWER according to Equation 1. An overview is provided in Table 16.2 (sorted by year of publication).

Reference	**Grouping Variable**	**Paths**	**Comparisons**	**FWER**
Keil et al. (2000)	culture (Finland, Netherlands, Singapore)	5	15	53.67%
Ahuja and Thatcher (2005)	gender (male, female)	5	5	22.62%
Srite and Karahanna (2006)	cultural values (individualism, collectivism)	4	4	18.55%
Zhu et al. (2006)	users (EDI user, non-user)	16	16	55.99%
Hsieh et al. (2008)	economically (advantaged, disadvantaged)	9	9	36.98%
Sia et al. (2009)	cultural differences (Australia, Hong Kong)	6	6	26.49%
Shen et al. (2010)	gender (male, female)	6	6	26.49%
Yeh et al. (2012)	gender (male, female)	4	4	18.55%
Dibbern et al. (2012)	country (Germany, United States of America)	5	5	22.62%

Reference	Grouping Variable	Paths	Comparisons	FWER
Zhou et al. (2015)	indulgence (high indulgence, low indulgence)	4	4	18.55%
Huma et al. (2017)	organization (private, public)	6	6	26.46%
Shi et al. (2018)	gender (male, female)	3	3	14.26%

Table 16.2 Multigroup Analysis in IS research

Our review indicates that interest in MGA has increased. Fundamental papers that paved the way for MGA in the context of PLS-PM (Keil et al. 2000; Qureshi and Compeau 2009) have undoubtedly contributed to this development. At the same time, this review also shows that issues associated with multiple comparison tests, i.e., the FWER, have received little attention so far. Across all reviewed papers, there was no report of any kind of correction (e.g., Bonferroni correction). Hence, we are inclined to assume that a correction was not applied. In conclusion, most papers might be affected by a considerable inflation of the FWER ($14.26\% < FWER < 55.99\%$). This issue particularly affects studies that investigate more than two groups and/or a high number of path coefficients.

16.3 A Test to Compare Multiple Groups

16.3.1 Measuring heterogeneity across groups

Here, we propose two new tests to compare whole models across groups to investigate heterogeneity. Similar to the test for overall model fit in PLS-PM (Dijkstra and Henseler 2015b), which considers the discrepancy between the empirical indicators' covariance matrix and the model-implied counterpart, we propose to investigate the distances between the indicators' model-implied correlation matrices across groups.[3]

To determine the differences between the model-implied indicators' correlation matrices across groups, every measure that satisfies the properties of a distance (Deza and Deza 2016, p. 3) can be used. Consequently, a distance greater than zero implies that two groups differ. If there is a statistically significant distance between the groups, further steps can be conducted to investigate the differences in more depth, e.g., investigation of specific path coefficients.

For the purpose of our research, i.e., assessing the distances between model-implied indicators' correlation matrices, we consider two established distance measures: the geodesic distance and the

[3] For a better comparison, we consider the model-implied correlation matrix of the indicators instead of their model-implied covariance matrix.

squared Euclidean distance. While the squared Euclidean distance is well known, the geodesic distance is illustrated as follows: It belongs to Swain's (1975) class of fitting functions and can be employed to estimate the model parameter in SEM. Properly scaled, it is asymptotically equal to the fitting function used in the maximum likelihood (ML) estimation for SEM.

In the case of two groups, the geodesic distance between the model-implied correlation matrix of group 1 ($\boldsymbol{\Sigma}(\boldsymbol{\theta}_1)$) and group 2 ($\boldsymbol{\Sigma}(\boldsymbol{\theta}_2)$) is calculated as follows:

$$d_g = \frac{1}{2}\sum_{i=1}^{K} \ln(\varphi_i)^2, \tag{2}$$

where φ_i is the i^{th}eigenvalue of the matrix $\boldsymbol{\Sigma}(\boldsymbol{\theta}_1)^{-1}\boldsymbol{\Sigma}(\boldsymbol{\theta}_2)$ and K is the number of rows of one of these two matrices. When the two matrices are equal, the geodesic distance is zero since all eigenvalues of a unit matrix are one.

The squared Euclidean distance between $\boldsymbol{\Sigma}(\boldsymbol{\theta}_1)$ and $\boldsymbol{\Sigma}(\boldsymbol{\theta}_2)$ is calculated as follows:

$$d_E = \frac{1}{2}\sum_{i=1}^{K}\sum_{j=1}^{K}\left(\sigma_{ij,1} - \sigma_{ij,2}\right)^2, \tag{3}$$

where K is again the number of rows and $\sigma_{ij,1}$ and $\sigma_{ij,2}$ are elements of the respective matrix. If both matrices are identical, the squared Euclidean distance is zero; otherwise, this distance is greater than zero.

Since MGA is often conducted with more than two groups, we calculate the arithmetic mean of the distances of all possible pairs of groups. Note that the total number of group comparisons is $\frac{G(G-1)}{2}$, where G is the number of groups. Therefore, the average geodesic distance (D_g) for G groups is calculated as follows:

$$D_g = \frac{2}{G(G-1)}\sum_{g=2}^{G}\sum_{h=1}^{g-1}\sum_{i=1}^{K} \ln(\varphi_i)^2 \tag{4}$$

where $\varphi_i$is the i^{th}eigenvalue of the matrix $\boldsymbol{\Sigma}\left(\boldsymbol{\theta}_g\right)^{-1}\boldsymbol{\Sigma}(\boldsymbol{\theta}_h)$.

In a similar manner, we calculate the average squared Euclidean distance for more than two groups as follows:

$$D_e = \frac{2}{G(G-1)}\sum_{g=2}^{G}\sum_{h=1}^{g-1}\sum_{i=1}^{K}\sum_{j=1}^{K}\left(\sigma_{ij,g} - \sigma_{ij,h}\right)^2, \tag{5}$$

where $\sigma_{ij,g}$ and $\sigma_{ij,h}$ are the elements of the corresponding model-implied correlation matrix. Since the squared Euclidean and the geodesic distance are either larger than or equal to zero, the

two proposed average distances cannot be negative. Moreover, these distances are zero if all correlation matrices are equal; otherwise, they are larger than zero.

In terms of MGA, the considered null hypothesis is as follows: $H_0: \boldsymbol{\Sigma}(\boldsymbol{\theta}_1) = \cdots = \boldsymbol{\Sigma}(\boldsymbol{\theta}_g) = \cdots = \boldsymbol{\Sigma}(\boldsymbol{\theta}_G)$, where $\boldsymbol{\Sigma}(\boldsymbol{\theta}_g)$ is the model-implied population correlation matrix of the indicators for group *g*. To obtain the reference distribution of the distance measures including the average distances, we apply a permutation procedure, as described below.

16.3.2 Permutation tests

Permutation tests were introduced by Sir Ronald Fisher (1935) as a general approach for statistical inferences and have been considered the gold standard in medicine research (Edgington and Onghena 2007, p. 9). There are three common types of permutation tests: exact permutation tests, moment-approximation permutation tests, and resampling-approximation permutation tests (Berry et al. 2014). All three types of tests share the characteristic that they use permutation to obtain the distribution of the test statistic under the null hypothesis. The exact permutation test obtains the reference distribution by calculating the test statistic for all possible permutations of the original data set. Thus, the number of calculations can grow considerably with an increasing number of observations. Consequently, the application of an exact permutation test is not always reasonable. The moment-approximation permutation test requires the computation of the exact moments of the test statistic, which are then used to fit a specific distribution. In turn, this distribution is used for the calculation of the p-value. The resampling-approximation permutation test is similar to the exact permutation test; however, the reference distribution of the test statistic is based on only a subset of all possible permutations of the original sample. Due to its feasibility, this test is widely used.

Multiple resampling-approximation permutation tests have been developed in the context of PLS-PM; for example, a permutation test for compositional invariance (Henseler et al. 2016) and a permutation test to compare parameters across groups (Chin and Dibbern 2010) have been developed. This type of permutation test has a distinct advantage compared to parametric tests. For example, it makes no assumptions about the distribution of the test statistic. Since PLS-PM also makes no distributional assumptions, this type of permutation test is perfectly in line with the PLS-PM's spirit. Moreover, such permutation tests have favorable properties for small sample sizes (Ludbrook and Dudley 1994), and they are robust against extreme values. Therefore, we also choose this type of permutation test to compare the model-implied indicators' correlation matrices across groups.

16.4 Monte Carlo Simulation

16.4.1 Simulation design

We used a Monte Carlo simulation to evaluate the sensitivity (power) and specificity (Parikh et al. 2008) of our two proposed permutation tests, where one is based on the average geodesic distance (D_g) and the other on the average squared Euclidean distance (D_e). While specificity is the ability to correctly reveal homogeneity across groups, sensitivity is the ability to correctly detect heterogeneity across groups. To compare the performance of our two proposed permutation tests to existing testing procedures, we also included a test procedure based on repeated comparisons of path coefficients (RCPC), i.e., the path coefficients are compared across all groups (Chin 2003; Chin and Dibbern 2010).

Similar to the previous literature on MGA (e.g., Qureshi and Compeau 2009), we used a structural population model with four constructs modeled as composites (Figure 16.1)[4] All composites consist of three indicators. The population weights to form composites C2 to C4 are set to 0.3, 0.5, and 0.6. The weights from C1 vary according to the following five scenarios, in which we compare three groups: (i) the groups are homogenous; (ii) the groups have small differences among their structural models; (iii) the groups have moderate differences among their structural models; (iv) the population weights of the first composite vary across groups; and (v) in addition to the previous scenario, the structural models also show small differences across groups. Table 16.3 presents the manipulated population parameters.

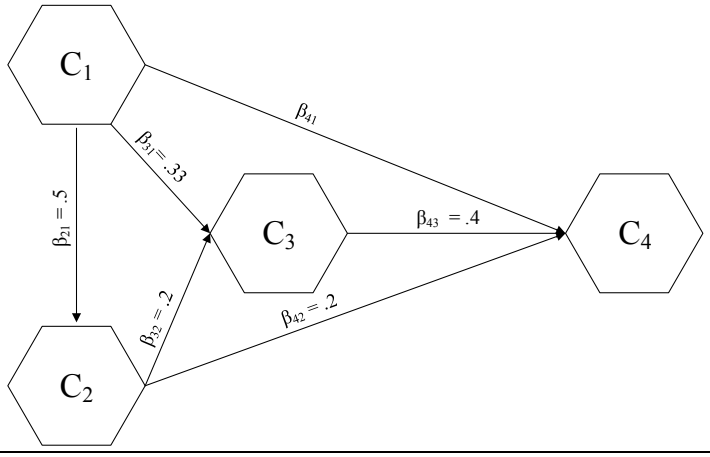

Figure 16.1 Structural Population Model

[4] Since PLS-PM is often applied to models with more than four constructs (Ringle et al. 2012), we also ran the simulation with a larger model that includes eight composites. Since the results were comparable, they are not reported here.

Scenario	D_g	D_e	g	β_{41}	w_{11}	w_{21}	w_{31}
(i) Homogeneity	0	0	1	0	0.30	0.50	0.60
			2	0	0.30	0.50	0.60
			3	0	0.30	0.50	0.60
(ii) Small Structural Difference	0.0471	0.0133	1	0	0.30	0.50	0.60
			2	**0.1**	0.30	0.50	0.60
			3	**0.2**	0.30	0.50	0.60
(iii) Moderate Structural Differences	0.3293	0.0266	1	0	0.60	0.50	0.30
			2	**0.2**	0.30	0.50	0.60
			3	**0.4**	0.30	0.50	0.60
(iv) Different Weights*	0.2576	0.0337	1	0	0.60	0.50	0.30
			2	0	**0.80**	**0.30**	**0.30**
			3	0	**0.38**	**0.38**	**0.66**
(v) Structural Differences and different weights*	0.3138	0.0409	1	0	0.60	0.50	0.30
			2	**0.1**	**0.80**	**0.30**	**0.30**
			3	**0.2**	**0.38**	**0.38**	**0.66**

Group (g); Average geodesic distance (D_g); Average squared Euclidean distance (D_e)
*Weights are rounded (2 digits).

Table 16.3 Population Parameters

Furthermore, we varied the sample size per group from 100 to 500 observations. Finally, to investigate the robustness of our tests, we consider normally distributed and non-normally distributed samples. To generate the non-normal data, we multiplied the samples drawn from the multivariate standard normal distribution by a scale factor, as proposed by Dijkstra and Henseler (2015b), leading to a kurtosis of approximately 1.74. We expect that the tests perform slightly worse when non-normally distributed, in contrast to the results of tests using normally distributed data. In total, we consider 50 experimental designs (5 scenarios x 2 different distributions x 5 sample size). For each design, we conduct 300 runs.

For consistent estimation of the weights, we employed Mode B (Dijkstra 1981). To obtain the reference distribution of the two test statistics, we used 499 permutation runs. The simulation was implemented in the statistical programming environment R (version 3.4.0., R Core Team 2017) using the mvrnorm function of the MASS package to draw data from the multivariate normal distribution (version 7.3-47, Ripley et al. 2017) and the matrixpls package to estimate the specified model with the same structure as the population models (version 1.0.5, Rönkkö 2017).

16.4.2 Simulation results

The produced rejection rates of the two permutation tests are displayed in Table 16.4.

		Normal Data			Non-Normal Data		
Scenario	n/group	D_g	D_e	RCPC	D_g	D_e	RCPC
(i) Homogeneity	100	5.7%	7.0%	50.3%	5.0%	7.3%	51.7%
	200	5.0%	4.3%	51.0%	3.0%	2.7%	53.3%
	300	2.3%	4.7%	52.7%	6.7%	5.7%	54.3%
	400	4.7%	4.7%	55.0%	4.3%	2.3%	47.0%
	500	4.0%	6.3%	48.0%	4.7%	5.0%	56.0%
(ii) Small Structural Difference	100	12.3%	9.0%	68.7%	8.7%	4.7%	64.7%
	200	19.7%	11.7%	77.0%	16.7%	15.3%	71.3%
	300	32.0%	22.7%	84.7%	22.7%	18.3%	78.7%
	400	45.7%	28.3%	91.0%	30.7%	24.3%	86.7%
	500	56.7%	36.7%	96.3%	41.0%	33.7%	92.3%
(iii) Moderate Structural Differences	100	70.3%	25.3%	91.3%	41.0%	18.7%	85.7%
	200	99.0%	59.3%	99.7%	84.3%	46.7%	97.0%
	300	100.0%	86.3%	100.0%	99.0%	76.7%	100.0%
	400	100.0%	96.3%	100.0%	99.7%	86.3%	100.0%
	500	100.0%	99.3%	100.0%	100.0%	96.3%	100.0%
(iv) Different Weights	100	54.3%	59.0%	52.7%	37.3%	42.7%	56.3%
	200	97.7%	97.0%	58.0%	85.3%	83.7%	58.0%
	300	100.0%	100.0%	62.3%	99.0%	99.3%	60.3%
	400	100.0%	100.0%	62.0%	99.7%	99.7%	59.3%
	500	100.0%	100.0%	63.0%	100.0%	100.0%	62.0%
(v) Structural Differences and Different Weights	100	71.7%	70.0%	64.3%	51.7%	56.3%	61.3%
	200	99.7%	99.0%	80.7%	93.0%	94.7%	72.3%
	300	100.0%	100.0%	89.7%	100.0%	100.0%	82.0%
	400	100.0%	100.0%	93.3%	100.0%	100.0%	89.3%
	500	100.0%	100.0%	97.0%	100.0%	100.0%	95.3%

Table 16.4 Rejection Rates

Homogeneity (scenario (i)). The degree of specificity is shown in the first rows of Table 3 ("Homogeneity"). For this scenario, our two tests maintain the predefined significance level of 5% quite well, while the repeated comparison testing procedure rejects the null hypothesis of no group differences far too often (> 48.0%).

Structural differences (scenarios (ii) and (iii)). Concerning small structural differences, both new tests are limited in terms of their rejection rates. In most of the conditions, the rejection rates are below the recommended threshold of 80% (Cohen 1988). For moderate structural differences, both permutation tests reliably detect differences in most of the conditions. However, the repeated comparison test produces even higher rejection rates.

Different weights (scenarios (iv) and (v)). The results also confirm that our approach is able to detect heterogeneity in groups with different weights. In situations where only the weights differ, both new tests perform quite well, i.e., high rejection rates, and outperform the RCPC approach

in most conditions. It is notable that the new tests perform even better if both the structural model and the weights differ across groups.

Sample size and data distribution. Across all conditions, all tests benefit from an increasing sample size, which results in a higher statistical power. Moreover, our results confirm that all tests perform slightly worse once the data are non-normally distributed. However, with a sufficiently large sample size, heterogeneity across groups can still be detected. With regard to moderate structural differences, 200 observations are necessary to obtain a sufficient degree of power (D_g: 99.0%) for normally distributed data. For non-normal data, 300 observations per group are necessary to achieve a similar level of statistical power (D_g: 99.0%).

Summary. Overall, the test based on the average geodesic distance produces higher rejection rates than the test based on the average squared Euclidean distance. The highest rejection rates for structural differences are produced for scenario (iii), i.e., moderate differences in the structural model across groups. Here, the test based on the average geodesic distance provides acceptable results, even if the sample size is small (n = 200; 99.0%). In contrast, the test based on the average squared Euclidean distance detects heterogeneity in only 59.3% of the cases.

16.5 Discussion

Despite the prevalence of heterogeneity in the social sciences, a test to compare a whole model across groups has not been available thus far. To allow for such a comparison, this study contributes to the existing literature by proposing two novel permutation tests based on the average geodesic distance (D_g) and the average squared Euclidean distance (D_e).

Our simulation study provides initial evidence that the two tests are viable options when the aim is to detect heterogeneity across multiple groups. Most importantly, the two proposed tests are capable of maintaining a predefined significance level. Hence, homogenous groups are not falsely classified as heterogeneous. This is a major advantage over the RCPC, which yields an inflation of FWER when not adjusted properly.

Based on the power results, the test based on the average geodesic distance is superior across the considered conditions. In particular, in situations with only small differences across groups, D_g outperforms D_e. As expected, an increasing sample size improves the power of all tests. Our simulation results also indicate that 100 observations are not sufficient for an acceptable power. Instead, 200 observations are required to exceed the threshold. This is in line with previous studies that highlighted the requirement of a sufficient sample size to detect heterogeneity (Qureshi and Compeau 2009).

As indicated by the results of the variation in population composite weights, our approach is also able to detect differences within the measurement model across groups. This highlights a major strength of this generic approach because it can be used for different purposes and is not limited to structural differences only. However, to apply MGA, it is important to establish measurement invariance in advance. Otherwise, an MGA may yield misguiding or incorrect conclusions (Henseler et al. 2016). Therefore, we recommend applying the presented tests after measurement invariance is established.

Against this background, current MGA guidelines in the context of PLS-PM need to be extended. If measurement invariances are established, we recommend initiating MGA by providing the results of one of the proposed tests, preferably the test based on the average geodesic distance. Only if there is a significant difference in the model-implied indicators' correlation matrices across groups should existing techniques that allow for the investigation of single effects be applied. In fact, if a grouping variable does not lead to significant differences between groups, a researcher should either reject heterogeneity or respecify a grouping variable before conducting further analyses. Therefore, we propose new MGA guidelines that comprise our proposed tests and existing MGA procedures and consist of the following four steps displayed in Figure 16.2:

1) **Establish measurement invariance**: Before conducting an MGA, a researcher should establish measurement invariance (Henseler et al. 2016). Otherwise, an MGA is not meaningful. If measurement invariance is established, the subsequent steps can be applied to test for heterogeneity.
2) **Overall evaluation:** Testing differences across all groups is considered the starting point for MGA. With this initial test, a researcher is able to determine whether groups differ significantly. This initial effort is particularly important when more than two groups are considered. If the test does not support heterogeneity, a researcher can either reject heterogeneity or respecify the grouping variable.
3) **Pair-wise evaluation:** If heterogeneity was found in the previous step, the purpose of this step is to investigate the heterogeneity in more detail. For that purpose, the proposed tests can be used for each pair of groups to examine which groups actually differ.
4) **Effect-wise evaluation**: Finally, the differences are investigated with regard to specific coefficients such as path coefficients. For that purpose, researchers can draw from parametric approaches (Chin 2000; Keil et al. 2000) or non-parametric approaches (Henseler 2012). As a result, we can determine whether there are group differences with respect to a specific effect.

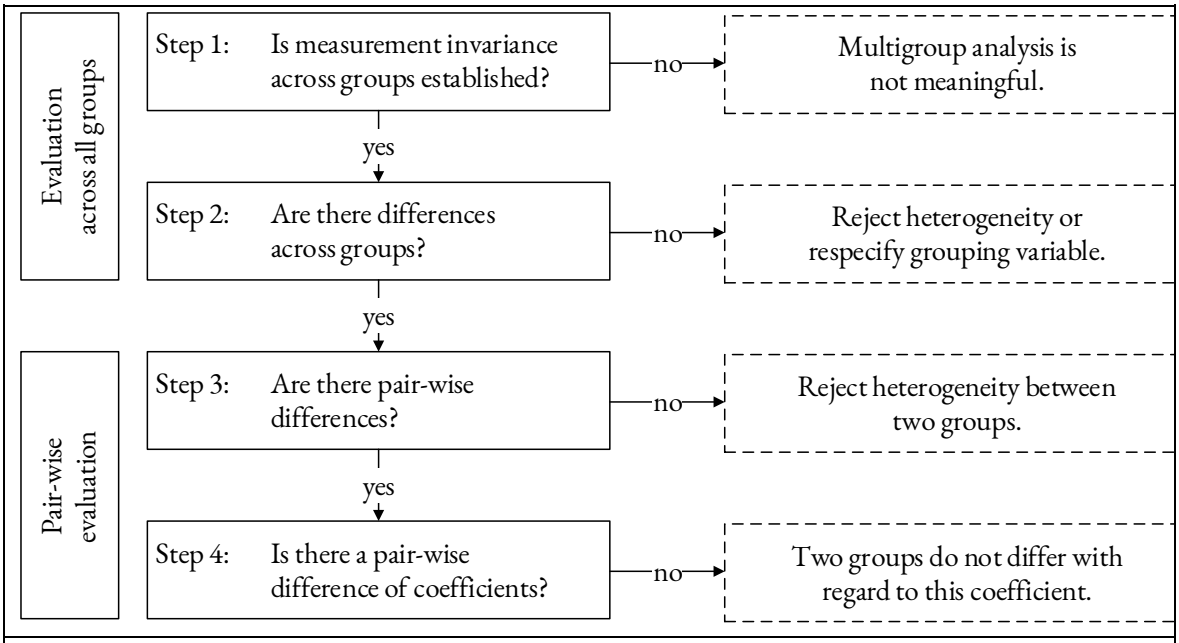

Figure 16.2 A Comprehensive Test Procedure for MGA

16.6 Limitations and Outlook

This paper presents initial insights into the efficacy of the tests for the comparison of the model-implied indicators' correlation matrices across groups, while other questions remain unanswered and should be addressed by future research. The simulation study should be extended to further investigate the tests' performance. Important extensions include the consideration of unequal group sizes, a population model with a non-saturated structural model, and path coefficients with positive and negative signs. Moreover, since PLS-PM is a composite-based estimator that can be used to estimate models containing both composites and factors, future research could further investigate the performance of our proposed tests for that type of model. We argue that the permutation tests should be based on the model-implied indicators' correlation matrix to compare the whole model across groups. However, the permutation tests may also be based on other matrices, such as the model-implied constructs' correlation matrix, so that differences in only the structural model are investigated across groups. We chose to utilize two established distance measures, namely, the squared Euclidean distance and the geodesic distance. Since the literature provides several other distance measures that may also be useful (Deza and Deza 2016), future research could compare their performance in the context of our proposed testing procedure. Because PLSc (Dijkstra and Henseler 2015a) encourages the use of PLS-PM for factor models, it also seems necessary to compare the test's performance to the performance of tests typically used in

factor-based SEM. Finally, although not explicitly emphasized, our tests for multigroup comparison are of a confirmatory nature. Hence, it should be used with caution when applied to groups created by cluster analysis or similar techniques.

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16.9 Appendix: FWER in Multiple Comparison Scenarios

Assuming that we have a fixed number of groups with a fixed number of parameters, the total number of comparisons can be determined according to Equation 1. Performing multiple comparisons without correction for type I errors results in a $1-(1-\alpha)^c$ FWER, where c is the total number of comparisons and α is the predefined significance level for each comparison.

Number of groups	Number of parameters	Total number of comparisons (c)	FWER (α =5%)
2	4	4	18.55%
	8	8	33.66%
	10	10	40.13%
3	4	12	45.96%
	8	24	70.80%
	10	30	78.54%
4	4	24	70.80%
	8	48	91.47%
	10	60	95.39%
5	4	40	87.15%
	8	80	98.35%
	10	100	99.41%

Table 16.5 FWER in MGA