Working after hours, sharing availability expectations, and interrupting yourself: Extending perspectives on ICT-related concepts in research

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Abstract/ Zusammenfassung

This dissertation investigates Information and Communication Technologies (ICTs) and their role for recovery, well-being, and performance at work. The three empirical studies compiled in this dissertation investigate the influence of ICT work-related use at work and at home, as well as supervisors' expectations regarding extended availability. The three main goals of the dissertation were to explore alternative ways of understanding ICT-related concepts, to identify additional factors that change their impact and the way they can be managed, and to implement methodological research designs that allow for an appropriate and thorough investigation of our research questions. The first study examines the temporal relationship between work-related ICT use and detachment from work with a cross-lagged panel diary study. The second study focuses on supervisors' expectations regarding availability and concludes that explicitly sharing expectations is beneficial for subordinates. The third study differentiates between internal and external interruptions on a conceptual level and based on this, investigates their different impact on task performance in two laboratory experiments.

Die hier vorliegende Dissertation beschäftigt sich mit dem Einfluss von Informations- und Kommunikationstechnologien (IKT) auf die Erholung, das Wohlbefinden und die Arbeitsleistung von Wissensarbeitern. Die Arbeit setzt sich aus drei empirischen Studien zusammen, die den Einfluss von arbeitsbezogener IKT-Nutzung bei der Arbeit und am Feierabend, sowie die Erwartungen von Führungskräften, dass Mitarbeiter durch IKT erreichbar bleiben, untersuchen. Eines der zentralen Ziele der Dissertation ist, die herkömmlichen Perspektiven auf IKT um alternative Prozesse oder Sichtweisen zu ergänzen. Darüber hinaus werden zusätzliche Faktoren identifiziert, die den Einfluss von IKT verändern. Weiterhin werden in den drei Studien Forschungsmethoden eingesetzt, mit denen die gestellten Forschungsfragen adäquat und gründlich bearbeitet werden können. Die erste Studie ermittelt

die zeitliche Beziehung zwischen arbeitsbezogener IKT-Nutzung und dem Abschalten von der Arbeit. Die zweite Studie konzentriert sich auf die Erwartungen von Führungskräften bezüglich der Erreichbarkeit ihrer Mitarbeiter und legt nahe, dass eine explizite Kommunikation dieser Erwartungen hilfreich für die Mitarbeiter ist. Die dritte Studie differenziert auf konzeptueller Ebene zwischen internen und externen Unterbrechungen und untersucht basierend auf diesen Unterschieden ihren unterschiedlichen Einfluss auf die Leistung in zwei Laborexperimenten.

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ICT(s)……**I**nformation and **C**ommunication **T**echnolog(y/ies)

1. Introduction

"Managers routinely overload their subordinates, contact them outside of business hours, and make last-minute requests for additional work. To satisfy those demands, employees arrive early, stay late, pull all-nighters, work weekends, and remain tied to their electronic devices 24/7. And those who are unable—or unwilling—to respond typically get penalized" (Reid & Ramarajan, 2016, p. 86).

Information and communication technologies (ICTs) have fundamentally changed the way knowledge workers communicate, collaborate and work. ICTs enable knowledge workers to access and share "any information, any time, and [from] any place" (David et al., 2014, p. 73), allowing them to work remotely and to adjust their work schedule to their own preferences and needs. However, while the increased flexibility and accessibility are appreciated by many knowledge workers, ICTs are often described as a "double-edged sword" (e.g., Diaz, Chiaburu, Zimmerman, & Boswell, 2012). This is because of the same features that make them so useful in a work context – they enable accessibility and connectedness from any location and at any time. For this reason, many knowledge workers are constantly connected to their workplace and are apparently available for requests from supervisors, colleagues and customers on weeknights, weekends and even while on vacation (Hassler, Rau, Hupfeld, & Paridon, 2016). Moreover, ICTs have increased interruptions at work, making it increasingly difficult for knowledge workers to focus on their work tasks without being interrupted or interrupting themselves (Adler & Benbunan-Fich, 2013; Baethge & Rigotti, 2013; Baethge, Rigotti, & Roe, 2015). Of particular prevalence are research studies addressing the effect of extended availability and work-related ICT use on recovery (Derks, ten Brummelhuis, Zecic, & Bakker, 2014; Derks, van Mierlo, & Schmitz, 2014; Park, Fritz, & Jex, 2011) and work-home interferences (Boswell & Olson-Buchanan, 2007; Derks, van Duin, Tims, & Bakker,

2015; Diaz et al., 2012). When it comes to the impact of interruptions, performance and affect are important outcome variables (Baethge & Rigotti, 2013; Bailey & Konstan, 2006). From these studies, we have mostly gained insight into the risk ICTs might pose for individuals. In fact, the above quote by Reid and Ramarajan (2016) summarizes the current research consensus regarding work-related ICT use and extended availability quite well. While studies focusing on the risks and detrimental consequences of ICT-related concepts are abundant, there are currently not many studies highlighting the positive sides of ICTs. For example, being able to work remotely via ICT allows individuals to attend to private obligations. They also enable colleagues to exchange ideas or information easily and independent from each other's location, ranging from a short one-time interaction after an important event to sustained collaboration in a global work group. Needless to say, as there are positive and negative sides to ICT-related concepts (Diaz et al., 2012) it is necessary to also investigate context factors and conditions under which ICTs are helpful or beneficial for employees to provide a more balanced picture.

1.1 Key Terms and Definitions

To facilitate the reading of this dissertation, a few key terms need to be explained first.

Work-related ICT use. The use of any kind of ICT (e.g. notebooks, smartphones, tablets) for a wide range of work tasks and for communication with work-related contacts. Put differently, work-related ICT use encompasses all work-related behaviors that are executed with the help of any kind of ICT.

Integration and segmentation. Integration and segmentation preferences and norms are terms coined in boundary theory (Ashforth, Kreiner, & Fugate, 2000). An integration preference describes the preference of an individual to mesh work and life domains, whereas a segmentation preference describes the preference to keep life domains separated. Aside from

individual preferences, certain norms regarding the integration-segmentation continuum also apply to organizations. While some workplaces lean towards an integration of work into private life and vice versa, at others a segmentation of life domains is practiced. In workplaces with stronger integration norms, it is the norm for employees to stay connected to work outside of regular work hours, while stronger segmentation norms encourage employees to leave work at the office (Derks, van Mierlo et al., 2014; Kreiner, 2006; Park et al., 2011).

Availability expectations. Availability expectations or ICT demands describe employees' perception of the amount of availability that is expected of them by their organization, supervisor, and colleagues (Day, Paquet, Scott, & Hambley, 2012). This is strongly connected to the segmentation / integration norms of the organization and the team, with stronger integration norms being associated with stronger availability expectations.

External and internal interruptions. External interruptions can be defined as uncontrollable, unpredictable events that shift the attention from a primary task toward the interruption (Speier, Vessey, & Valacich, 2003). For internal interruptions, the attention also shifts from a primary task to a different one, but this shift is self-initiated and under personal control (Jett & George, 2003).

1.2 Work-Related ICT Use Outside of Regular Work Hours

Using ICTs to work outside of regular work hours has become pervasive (American Psychological Association, 2013). As already mentioned, work-related ICT use is often discussed as a double-edged sword (Diaz et al., 2012) since the same features that make ICTs so useful for modern knowledge work represent the risks that are associated with them. By using ICTs, the boundaries between life domains become more permeable. In a work context, they enable users to share and access information and to communicate and be available

independent from their current location. As a consequence, by using these technologies employees experience increased flexibility (Diaz et al., 2012) and the ability to work independent from their location (Middleton & Cukier, 2006). Still, this permeability also comes with certain risks for employees since work problems and pressing issues can easily spill over into the home domain. In fact, with few exceptions (Derks, Bakker, Peters, & van Wingerden, 2016; Derks, ten Brummelhuis et al., 2014) research concludes that work-related ICT use from home increases work – home interferences (Boswell & Olson-Buchanan, 2007; Derks & Bakker, 2014; Fenner & Renn, 2010; Olson-Buchanan & Boswell, 2006; Wright et al., 2014) and impairs detachment and recovery (Derks, ten Brummelhuis et al., 2014; Derks, van Mierlo et al., 2014; Ohly & Latour, 2014; Park et al., 2011). Some studies also report a negative impact on other health and well-being outcomes, for example sleep quality, engagement (Lanaj, Johnson, & Barnes, 2014), and burnout (Day et al., 2012).

1.3 The Role of Availability Expectations

The impact of ICTs extends their actual use for work after hours. When organizations provide their employees with ICT, this apparent benefit comes with certain expectations regarding availability and supplemental work from home. However, in Germany some organizations have tried to counterbalance excessive availability expectations and high integration norms by introducing formal procedures to limit ICT-mediated communication after hours. VW is an often-quoted example for this solution, where for certain employees, email servers are disconnected after standard work hours. While there are arguments that can be made for formally regulating availability, implementing formal boundaries removes some of the benefits of ICT as well – in a way throwing out the baby with the bathwater. While most organizations do not provide their employees with formal guidelines and regulations regarding

extended availability (Leonardi, Treem, & Jackson, 2010), certain availability and communication norms establish themselves in organizations and work teams and are learned by their members in implicit ways (Derks et al., 2015). As was already introduced earlier, these social norms can vary on a continuum ranging from strict segmentation to complete integration of life domains (Ashforth et al., 2000), with many organizations increasingly moving towards integration. The degree of integration that is expected of employees has certain consequences for the way they can meet and balance the demands from work and other life domains. With strong integration norms, employees are expected to stay connected to and available for work outside of regular work hours which restricts the opportunities they have to fully detach from work (Barber & Jenkins, 2014; Barber & Santuzzi, 2015; Derks, van Mierlo et al., 2014), and engage in recovery activities. High availability expectations and integration norms are further associated with more work home interferences (Chen, Powell, & Greenhaus, 2009; Gadeyne, Verbruggen, Delanoeije, & Cooman, 2018; Kreiner, 2006; Park et al., 2011) since work problems and pressing issues can easily spill over into the home domain because of the high permeability of boundaries. While research on availability expectations is still in its initial phase, it seems that supervisors play a crucial role for the way employees perceive availability expectations. For example, how supervisors manage the boundaries between work and life influences employees' perceptions of how much availability and integration is expected from them (Koch & Binnewies, 2015). For this reason, Derks et al. (2015) encourage supervisors to share their expectations explicitly with employees.

1.4 The Impact of External and Internal Interruptions on Work

As most knowledge workers accomplish many of their work tasks by using ICTs, for example to send emails and to use work-related instant messenger services, these technologies

are pervasive in modern workplaces. As useful as they are to enable seamless communication and the sharing of information, they are also a major cause for external and internal interruptions and the "constant, constant multi-tasking craziness" (González & Mark, 2004, p. 113). The negative impact of external interruptions on performance and well-being is well-documented. External interruptions increase time pressure and lead to the use of suboptimal strategies and ultimately result in worse performance and heightened stress (Baethge & Rigotti, 2013; Speier et al., 2003). Those effects are even more pronounces for cumulative interruptions and interruptions during complex tasks (Baethge et al., 2015; Speier et al., 2003). For internal interruptions many questions about their causes and their impact on performance and well-being remain unresolved as they are more difficult to investigate (Baethge et al., 2015). However, one potential advantage of internal interruptions is that individuals can control their timing and thus choose times when switching to a different task does not lead to increased stress or time pressure (Jett & George, 2003). Nevertheless, research often views all types of interruptions as negative. Therefore, it is commonly advised that employees focus on one task at a time and avoid all interruptions.

One exception for this somber view on interruptions can be found in the task switching literature focusing on creative tasks and decision-making. Here it is assumed that while the attention is focused on a secondary task, unconscious processes are set into motion that can help the individual to gain insight into a problem, to come up with new creative ideas, or to get unstuck (Dijksterhuis & Meurs, 2006; Lu, Akinola, & Mason, 2017).

1.5 Purpose of this Dissertation and Research Questions

This dissertation pursues three main goals, which will be discussed in the following sections. The first goal of this dissertation was to explore alternative ways of looking at ICT-

related concepts, by taking a closer look at the underlying process, shifting the focus of observation, or investigating alternative concepts. Second, this dissertation aims to identify additional situational or context factors that alleviate or reverse potential negative effects. The third goal was to implement research designs in all three studies that are an improvement of the designs used in prior studies. Thereby this dissertation advances our understanding of ICT-related concepts empirically and methodically. While research has established a good knowledge base about ICTs role in the workplace, and we have made significant progress in what we know about the effects and underlying processes, several issues remain underexplored. Based on the results of the studies compiled in this dissertation, the findings on work-related ICT use in the work domain and the home domain are connected with the findings on the boundary-spanning aspect of ICT to discuss the overlaps and transferable findings (see also Figure 1).
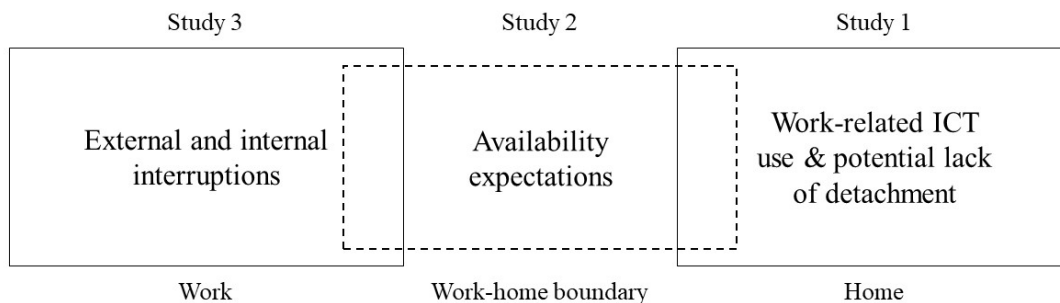
Figure 1. Connection between the three studies.

First, most studies on ICT-related concepts focus on the detrimental effects on health and well-being. Only a few studies offer a more nuanced picture of effects or explore the upsides of using ICTs. Thus, there is currently a lack of empirical studies that are designed to offer alternative ways of understanding ICT-related concepts. For this reason, the first goal of this dissertation was to present alternative ways of looking at ICT-related concepts.

In Study 1, we did so by proposing that work-related ICT use can be understood as a behavior caused by underlying work stressors and low detachment. We then investigated the temporal relationship between work-related ICT use and detachment, to explore if the conventional classification of ICT use as a work stressor or as our alternative perspective of work-related ICT use as a behavioral consequence of underlying work stressors was appropriate.

In Study 2, we investigated availability expectations with a focus on the supervisor instead of the organizational perspective that has been used in prior studies. Examining availability expectations with a focus on the leadership is important to lay the groundwork for behavioral recommendations for supervisors. While many studies have contributed to the organizational and individual perspective on availability expectations, studies that more specifically focus on supervisors have been rare so far (for an exception, see Derks et al., 2015). For example, this study was designed to identify ways in which availability expectations can be managed effectively by supervisors themselves. To do so, Study 2 follows up on Derks et al. (2015) recommendation that supervisors communicate their expectations explicitly to their subordinates to alleviate negative effects. We developed and evaluated an intervention and thereby examine the effectiveness of sharing expectations transparently with subordinates.

Finally, when it comes to ICT use and interruptions at the office, most studies have focused on external interruptions, even though internal interruptions account for a significant percentage of task switches. A recent study by Dabbish, Mark, and Gonzalez (2011) is still an exception when it comes to investigating internal interruptions empirically but did not determine the impact of internal interruptions on task performance. In Study 3, we aimed at taking a first step to better understand the consequences of internal interruptions for task performance. We proposed that they would positively affect performance on two typical knowledge worker tasks. Thus, we conducted two laboratory experiments, in which

participants completed a creative task (Study 3a) and a planning task (Study 3b) while initiating an internal interruption during task execution. We also explored two alternative processes by which this positive impact could be explained by comparing an energy-management process with a task control process. Task switches have not consistently been shown to replenish energy resources in prior studies (Fritz, Lam, & Spreitzer, 2011; Zacher, Brailsford, & Parker, 2014). We explored a task control process to introduce an alternative explanatory approach to the energy management process.

Second, we currently know little about situational and context factors that make ICT use beneficial or alleviate potential risks. Prior studies have identified some person-level characteristics that alleviate negative effects of work-related ICT use and availability expectations. For research on interruptions, certain situational factors and task characteristics that moderate effects have been identified, but little attention has been paid to the type of interruption. Thus, for interruptions, we aimed to focus on the conceptual differences between types of interruptions as a potential influence.

In Study 1, we examined if the task ICTs are used for influences outcomes. Past research has shown that, if the individual sets boundaries and priorities and uses ICT autonomously motivated this seem to alleviate the detrimental impact of using ICTs to work after hours (Barber & Jenkins, 2014; Fenner & Renn, 2010; Ohly & Latour, 2014). We proposed that the characteristics of the task itself could impact if work-related ICT use comes with benefits. A qualitative study by Barley, Meyerson, and Grodal (2011) suggests that ICTs help employees cope with feelings of overload. Further, as the facilitation of goal attainment is ascribed to job resources (Bakker & Demerouti, 2007), ICT could be used in a way that buffers the negative impact of work stressors if using ICT can help employees to deal with them. Specifically, we investigated if using ICT would help employees to make progress on unfinished tasks over the course of an evening and thus be linked to goal attainment. Weigelt and Syrek (2017) found

that task progress through supplemental work over the weekend alleviated the negative effects of unfinished tasks on detachment. By first identifying more general tasks and situations in which work-related ICT use is beneficial for employees, with time we can also identify the more specific context factors that influence the impact of work-related ICT use.

In Study 2a we investigated if the way in which availability expectations are communicated has an impact on well-being. It has already been shown that a preference for integrating life domains can buffer the relationship between work-related ICT use and work home interferences, but only when the work environment is characterized by a segmentation norm (Gadeyne, et al., 2018). However, personal preferences and organizational norms are relatively stable and not under the personal control of supervisors. Since the way in which supervisors share their expectations with subordinates can be easily changed, we proposed that the ambiguity of the expectation impacts well-being in addition to the extent of supervisors' availability expectations. Our goal was to gather evidence for the usefulness of making expectations more explicit, to form a foundation for the intervention we conducted in Study 2b that was based on suggestions by Derks et al. (2015).

In Study 3, we examined if the conceptual differences of internal and external interruptions can be used to explain their different impact. We already know that the complexity of the primary task (e.g., Speier et al., 2003) and the timing of the interruption (e.g., Adamczyk & Bailey, 2004; Bailey & Konstan, 2006) moderate the negative effect of the interruptions. Additionally, some studies have found that for creative tasks external interruptions can be beneficial (e.g., Dijksterhuis & Meurs, 2006). Still, few studies have investigated if the conceptual type of interruption impacts the consequences of the interruption. We thus applied action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005) to internal and external interruptions to formulate theory-derived expectations for their effect on performance and perceived task control and explain their different impact on the action process.

Third, most studies on ICT-related concepts have used research designs that do not allow conclusions about causality. Consequently, the third goal of this dissertation was to implement appropriate research designs that allow us to draw conclusions about causal effects or make steps towards causal conclusions.

In Study 1, we addressed the issue of causality between work-related ICT use and detachment by conducting a cross-lagged panel diary study. Since prior studies assessed work-related ICT use and detachment at the same time point, we concluded that drawing causal conclusions was a bit premature and that the effects of work-related ICT use are confounded with its source. With cross-lagged panel designs, researchers cannot draw causal conclusions as confidently as with experimental designs, but they allow for an untangling of both possible effects, thus providing a better understanding of the relationship between work-related ICT use and detachment (Finkel, 1995; Zapf, Dormann, & Frese, 1996). Research to date had mostly applied the stressor-detachment model (Sonnentag & Fritz, 2015) to work-related ICT use after hours (Barber & Jenkins, 2014; Derks, ten Brummelhuis et al., 2014). In the context of this framework work-related ICT use is assumed to be the stressor that impairs detachment and well-being. To the best of our knowledge, no studies have suggested a reversed relationship. However, in a comprehensive review of the stressor-detachment model Sonnentag and Fritz (2015) mention that failing to detach might go hand in hand with certain work-related behaviors, for example when employees try to solve a work problem they cannot stop thinking about. From this perspective, engaging in work-related ICT use might not be framed as the stressor, but instead ICTs could be the tool employees use to deal with underlying work factors, for example a high workload or unfinished tasks. Thus, a cross-lagged panel diary design allowed us to untangle both alternative effects.

Regarding Study 2, we conducted workshops encouraging supervisors to communicate their availability expectations to their subordinates and evaluated this intervention by collecting

data from supervisors' subordinates before and after the intervention. We examine the effect of the intervention on *Behavior* criteria (if supervisors communicated expectations to their subordinates) and *Results* criteria (ICT-related outcomes, as well as broader well-being outcomes). By assessing all variables before and after the intervention, we examined if changing the way in which availability expectations are communicated affects the outcome variables. According to Kirkpatrick (1976), *Behavior* and *Results* criteria are more advanced evaluation criteria than simply measuring participants satisfaction with the intervention. A common problem of intervention studies is the difficulty of implementing completely controlled study designs (Cox, Karanika, Griffiths, & Houdmont, 2007). Thus, as we were not able to include a control group in our study, we again cannot make causal claims as confidently as with an experimental design. Still, collecting data before and after the intervention, using different sources than workshop participants themselves, and measuring *Behavior* and *Results* criteria are major methodological strengths of the evaluation. Doing so goes beyond the efforts of most intervention studies in a work context (e.g., Arthur, Bennett, Edens, & Bell, 2003; Sitzmann, Brown, Casper, Ely, & Zimmerman, 2008).

Finally, for Study 3, we formulated theory-derived expectations for the effect of internal and external interruptions on performance, energy levels, and perceived task control. Moreover, we empirically investigated internal and external interruptions alongside each other, to be able to directly compare their effects on performance using two common knowledge work tasks in a two laboratory experiments (a creative task in Study 3a and a planning task in Study 3b). By using fully controlled environments, we can conclude that the difference in performance between our experimental groups can be traced back to the different type of interruption in both groups.

In summary, in this dissertation we examine the following key research questions:

- When looking at same-evening effects, does work-related ICT use lead to impaired detachment or does low detachment lead to work-related ICT use? (Study 1)

- Are unfinished tasks an example for an underlying work stressor where work-related ICT use could potentially be beneficial as it contributes to goal achievement? (Study 1)

- Is the ambiguity of availability expectations relevant for employees' well-being? (Study 2a) And if yes, when supervisors make availability expectations more transparent, does this change ICT-related variables and well-being outcomes for subordinates? (Study 2b)

- What are the conceptual differences between internal and external interruptions? What are the consequences of these differences for their impact on performance? (Study 3)

- Do internal interruptions positively impact performance for a creative task (Study 3a) and a planning task (Study 3b)? Do internal interruptions also show a more positive impact on performance for tasks where a positive impact of external interruptions can be expected (namely, creative tasks)?

Hence, this dissertation evaluates the consequences of ICT use in and between different life domains. We explore the consequences of work-related ICT use at home in Study 1, focus on the boundary-spanning aspect of availability expectations in Study 2, and finally also explore internal interruptions at work as a phenomenon that is associated with the increasing use of ICTs and their distracting qualities in modern knowledge work in Study 3.

1.6 Summary of the Studies Compiled in this Dissertation

1.6.1 Study 1: When thinking about work makes employees reach for their devices. A cross-lagged panel diary study

Previous research assumed that work-related ICT use impairs psychological detachment from work. However, since past studies assessed both variables cross-sectionally, little is known about the actual direction of effects. For this 5-day diary study we implemented a cross-lagged panel design to shed light on the relationship between work-related ICT use and detachment ($N = 211$ employees, $N = 2816$ data points). We also investigated unfinished work tasks as we assume that effects of work-related ICT use are often confounded with underlying work stressor. Contrary to current research consensus we found that psychological detachment was related to an increase in work-related ICT use, but not vice versa. Furthermore, our results support the notion that unfinished work tasks precede both variables and work-related ICT use contributes to progress made on these tasks. Our findings suggest that work-related ICT use should not be treated as a stressor. Instead it needs to be investigated as a behavior that employees engage in when they cannot detach from work.

1.6.2 Study 2: "Dear manager, now I know what you expect": An intervention targeting supervisors to establish clear availability expectations

Research on organizational availability expectations has rarely differentiated between the expectations from different sources. In one cross-sectional study (n = 235) and one intervention study (n = 33) we focused specifically on the effect of supervisors' availability expectations on subordinates and assessed the ambiguity of these expectations as an additional attribute. We proposed that availability ambiguity would individually contribute to the negative impact of availability expectations. In our first study, we demonstrated that ambiguity contributed to

satisfaction with communication via ICT, detachment, and work home interference in addition to the extent of availability expectations. As few subordinates reported that expectations were openly communicated to them (Study 2a), we focused on this aspect in a second study (Study 2b). During a half-day intervention, we educated supervisors about the impact of after hour ICT use and extended availability and encouraged them to make expectations transparent to their subordinates. We collected data from 33 subordinates one week before and six weeks after the intervention. Perceived availability expectations decreased after the intervention and satisfaction with ICT communication increased. Availability ambiguity was only affected when supervisors explicitly shared their expectations with subordinates.

1.6.3 Study 3: Interrupt yourself! When it comes to creative and planning performance switching tasks at your own pace beats concentrated and externally interrupted work

Employees experience frequent interruptions during work. Interruptions can be external (e.g. receiving a call) or internal (e.g. being stuck and switching to another task). Based on action-regulation theory and research on energy management and task autonomy we proposed a different impact of both types of interruptions on performance for different tasks. We expected an internal interruption to consistently improve performance, and an external interruption to improve creative performance and to impair planning performance. We also examined if both types of interruptions affect energy levels and perceived autonomy to gain insight into the process by which interruptions affect performance. To investigate our hypotheses, we conducted two laboratory experiments with a 1x3 design. In our first experiment, participants (N=137) conducted a creative task (Study 3a). In our second experiment, we focused on a planning task (N=223; Study 3b). Contrast analysis revealed that compared to the control group the internal interruption affected performance positively in both

tasks. However, on both tasks the external interruption group did not perform differently from the control group and did only perform worse than the internal interruption group on the planning task. Moreover, task autonomy but not energy is differently affected by the type of interruption which indicates that interruptions affect performance through a process based on perceived task autonomy. Overall, our research emphasizes the importance of distinguishing between external and internal interruptions in future studies as they differently affect various outcomes.

Taken together, the three studies compiled in this dissertation extend our knowledge on the more positive aspects of ICT-related concepts and ways in which potential risks can be alleviated and managed. In the first study, we dissolve concerns that work-related ICT use after hours always comes with negative consequences for employees' recovery. In the second study, we explore how supervisors can compensate for high availability expectations by making them more transparent. In the third study, we show that internal interruptions can positively impact performance and therefor do not deserve the negative reputation of external interruptions. A second goal of this dissertation was to investigate work-related ICT use with methods or from perspectives that have been underused in research so far, by conducting a cross-lagged panel diary study to investigate directional effects, by focusing on supervisors as an important source if availability expectations, and by using more advanced evaluation criteria (*Behavior* and *Results*; Kirkpatrick, 1976) to investigate the effectiveness of an intervention directed at supervisors' availability expectations.

Parts of the studies in this dissertation were conducted in close collaboration with coauthors (for more details regarding the specific contribution in each study see Table A3 in the Appendix. In order to avoid inconsistencies in style due to different personal pronouns, the plural will be used throughout the three studies of this dissertation.

2. Study 1: When Thinking About Work Makes Employees Reach for Their Devices. A Cross-Lagged Panel Diary Study

2.1 Introduction

Work-related information and communication technology (ICT) use has been widely painted as a factor adding to already high employee stress and impairing employee recovery even outside of regular working hours. In fact, scholars have not tired from pointing out the risks ICT might bring to the home domain as well as the workplace (Boswell & Olson-Buchanan, 2007; Derks et al., 2015; Lanaj et al., 2014; Park et al., 2011). Still, many employees appreciate the flexibility these technologies offer and evaluate their use favorably (Harter, Agrawal, & Sorenson, 2014; Middleton, 2008). Considering that work-related ICT use during leisure time is increasingly pervasive (American Psychological Association, 2013), it seems important to improve our understanding of the processes through which work-related ICT use affects employee recovery and well-being.

Current research largely categorizes work-related ICT use as a work stressor assuming that it hinders detachment and consequently impairs well-being (Derks, van Mierlo et al., 2014; Lanaj et al., 2014; Ohly & Latour, 2014). Detachment can be defined as the sense of being away from the work situation physically and mentally (Etzion, Eden, & Lapidot, 1998; Sonnentag & Fritz, 2007). We will discuss the theoretical arguments and some empirical evidence supporting the negative effect of ICT use on detachment in the following section of this paper. However, Sonnentag and Fritz (2015) mention that impaired detachment goes hand in hand with certain behaviors, such as engaging in work-related activities. It can thus be assumed that employees engage in work-related ICT use when detachment is low, which reverses the assumed effect. Currently, there is a lack of studies investigating the actual temporal order of detachment and work-related ICT use after hours. For this reason, it is not

yet possible to confidently make declarations about the consequences of work-related ICT use and to support its treatment as a work stressor. A better understanding of the nature and outcomes of ICT use is important in theoretical and practical terms, e.g. to be able to design appropriate interventions. Only if ICT use is responsible for negative outcomes, measures need to be taken to limit it. For example, a recently established French law regulating work-related email communication after hours (Bersay Associes, 2017; Legifrance, n.d.) would only be an appropriate measure if work-related ICT use is indeed the cause of impaired detachment and in the long run detrimental to well-being.

One possible explanation for the negative view of work-related ICT use in psychological research can be found in the stressor-detachment model (Sonnentag & Fritz, 2015), as it is commonly used to explain the process by which various job stressors impair health and well-being. In this model it is assumed that when employees are exposed to stressors during their time at work it is more difficult for them to detach properly, which then keeps their strain levels elevated and leads to insufficient recovery and further negative health and well-being outcomes (Sonnentag & Fritz, 2015). Since early research on work-related ICT use focused on potential negative outcomes, the stressor-detachment model provided an appropriate theoretical framework. Therefore, the relationship between work-related ICT use and detachment is frequently investigated (Barber & Jenkins, 2014; Derks, ten Brummelhuis, et al., 2014; Ohly & Latour, 2014; Park et al., 2011). While we agree with the well-established assumption that exposure to work stressors makes it more difficult to detach from work, we argue that work-related ICT use is not a work stressor. Instead we argue that the negative relationships of work-related ICT use with recovery and well-being are driven by work stressors like a high workload and unfinished work tasks that result in work-related ICT use and negatively impact recovery. Thus, the effects of work-related ICT use are confounded with

its source. Therefore, work-related ICT use can be classified as a behavioral consequence of certain work stressors and insufficient detachment (Sonnentag & Fritz, 2015).

Our main goal for this study is to clarify how work-related ICT use and detachment are temporally connected on a day-level by using a cross-lagged panel diary design. This design involves measuring detachment and work-related ICT use after hours twice over the course of an evening for one work week. Thereby, it is possible to compare the two possible causal claims between work-related ICT use and detachment while controlling for existing levels of either variable (Finkel, 1995; Zapf, Dormann, & Frese, 1996). While field experiments are better able to establish causality, cross-lagged panel designs have been lauded as the next-best method to improve our understanding of causality in field settings where experimental research is not feasible (Finkel, 1995; Zapf et al., 1996).
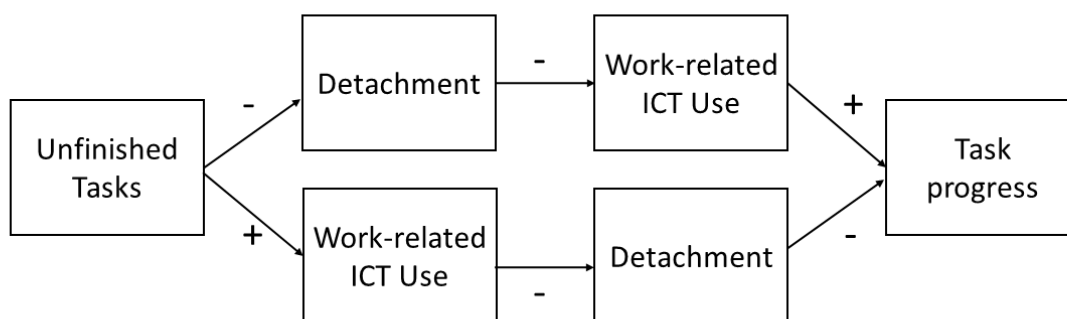
Figure 2. The conceptual model.

We directly compare the conventional process (ICT use as a stressor) with the alternative process (ICT use as a behavioral consequence; see Figure 2) to ensure a valid investigation with the goal of achieving a better understanding of the underlying process. The cross-lagged panel diary was appropriate (Ohly, Sonnentag, Niessen, & Zapf, 2010) since all

variables have been shown to fluctuate daily in prior research (Lanaj et al., 2014; Sonnentag & Bayer, 2005). By using this design, we can predict the change in both outcomes between the first and second measurement point. Further, to illustrate how a work stressor can potentially trigger the process, we focus on unfinished work tasks as an antecedent of both detachment and work-related ICT use. According to Syrek, Weigelt, Peifer, and Antoni (2017, p. 227) unfinished tasks "refer to tasks that the employee aimed to finish (or make certain progress [on]), but which were left undone (or left in an unsatisfactory state) when the employee stopped working". When employees have to leave unfinished work tasks behind, they are more likely to be mentally occupied with work (Syrek et al., 2017; Syrek & Antoni, 2014).

Taken together, this study makes three contributions to current research. First, the findings of our study can foster discussion about alternative ways of thinking about work-related ICT use, namely as a behavioral consequence of impaired detachment. So far, research has considered work-related ICT use after hours as job stressor and thus antecedent of impaired detachment. The cross-lagged panel diary design of this study allows for an untangling of both effects, thus providing a better understanding of the relationship between ICT use and detachment. Second, our study contributes to the detachment literature by investigating the consequences of (not) detaching from work, focusing on work-related ICT use and making progress on unfinished work tasks. By measuring detachment multiple times over the course of one evening we also investigate the dynamic aspects of the recovery process, addressing a call by Sonnentag, Venz, and Casper (2017). Third, we extend our current understanding of factors influencing work-related ICT use by examining unfinished tasks. We complement previous studies by showing how the daily level of work characteristics, namely unfinished tasks, affect the daily level of work-related ICT use and detachment. Empirically, we add to the literature by using a cross-lagged panel diary design to examine reciprocal links between detachment and ICT use.

2.1.1. Work-related ICT use as a double-edged sword

Work-related ICT use refers to all work-related behaviors that are executed with any kind of ICT. Employees spend an increasing amount of time using electronic devices like notebooks, smartphones, and tablets for a wide range of work tasks and to communicate with customers, supervisors and colleagues (David et al., 2014; Day, Scott, & Kelloway, 2010). The utilization of ICT facilitates work processes, since information is more accessible, tasks can be executed independent from location, and communication in a global workforce is made easier (Day et al., 2010; Diaz et al., 2012). An inherent feature of ICT is that it makes the boundaries between work and home more permeable and thereby enables the so-called integration of life domains (Ashforth et al., 2000). For example, by using ICT employees can answer client emails during their commute, prepare slides for a presentation from home, and efficiently schedule a meeting with an online tool. Employees who are able to access "any information, any time, and any place" (David et al., 2014, p. 73) can structure their working hours in a way that better suits their individual needs. Therefore, ICT can offer employees more flexibility and autonomy.

2.1.1.1 Work-related ICT use as a stressor. However, the risks of work-related ICT use outweigh the benefits when it spills over into leisure time. First, for employees who are equipped with ICT it is often difficult to maintain a segmentation of life domains as ICT makes the boundaries more permeable (Boswell & Olson-Buchanan, 2007; Park et al., 2011). When boundaries are more permeable, boundary transgressions are more frequent, which has been shown to impair detachment (Park et al., 2011) and to increase work-life conflict (Boswell & Olson-Buchanan, 2007; Park & Jex, 2011). Second, studies show that engaging in work-related ICT use after hours is negatively related to detachment and recovery (Derks et al., 2013; Ohly & Latour, 2014; Park et al., 2011), sleep quality (Lanaj et al., 2014), and positively to

work-life conflict (Derks & Bakker, 2014; Fenner & Renn, 2010; Wright et al., 2014). This relationship persists even when an employee evaluates a specific case of work-related ICT use as positive (Braukmann, Schmitt, Ďuranová, & Ohly, 2018). Third, being easily accessible via ICT also means that employees feel obligated to stay connected to work and respond quickly to incoming work communication (Barber & Santuzzi, 2015). Even when employees are not contacted, the pressure to be available alone has been shown to be detrimental to employees' health and well-being. For example, feeling that you are expected to stay available impairs recovery (Braukmann et al., 2018; Park et al., 2011), and increases work-life conflicts (Olson-Buchanan & Boswell, 2006), strain, and burnout (Day et al., 2012). Moreover, the relationship between work-related ICT use and well-being outcomes is stronger when organizational expectations regarding availability are higher (Derks et al., 2015) and weaker when organizational expectations are congruent with individual preferences (Chen et al., 2009). For these reasons, research has often described the utilization of ICT for work as a double-edged sword (Day et al., 2010; Day et al., 2012; Diaz et al., 2012).

Certain variables have been shown to buffer detrimental effects of work-related ICT use. For example, negative effects on well-being become nonsignificant for individuals with high job engagement and employees who use ICT for work out of autonomous motivation (Derks et al., 2015; Ohly & Latour, 2014). Setting boundaries and priorities for work-related ICT use after hours and getting ICT support from the organization also mitigate effects (Barber & Jenkins, 2014; Day et al., 2012; Fenner & Renn, 2010). Additionally, Derks et al. (2016) show that work-related ICT is unrelated to work-life conflicts for individuals preferring an integration of life domains. Several qualitative studies state that work-related ICT use during leisure time might have some benefits for employees, e.g. for coping with feelings of overload (Barley et al., 2011) and in dealing with work demands (Matusik & Mickel, 2011; Mazmanian,

Orlikowski, & Yates, 2006), but to the best of our knowledge this notion has not yet been tested in quantitative studies, and it thus remains an open question if ICT use has beneficial effects.

To summarize, the use of ICT for work after hours has often been regarded as a factor leading to impaired detachment and reduced well-being (Derks, van Mierlo et al., 2014; Lanaj et al., 2014; Ohly & Latour, 2014). Several studies suggest that ICT affects employees' ability to detach from work. Since "it is not sufficient for one to change location by leaving the working place; one must also take a break from thinking about work-related issues" (Sonnentag & Bayer, 2005, p. 395) it is not possible to engage in work-related activities and detach from work at the same time. Thus, we propose that when an employee uses ICT for work early in the evening, his or her level of detachment will decrease over the course of the evening.

Hypothesis 1: Over the course of one evening, the length of work-related ICT use affects the change in level of detachment.

2.1.1.2 Work-related ICT use as a neutral behavior. While current research classifies working via ICT as a dysfunctional behavior making detachment less likely (Ďuranová & Ohly, 2016), it can also simply be regarded as a behavior employees fall back on to deal with a high workload, to finish a nagging task, or to solve a problem that occupies their mind. From this perspective, the inability to fully detach from work plays a central role as it acts as a starting point to engage in work-related behaviors.

Properly detaching from work is central to the recovery process, but it can be difficult when an employee has been exposed to a high level of job stressors (e.g., time pressure or a high workload) during the workday (Berset, Elfering, Lüthy, Lüthi, & Semmer, 2011; Sonnentag & Bayer, 2005). Albeit, not being able to detach from work has been shown to negatively relate to well-being and health outcomes in numerous cross-sectional and

longitudinal studies (for reviews, see Sonnentag & Fritz, 2015; Wendsche & Lohmann-Haislah, 2017). While immediate behavioral consequences of detachment have been neglected in research so far, Sonnentag and Fritz (2015) specifically mention engaging in work-related activities as a potential consequence of impaired detachment. The availability of ICT might encourage engaging in these activities as they provide access to work-related information that would not otherwise be available and enable employees to work independent from their location (Park et al., 2011; Sonnentag, 2001). Without access to ICT, an employee who is unable to detach from work has less opportunities to engage in extensive work-related behavior from home. Hence, we conclude that employees might engage in work-related ICT use to deal with work tasks that make detachment difficult. For example, employees who are confronted with a tight deadline at work might know that they will be unable to switch off from work during the evening. They might then use ICT to finish certain tasks, to jot down a few ideas, or to get an overview over topics that need to be discussed the next day. The degree to which this behavior is functional or not is dependent on how work-related ICT is used (e.g., if goals and priorities were set for its use) and how much progress is achieved (Barber & Jenkins, 2014; Fenner & Renn, 2010).

Although the notion that work-related ICT use is itself a consequence of impaired detachment has been mostly unexplored, some studies interpret work-related ICT use differently than current research consensus. Several qualitative studies reason that employees use ICT to respond to work-related demands in a convenient way (Matusik & Mickel, 2011; Mazmanian et al., 2006) or to cope with work demands (Barley et al., 2011). As far as quantitative studies are concerned, Ohly and Latour (2014) show that a long duration of work-related ICT use can be detrimental, but not the use per se. They conclude that the use of ICT could be a helpful strategy to enhance detachment, for example when it helps employees to finish work tasks.

We thus propose that on days when an employee is not able to detach early in the evening, he or she will use work-related ICT use more over the course of the evening as the employee is more likely to engage in work-related behaviors.

Hypothesis 2: Over the course of one evening, the level of detachment negatively affects the change in an individual's length of work-related ICT use.

2.1.2 The role of unfinished tasks

Not being able to finish all work tasks is a common experience in modern work life. We argue that one reason why ICT use is associated with impaired well-being is because it is often a consequence of high workload and unfinished tasks which spill over into the home domain. Bringing job demands or stressful experiences at work into the home-domain via work-related ICT might pronounce the effects of these job stressors. They are often a result of high workload and lead to rumination and impaired sleep (Sonnentag & Kruel, 2006; Syrek et al., 2017; Syrek & Antoni, 2014). When employees are unable to finish work tasks, they find it difficult to disengage from work-related thoughts and cannot properly engage in recovery activities (Syrek et al., 2017; Syrek & Antoni, 2014; Weigelt & Syrek, 2017). As described above, engaging in work-related ICT use might be a behavioral consequence of facing unfinished work tasks. In this case, engaging in work-related activities might not necessarily impact recovery and well-being beyond the negative impact of reduced detachment. A qualitative study by Barley et al. (2011) even concluded that employees were able to increase their ability to cope with job demands by using e-mail. Additionally, Weigelt and Syrek (2017) show that making progress on unfinished tasks over the weekend by doing supplemental work alleviates some of the detrimental effects of unfinished tasks as it removes the stressor and fulfills a need for closure. Therefore, we argue that in situations in which employees are

confronted with unfinished work tasks, they can benefit from work-related ICT use after hours when they are able to make progress on or complete unfinished work tasks.

Following this argument, ICT provides a means to complete work tasks, but engaging in work-related ICT use is not inherently harmful. Based on this reasoning, we propose that on days when employees have to deal with a high level of unfinished tasks when finishing their work day, they will be less able to detach from work in the evening and will use work-related ICT more which relates to higher task progress.

Hypothesis 3a: In an evening with more unfinished tasks after work the level of detachment will be lower.

Hypothesis 3b: In an evening with more unfinished tasks after work the amount of work-related ICT use will be higher.

Hypothesis 4a: In an evening when individuals engage in longer work-related ICT use, they will make more progress on unfinished work tasks.

Hypothesis 4b: In an evening when individuals report high detachment, they will make less progress on unfinished work tasks.

We tested Hypotheses 1-4 in a diary study assessing unfinished tasks directly after work (T0), and detachment and ICT use 90 (T1) and 180 minutes (T2) later. Progress on unfinished tasks was measured at T2.

2.2 Method

2.2.1 Procedure and Participants

We commissioned a German market research company to invite members of their panel who a) qualified as knowledge workers, b) were full-time employees (defined as working 30 hours or more per week), c) were not on vacation for the two weeks prior to the diary study, d) were equipped with any ICT (e.g., smartphone, notebook) by their company, and e) owned an additional private smartphone. A private smartphone was a necessary precondition, as using a work phone to answer questionnaires would potentially create biases (e.g. by evoking work-related thoughts or by drawing attention to notifications about incoming work requests). The invited panel members first received a letter outlining the purpose of the study, detailing the requirements, and assuring the anonymity and confidentiality of all responses. The letter also contained instructions on how to participate. Volunteer participants filled out a screening questionnaire to assure they met the requirements. Eligible participants then completed a general online questionnaire with background information. Participants were asked to fill out three daily questionnaires over the course of five working days (15 daily questionnaires in total). They were instructed to fill out the first daily questionnaire each day when they were finishing up work (T0) to assess if there were any work tasks, they left unfinished. 90 minutes (T1) and 180 minutes (T2) after the first daily questionnaire. Notifications to fill out surveys were sent via a smartphone application. Participation could be delayed for a maximum of 60 minutes thus delaying the notification for the following survey for the same amount of time. We chose these time lags because a standard work day in Germany ends between 4pm and 6pm (Indeed, 2016), so that the second evening questionnaire was completed at the maximum 5 hours later between 9pm and 11pm. On average, the time lag between the start of the T0 and the start of the T1 questionnaire was 103.8 minutes ($SD = 14.84$); a similar time lag emerged for T1 and T2 ($M = 101.5$, $SD = 12.59$). As a reward for participating in the study and to

prevent drop out participants were only eligible for the compensation of 35€ once they completed the general and 12 out of the 15 daily questionnaires (80 %). Of the 435 participants who originally agreed to participate in the survey, 211 participants (48 %) fulfilled these requirements. In total, we received 2816 responses for the five-day study.

We examined if participants who dropped out during the course of the study were different from participants who fulfilled the required quota. No significant differences between the two groups in terms of gender, leadership status, age, work tenure, time spent in company and time spent in current position were found ($p > .05$). However, participants who dropped out of the study had a slightly higher preference for segmenting work from their private lives (dropped out: $M = 3.96$, $SD = .95$; completed: $M = 3.77$, $SD = .79$).

The final sample consists of 211 German knowledge workers from a wide range of industries and professions, such as marketing, consulting, management and research. Participants usually occupied more high-level positions with 78.6% holding a leadership position. Slightly more than half (54.5%) of our sample was male. Mean age of participants was 40.13 years ($SD = 10.3$). In total, 3.8% of the sample had a doctoral degree, 46.0% had a university degree, 26.1% had a high school degree, 22.3% had a middle school degree, and 1.4% had a general education secondary school degree. On average, participants had 18.3 years of work experience ($SD = 10.62$), and they had been working at their current company on average for 10.08 years ($SD = 7.53$). Average tenure at their current job was 6.3 years ($SD = 4.96$), average hours worked per day was 8.54 ($SD = .81$). Participants needed to be equipped with ICT by their employer. Most participants were equipped with a notebook (82%) and/or a smartphone (74.4%). Additionally, 34.6% of participants were equipped with a tablet.

2.2.2 Measures

We used abbreviated scales to reduce burden on our participants, consistent with recommendations by Ohly et al. (2010).

Unfinished tasks[1]. We measured unfinished tasks at the end of the workday before participants left the workplace (T0) with three out of six items from a scale developed by Syrek et al. (2017) that we adapted to refer to the day-level. Participants responded on a Likert-type rating scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item for this scale is: "I have not finished important tasks that I had planned to do today". Average reliability was $\lambda^2 = .85$. We excluded the three items that were not as suitable for assessing unfinished tasks on a day-level (e.g., "I have not finished a large amount of due tasks this week.").

Detachment[1]. We adapted three items from the four-item scale developed by Sonnentag and Fritz (2007) to refer to detachment during the timespan between measurement points. A sample item is: "In the time that has passed since answering the last questionnaire, I forgot about work" (1 = *strongly disagree* and 5 = *strongly agree*). Average reliability was $\lambda^2 = .94$ for T1 and $\lambda^2 = .95$ for T2. To shorten the scale, we excluded the fourth item ("I get a break from the demands of work") which had the lowest loading on the detachment factor in the study by Sonnentag and Fritz (2007).

ICT use. We asked participants to estimate the duration of their ICT use for work in the timespan between measurement points using the following item: „In the time that has passed since answering the last questionnaire how long did you use new technologies (e.g.,

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[1] Guttmans λ^2 is used as an indicator of scale reliability (Guttman, 1945). Cronbach's alpha requires tau-equivalence of items and uncorrelated residuals which is not the case in this study, and according to (Yang & Green, 2011) in most research.

smartphone, computer, tablet) for work?". Participants estimated the duration of work-related ICT use in minutes. If participants indicated that they did not use ICT, we coded the length of ICT use as zero minutes.

Task progress[1]. We adapted the three items from the scale by Syrek et al. (2017) we used to measure unfinished tasks to indicate task progress or task completion. Participants responded on a Likert-type rating scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item is: "I have finished important tasks that I had planned to do today but was not able to finish during work hours". Average reliability was $\lambda^2 = .90$.

2.2.3 Additional measures

Segmentation Preference[1]. We measured segmentation preference in the general questionnaire before the start of the diary study. We assessed segmentation preference with a German translation of an adaption of the four item-scale by Kreiner (2006). Participants responded on a rating scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item for this scale is: "'I don't like to have to think about work when I'm at home". Reliability was $\lambda^2 = .84$.

2.2.4 Analytical strategy

Since we assessed detachment and ICT use at both time-points this results in a cross-lagged panel diary design. In line with recommendations by Finkel (1995) and Little, Preacher, Selig, and Card (2007) we used structural equation modeling (SEM) to analyze the data. For analyses, we considered the structure of the data with repeated measures being nested within

individuals. We used Mplus, version 7.11 (Muthén & Muthén, 1998-2013) to estimate the models.

In our models, the three latent variables detachment, unfinished tasks, and task progress were represented by three manifest items each. ICT use was modelled as a manifest variable. To correctly specify a cross-lagged panel model, the part of this model representing the cross-lagged relationships with detachment and ICT use needs to include the correlation between the variables at T1; the stability of each construct between T1 and T2; and the two cross-lagged paths (Lang, Bliese, Lang, & Adler, 2011). The complete structural model is pictured in Figure 3. The cross-lagged panel diary design of this study made it necessary to include certain specifications for the measurement model. T1 error terms were allowed to correlate with their T2 counterparts for detachment. This assumption was made due to the short time lag between measurement points. We also allowed two indicators for detachment to correlate at both measurement points since their wording was very similar. To rule out between-person effects, we centered the predictor variables around each person's mean in all our analyses. Since the focus of our study was to investigate the relationships between variables on the day-level (Level 1) we did not include any Level 2 variables into our analyses.

Our specified model included unfinished tasks (T0), detachment (T1 and T2), ICT use (T1 and T2), and task progress (T2). We specified a model that included the stability coefficients as well as the cross-lagged structural path from T1 ICT use to T2 detachment as well as the cross-lagged structural path from T1 detachment to T2 ICT use, resulting in a full cross-lagged panel model.
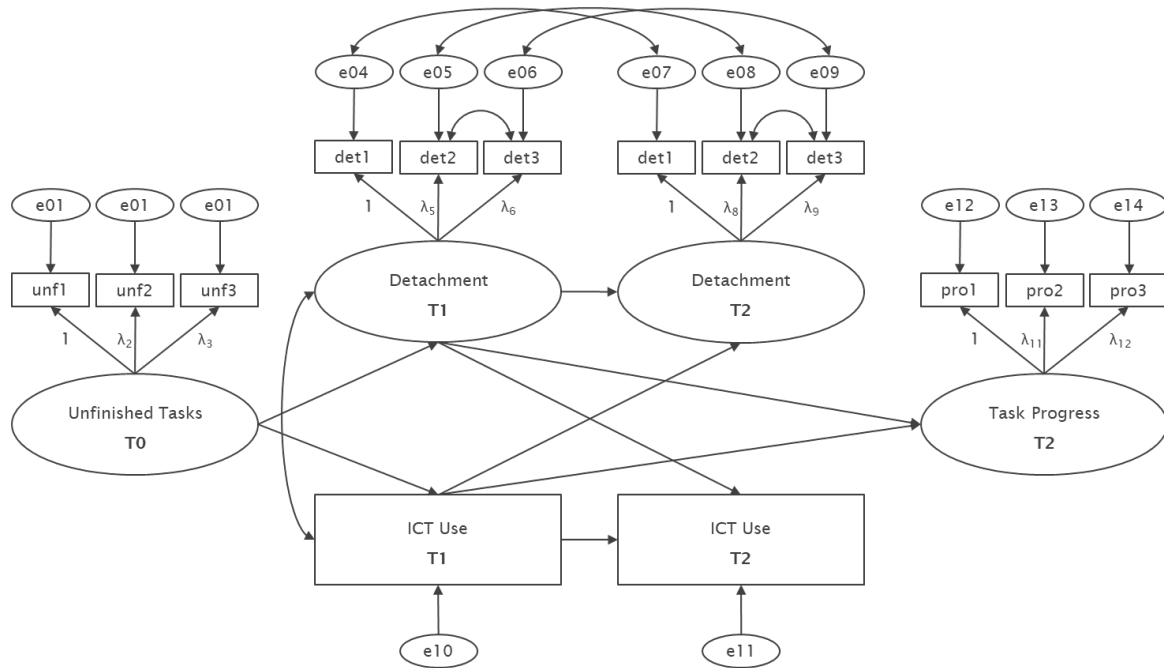
Figure 3. The complete structural model. T0 = Time 0; T1 = Time 1; T2 = Time 2; unf1 -

unf3 = items for unfinished tasks at T0; det1 - det3 = items for detachment at T1 and T2; pro1

– pro3 = items for task progress at T2; e01 – e14 = error variances of the items.

We estimated the models using the maximum likelihood estimation with robust

standard errors (MLR) due to the clustered data. We report only fully standardized results.

Model fit was assessed using the chi - square goodness of fit test. A non-significant χ^2 - value

indicates a good fit between the specified and the empirical covariance matrix (Schermelleh-

Engel, Moosbrugger, & Müller, 2003). In addition, we evaluated model fit with descriptive fit

indicators using the Root Mean Square Error of Approximation (RMSEA), the Standardized

Root Mean Square Residual (SRMR) and the Comparative Fit Index (CFI). As recommended

by Schermelleh-Engel et al. (2003) values less than .05 for RMSEA and SRMR and values of

.97 or higher represent a good fit.

2.3 Results

2.3.1 Descriptive statistics

Table 1 displays the means, standard deviations, and correlations among our study variables. To determine within-individual variance, we ran null models in Mplus. Null models can be used to estimate the within- and between individual variance in Level 1 variables. The analysis revealed significant within-individual variance for all Level 1 variables (see Table 2).

Table 1

Study 1: Within-Individual Descriptive Statistics and Correlations

	Variable	M	SD	1	2	3	4	5
1.	Unfinished tasks (T0)	2.21	.94	—				
2.	Detachment (T1)	3.61	1.27	-.24***	—			
3.	ICT use (T1)	10.18	17.41	.22***	-.59***	—		
4.	Detachment (T2)	4.10	1.10	-.08*	.27***	-.12**	—	
5.	ICT use (T2)	5.51	13.75	.07	-.13**	.12*	-.59***	—
6.	Task progress (T2)	2.35	1.24	.13***	-.23***	.20**	-.35***	.33***

Note. k at level 1 = 1039, *N* at level 2 = 211. All variables are within-person variables (Level 1). Correlations are based on within-individual scores. T0 = Time 0; T1 = Time 1; T2 = Time 2. **p* < .05; ***p* < .01; ****p* < .001.

Table 2

Study 1: Variance Composition of Level 1 Variables

Variable	Within-individual variance (e^2)	Between-individual variance (r^2)	Percentage of within-individual variance
Unfinished tasks (T0)	.60	.38	61.23
Detachment (T1)	.78	.65	54.23
ICT use (T1)	195.06	107.18	64.54
Detachment (T2)	.49	.09	51.04
ICT use (T2)	131.16	57.42	69.55
Task progress (T2)	.90	.08	56.27

Note. e^2 represents the within-individual variance and, r^2 the between-individual variance in the variable. Percentage of within-individual variance was computed as the ratio of the within-individual variance/(within + between variance).

2.3.2 Hypotheses testing

Model fits for our model are provided in Table 3[2]. Figure 4 shows the cross-lagged structural equation model including all effects. As represented in Table 3 a good fit was achieved with the model ($\chi^2(62) = 62.74$, $p = .44$; RMSEA = .003; SRMR = .03; CFI = 1.00). As indicated in Figure 4, after controlling for the stability of detachment ($\beta = .31$, $p < .001$) and ICT use ($\beta = .06$, $p = .34$), the cross-lagged effect of ICT use on detachment was not significant ($\beta = .07$, $p = .14$), thus failing to support Hypothesis 1. However, the cross-lagged effect of

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[2] We were unable to calculate model fit for our drop out sample. Because of the large amount of missing data in this sample Mplus was unable to converge a model.

detachment on ICT use was significant ($\beta = -.10$, $p <.05$), supporting Hypothesis 2. Further, Hypothesis 3 a) and b) were also supported, with unfinished task significantly predicting detachment ($\beta = -.24$, $p <.001$) and ICT use ($\beta = .22$, $p <.001$). Finally, Hypothesis 4 a) and b) were supported, with ICT use significantly and positively ($\beta = .09$, $p <.05$) and detachment negatively predicting task progress ($\beta = -.18$, $p <.001$).

Table 3

Study 1: Goodness-of-Fit Indices for the Model

Model	χ^2	df	χ^2/df	p	CFI	SRMR	RMSEA
Full model	62.74	89	1.20	.093	1.00	.03	.003

Note. N at level 2 = 211.
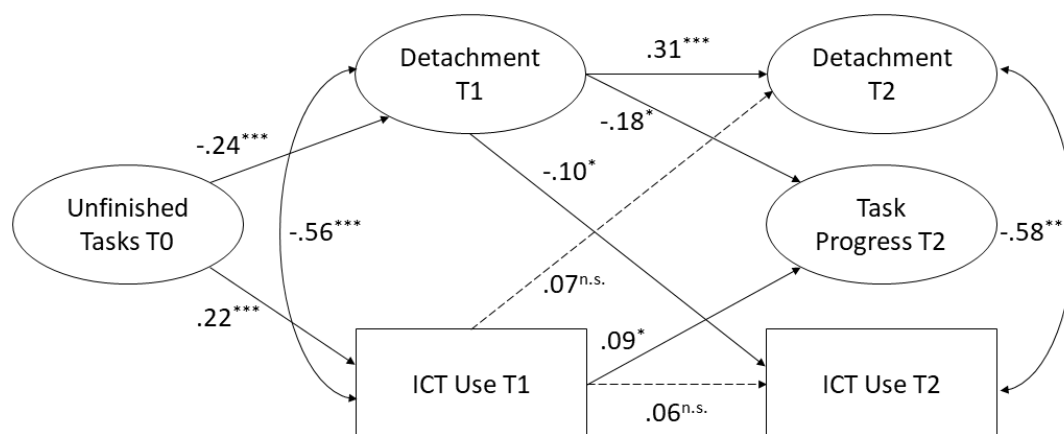
Figure 4. Estimates of the structural model. Relationships between unfinished tasks, detachment, work-related ICT use, and task progress. Factor loadings and covariances between indicators are not pictured. T0 = Time 0; T1 = Time 1; T2 = Time 2.

*p < .05; **p < .01; ***p < .001.

2.4 Discussion

The main purpose of this study was to test and evaluate the directions of effects between ICT use for work after hours and detachment from work. We used a cross-lagged panel diary study to allow for an investigation of reciprocal effects. Contrary to our expectations and current research consensus, Hypothesis 1, stating that work-related ICT use at T1 results in less detachment at T2, was not supported. The daily amount of work-related ICT use at T1 did not lead to a significant decline in detachment at T2. Instead, our results support Hypothesis 2: detachment at T1 was related to the length of ICT use at T2. Moreover, consistent with Hypothesis H3a and H3b unfinished tasks at T0 related to both ICT use and detachment at T1 the same day. Finally, Hypothesis 4a and 4b were fully supported. Engaging in work-related ICT use at T1 is related to individuals reporting that they made more progress on unfinished work tasks at T2. Contrary to this and supporting H4b, a higher level of detachment at T1 was significantly related to lower task progress at T2.

2.4.1 Theoretical implications

The present findings are more consistent with the alternative model assuming that the daily level of unfinished tasks impairs detachment, which in turn prompts employees to engage in work-related ICT use. From this perspective, employees engage in this behavior more on days when they have to cope with more work stressors, such as unfinished tasks, and find themselves unable to detach from work.

Our findings contribute to research in several ways. First, our finding that over the course of one evening ICT use at T1 was unrelated to both detachment at T2 implies that work-related ICT use cannot be regarded as a stressor by itself. Previous studies linking ICT use and low well-being, or lack of detachment might have confounded the behavior with its cause, the level

of unfinished tasks or other work stressors. Our study supports the view that stress is falsely attributed to ICT use (Barley et al., 2011) and corroborates earlier findings from qualitative studies (Matusik & Mickel, 2011) that ICT use is a way of dealing with high demands. Occasional work-related ICT use should thus be regarded as a behavioral consequence of underlying work stressors that result in low detachment. In light of our findings concerning the short-term consequences of ICT use, the rules and regulations concerning ICT use need to be re-evaluated. However, one needs to keep in mind that long-term consequences of lack of recovery might be severe (Geurts & Sonnentag, 2006; Söderström, Jeding, Ekstedt, Perski, & Åkerstedt, 2012), and persistent ICT use leaves little time for recovery.

Second, we find that the levels of detachment have consequences for immediate behavioral outcomes, specifically work-related ICT use. Our study answers to the call to investigate immediate behavioral consequences of impaired detachment (Sonnentag & Fritz, 2015). Our findings suggest that individuals who cannot properly detach from work continue working in the evening and use ICT to do so. Thus, employees who fail to fully detach from work early in the evening will not only experience lower levels of detachment later but will also engage in work-related activities that not only reduce the time available for recovery but also put further demands on their cognitive functional system (Meijman & Mulder, 1998). Since the activities employees engage in during their leisure time influence recovery and well-being (Sonnentag, 2001; Sonnentag & Zijlstra, 2006), it is important to broaden our understanding of the activities individuals choose when they cannot detach.

Third, our study suggests that unfinished tasks are one reason behind both work-related ICT use and impaired detachment. We suggest that employees engage in work-related ICT use to complete or make progress on work tasks that are still on their mind. Doing so is a double-edged sword, promoting task progress but not necessarily also detachment. Finishing a pressing work task by using work-related ICT might help employees to cope with the demands, but this

does not necessarily have a positive impact on detachment in the evening. Our results correspond to research by Weigelt and Syrek (2017) that suggests that making progress on unfinished tasks by engaging in supplemental work on the weekend neutralized but did not reverse negative effects on detachment.

The reason why employees engage in supplementary work might explain when and for whom it is a functional. For some employees, ICT use in the evening might be a strategy that helps them to detach or to cope with pressing job demands but others start working simply out of habit, without thinking about it. Only when employees strategically chose to engage in additional work, it might help them to detach. Additionally, work-related ICT use might be a useful strategy for detachment on the same evening if employees are indeed able to successfully finish work tasks. Under these circumstances they might be able to detach later in the evening since finished tasks are less likely to occupy the mind (Syrek et al., 2017; Syrek & Antoni, 2014; Weigelt & Syrek, 2017). More research is needed to examine if ICT use for work can under certain circumstances, for example task completion, indeed be a recovery-enhancing behavior.

Finally, this study contributes by investigating a cross-lagged panel design on the day-level. Diary studies have become increasingly important in organizational research (Ohly et al., 2010). These designs allow researchers to examine the dynamics of relevant factors, making them especially appropriate for research on recovery and ICT use. The call to pay more attention to temporal dynamics over the course of one evening (Sonnentag et al., 2017) highlights a gap in those research designs, since it is common to assess the relevant variables only at one point in time. Additionally, cross-lagged panel designs in applied research are still rare, despite strong encouragement to implement them more widely (Zapf et al., 1996). Earlier articles have also touched on the necessity to temporally separate predictor and outcome variable in order to avoid an inflation of the relationship by artificial sources and to differentiate

the timing and duration of work-related ICT use (Ohly et al., 2010; Ohly & Latour, 2014). Our research shows the value of implementing a cross-lagged panel design in a diary study, since by doing so we could clarify the direction of effects between work-related ICT use and detachment for same-evening effects. This clarification changes the perception of ICT use as a stressor and prompts new questions about its role in research on unfinished tasks and the interplay between the work and home domains.

2.4.2 Practical implications

Our study also contributes to practice. It has sometimes been suggested that companies need to stop employees from using ICT outside of regular working hours to protect their leisure time and to foster employee well-being. However, our results suggest that the advice to switch off ICT might not always help employees to recover better during the evening. A common attribute of today's work is having to deal with a high workload and to coordinate projects with several stakeholders. Thus, employees are frequently confronted with unfinished tasks at the end of a workday, which makes detachment difficult for them. Practitioners designing workplace stress management interventions could support employees by providing them with certain strategies they can use to leave unfinished tasks behind mentally, e.g. managing the boundaries between the work domain and the private domain through certain boundary tactics (Kreiner, Hollensbe, & Sheep, 2009), or creating specific plans for the completion of unfinished tasks (Smit, 2016). These strategies might be useful to support employees who occasionally have to use ICT for work after hours. Still, frequent and prolonged work-related ICT use during leisure time will likely negatively relate to well-being and health over time as it is still associated with less detachment and reduces time available for recovery (Geurts & Sonnentag, 2006; Söderström et al., 2012). For this reason, we encourage practitioners to

take a closer look at general working conditions when unfinished tasks and the need to finish those during leisure time are frequent and recurring. Additionally, since failing to detach was shown to be the core variable in our study, it makes sense to direct efforts to interventions that have been shown to improve recovery skills. For example, employees have been shown to benefit from interventions teaching them how to detach from work (Hahn, Binnewies, Sonnentag, & Mojza, 2011) and how to engage in restorative behaviors (Ebert et al., 2015). Further, for workplace stress management programs and interventions practitioners who would like to specifically focus on work-related ICT use still have several options to prevent potential negative consequences of this behavior. First, instead of telling employees to not use ICT at all, interventions could support employees in erecting boundaries around work-related ICT use, in encouraging ICT use for work in a way that fits individual preferences (Barber & Jenkins, 2014; Kreiner et al., 2009) and in raising awareness that potentially detrimental effects of work-related ICT use can be alleviated when employees set priorities and goals for its use, e.g. focusing on specific pressing work tasks that need to be finished (Fenner & Renn, 2010).

2.4.3 Limitations

This study has some limitations. First, although using a cross-lagged panel design is a considerable strength of this study, this method does not allow to draw causal conclusions in the way an experimental design does (Finkel, 1995; Zapf et al., 1996). Specifically, in cross-lagged panel analyses it is not possible to rule out all potential alternative explanations for the effects between variables. Nevertheless, conducting a study with an experimental design would be difficult since work-related ICT use can only be reliably assessed in field studies. Additionally, conducting a cross-lagged panel study is preferable to simple cross-sectional

research designs when the goal is to infer directions of relationships in a field setting (Zapf et al., 1996).

Second, this study only relied on self-report measures, which can lead to common-method bias. While it would have been preferable to measure ICT use for work in another way to avoid common-method bias as well as for accuracy, e.g. with a tracking app on the employees work-related ICT, this approach was not feasible for this study and is difficult to achieve for technological and privacy reasons. To reduce common-method bias, criterion and predictor variables were separated temporally and different response formats for both variables were used (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

A third limitation of this study is the time lag we used. Since this was to the best of our knowledge the first study in this field implementing a cross-lagged panel diary design the appropriate time lag is not yet clear. Future studies could implement varying time lags into their study design to investigate the effect of different lags onto results.

A fourth limitation of this study was the significant drop-out in our study, decreasing our sample from 435 to 211 participants. While no significant differences between our final sample and the drop-out sample emerged in terms of sociodemographic variables, we did find that final participants had lower segmentation preferences. Due to the large amount of missing data in this sample (participants were automatically dropped from the study after failing to answer three questionnaires) we do not know if the effects we found in our final sample would occur in a sample with significantly higher segmentation preferences. Therefore, the generalizability of our findings might be somewhat limited. Finally, the requirement to use a separate mobile phone for work and for private life points also limits the generalizability of our findings. While this requirement was important to avoid the use for work-related ICT for answering questionnaires, this might have screened out employees who set fewer boundaries

for work-related ICT use at home by using the same phone for their work as well as private life. It has been shown that those employees who fail to set boundaries for work-related ICT use suffer more of its negative consequences (Barber & Jenkins, 2014). Thus, by this criterion we might have rejected participants who experienced more negative consequences due to work-related ICT use than participants in our final sample. Still, the mean and standard deviation of segmentation preference in our final sample are comparable to findings in other studies, which limits this concern (Kreiner, 2006; Park et al., 2011).

2.4.4 Directions for future research

Some suggestions can be made for future research. First, we recommend that future studies implement research designs where the effects of ICT use and detachment can be investigated separately. Our results show that disentangling the two variables changed our understanding of cause and effect in the relationship with important consequences for the understanding of work-related ICT use. While this opens up new ways of looking at the immediate impact of work-related ICT use on a day-level studies focusing on other time frames are necessary to differentiate effects, e.g. long-term effects of frequent and prolonged ICT use.

Second, since our results show that work-related ICT use did not impair detachment from work, it will be useful to explore the actual role of work-related ICT use during leisure time further. It remains unresolved if and how the use of ICT for work during leisure time can affect employee well-being and behavior. Exploring this important question with a fresh mind could further research on work-related ICT use and current changes in the workplace. For example, it needs to be determined if employees use ICT in a strategic way to achieve detachment. It is important to find out if work-related ICT use can, under certain circumstances, contribute to employee recovery. By finishing work tasks employees might be supported in

successfully detaching from work on the same evening. Additionally, employees who finish a pressing task by using ICT could experience mastery which is another facet of recovery. Alternatively, engaging in work-related ICT use when one cannot detach from work could be a habitual response that is neither strategic not goal-directed. As our task progress scale did not differentiate between making task progress and finishing work tasks, future studies should differentiate between the two outcomes and investigate if finishing work tasks reverses effects or increases mastery experiences.

Third, while other job demands, e.g. social stressors, negatively impact detachment (Pereira & Elfering, 2014), it seems less likely that engaging in work-related ICT use would be a behavioral consequence of experiencing these stressors or not being able to detach because of them. Additionally, for unfinished tasks the perceived benefits of engaging in work-related ICT use are obvious as it allows employees to potentially remove the factor impairing detachment and recovery (Weigelt & Syrek, 2017). Even if employees engage in work-related ICT use more when they experience social stressors at work, the benefits of doing so are dubious. Additionally, while we specifically wanted to focus on unfinished tasks in this study, as it is a job demand that relates to both work-related ICT use and detachment, we still used a general measure of detachment. Future studies would need to differentiate between effects regarding different sets of job demands to see if positive effects emerge for certain job demands but not for others. Further, this might be made easier by using a more specific measure of detachment.

Finally, it would be interesting to investigate bidirectional effects between detachment and specific employee behavior over the course of one evening. It would be interesting to learn more about specific behaviors employees engage in when they cannot detach from work. In this study, we were able to demonstrate that engaging in work-related ICT use increases the progress made on unfinished work tasks. However, individuals might also choose to engage in

behaviors that are detrimental to health and well-being, for example drinking alcohol or ruminating about negative job experiences. Further research is needed to explore which activities are chosen. In a similar vein, it would be useful to uncover behavioral strategies that help employees with detaching from work, especially when they were unable to do so at an earlier time.

2.4.5 Conclusion

There are two main takeaways from this study. First, when employees are confronted with unfinished tasks and consequently have difficulty detaching from work, they use ICT to work. Secondly, work-related ICT use does not impair individual levels of detachment later the same day. It is possible that this relationship is affected by other variables, e.g. the completion of unfinished tasks. In summary, it can be stated that the classification of work-related ICT use as a stressor must be questioned, as it seems more likely that the behavior is confounded with its source, namely, unfinished work tasks and impaired detachment.

3. Study 2: "Dear Manager, Now I Know What You Expect": An Intervention Targeting Supervisors to Establish Clear Availability Expectations

3.1 Introduction

Research on information and communication technologies (ICT) has only relatively recently considered the role of supervisors for the work-related ICT use and the boundary management of their employees (Derks et al.; 2015; Koch & Binnewies, 2015; Park et al., 2011). While in many ways research on ICT is still an emerging field, it has been argued that the organizational expectations about after hour availability, as well as the expectations supervisors explicitly or implicitly communicate to their employees play an important role for employees' behavior and well-being. Organizational availability expectations can be described as employees' perception of the amount of availability that is expected outside of regular work hours by their workplace (Day et al., 2012). Employees who are faced with high availability expectations might not be able to disconnect from work and might not participate in certain leisure activities to make sure they are available for work purposes. For example, going on a hike or going to the theater might not be possible, or they might limit this to certain times. Frequently engaging in work-related ICT use and not participating in the leisure activities ones' family and friends engage in can cause friction and hinder recovery processes. In fact, it has been shown that organizational availability expectations affect employees' ICT use (Fenner & Renn, 2010; Park et al., 2011), the amount of work-life conflict they experience (Derks et al., 2015), and how well they can detach from work (Barber & Santuzzi, 2015; Park et al., 2011).

Most research on availability expectations focuses on the broader organizational perspective (Barber & Santuzzi, 2015; Chen et al., 2009; Day et al., 2012; Park et al., 2011).

However, a more specific focus on supervisors is a promising next step in research on availability expectations. Some studies suggest that supervisors' own availability behavior and work-related ICT use strongly affects subordinates – often without a conscious intention on the side of the supervisor (Barber & Santuzzi, 2015; Day et al., 2012; Derks et al., 2015; Park et al., 2011; Wright et al., 2014). For example, Derks et al. (2015) stress the importance of supervisors being conscious of their own behavior as well as the importance of carefully considering the expectations they create around ICT use after hours. This is because supervisors are in a position of power over their subordinates and serve as important role models for them (Bandura, 1979; Derks et al., 2015; Koch & Binnewies, 2015). Additionally, it has been argued that subordinates are often unsure of their supervisors' availability expectations, as they are not communicated directly and openly (Derks et al., 2015), which may result in role ambiguity when it comes to availability expectations (henceforth called *availability ambiguity;* Shumate & Fulk, 2004; Wright et al., 2014). Role ambiguity is defined as "the lack of clarity about duties, objectives, and responsibilities needed to fulfill one's role" (Beehr & Glazer, 2005, p. 12) and is associated with anxiety, lower job satisfaction, and depression (for meta-analyses see Jackson & Schuler, 1985 and Schmidt, Roesler, Kusserow, & Rau, 2014) and lower job performance (for a meta-analysis see Tubre & Collins, 2000). We suggest that it is important to specifically investigate how subordinates' perception of the amount and ambiguity of supervisors' availability expectations affects them.

The purpose of this study is to a) show that targeting availability ambiguity improves our understanding of the way in which availability negatively affects employee well-being, and b) to investigate if an intervention that targets the direct communication of availability expectations reduces the perception and ambiguity of availability expectations and positively affects employee well-being. We will first explore how availability expectations affect employee behavior and well-being, relying on social learning theory (Bandura, 1979) and

boundary theory (Ashforth et al., 2000). In this context, we will specifically focus on availability ambiguity. We then present two studies where we investigate our hypotheses. In the first study, we demonstrate that experiencing availability ambiguity negatively affects employee well-being in addition to the impact of availability expectations. In the second study, we conduct an intervention targeting supervisors in a German company. By collecting data from participants' subordinates at two timepoints before and after the intervention, we show that an intervention supporting supervisors in communicating their expectations is an effective means to establish communication about availability expectations. Our evaluation also reveals that it positively affects subordinates' satisfaction with ICT communication in the team and that an explicit communication of availability expectations reduces availability ambiguity.

Our study contributes to the literature in three ways. First, we contribute to research on availability expectations by focusing specifically on supervisors. Even though supervisors are often discussed as an important source of availability expectations (Day et al., 2012; Derks et al., 2015; Koch & Binnewies, 2015; Park et al., 2011), research has not yet differentiated between expectations from different sources (e.g., colleagues, supervisors, customers). Focusing on supervisor expectations extends our understanding of their role for employees' behavior and attitudes around availability. Second, we contribute to research by introducing the concept of availability ambiguity into the conversation on availability expectations. Investigating the impact of availability ambiguity extends our understanding of the process by which implicitly communicated availability expectations negatively affect employees. By demonstrating the importance of reducing availability ambiguity to alleviate the negative effects of high availability expectations, we reveal ambiguity as a crucial attribute of availability expectations. Third, we also contribute to research by evaluating an intervention targeting supervisors' communication of availability expectations. As organizational availability expectations are often not easily changeable by individuals, it is important to focus

on changes supervisors can make at their own discretion to create availability norms that fit their own preferences and at the same time protect their subordinates' well-being.

3.1.1 Formal guidelines about availability and work-related ICT use after hours

Since ICT use is still a relatively new phenomenon, formal guidelines for availability and after hour ICT use do not exist in most organizations (Hassler et al., 2016; Leonardi et al., 2010; Perlow, 2012). Additionally, when it comes to extra-role behaviors such as being available after hours, organizations typically cannot rely on formal systems to encourage employees to behave in line with expectations (Podsakoff, MacKenzie, Paine, & Bachrach, 2000; Yaffe & Kark, 2011). Still, a survey revealed that 60% of German employees in a knowledge worker sample expressed a desire to be provided with formal guidelines regarding availability (Hassler et al., 2016). It seems that neither supervisors nor employees are aware that it might be helpful to have a conversation about expectations when it comes to availability and after hour ICT use (Wright et al., 2014). Accordingly, we expect supervisors to rarely implement explicit agreements regarding availability with their subordinates.

Hypothesis 1: The majority (more than 50%) of employees do not have an explicit agreement regarding availability with their supervisor.

3.1.2 Availability expectations

With the rise of work-related ICT many knowledge workers are expected to be available via ICT after core work hours (Hassler et al., 2016; Rau & Göllner, 2019). Organizations and supervisors vary in the extent to which they expect employees to stay connected to work. Some do not consider it necessary for employees to remain connected to work except in emergency

situations, such as a tight deadline, while others expect them to react promptly to all incoming communication (Kreiner, 2006). Boundary theory (Ashforth et al., 2000) describes these differences as segmentation and integration norms. Organizations with a segmentation norm encourage employees to leave their work at the office and do not expect employees to stay available outside of regular work hours. In contrast, when there are strong organizational integration norms employees are expected to work from home and remain connected to and available for work outside of regular work hours (Derks, van Mierlo et al., 2014). It has been shown that organizational climate powerfully influences employee behavior (for a review see: Parker et al., 2003) and that managerial support is important for subordinates to erect boundaries between work and life (Anderson, Coffey, & Byerly, 2002; Koch & Binnewies, 2015). For this reason, it is no surprise that Park et al. (2011) find that employees comply with organizational expectations regarding availability. Studies acknowledge that employees have to derive availability expectations by observing what is implicitly, and often ambiguously, communicated to them by their supervisors and colleagues (Barber & Santuzzi, 2015; Derks et al., 2015; Park et al., 2011). For example, supervisors implicitly communicate the norm to stay connected to work after hours when they themselves send emails late at night or on the weekend or when they thank a colleague for getting back to them outside of normal work hours. While they do not explicitly say that they expect their subordinates to stay connected to work, doing so is demonstrated as the norm and is rewarded, which creates the expectation to conform.

According to role theory (Katz & Kahn, 1978), when individuals enact multiple roles in one domain, interference between roles can increase stress. Availability expectations make interferences between the work role and the family role more likely and impair detachment. Detachment describes the feeling of being away from the work situation physically and mentally and is a central component of the recovery process (Etzion, Eden, & Lapidot, 1998; Sonnentag & Fritz, 2007). Work-home conflicts are defined as "a form of interrole conflict in

which the role pressures from the work and family domains are mutually incompatible, such that participation in one role makes it difficult to participate in the other" (Greenhaus & Beutell, 1985, p. 77). Both are important outcomes since they are associated with many work-related and stress-related outcomes, e.g. turnover, burnout, work satisfaction and depression (Allen, Herst, Bruck, & Sutton, 2000; Sonnentag & Fritz, 2015). Availability expectations affect detachment and work-home conflicts for several reasons. First, enacting different roles in the same domain can lead to role conflict (Katz & Kahn, 1978). Employees who keep their devices switched on and engage in work-related ICT use cannot fully focus on their family role (Middleton & Cukier, 2006) and might not be able to fully disengage from one role to enact the one required (Fenner & Renn, 2010). Thus, they are not able to detach from work fully and might experience work-home conflict. For example, employees who feel that they are expected to stay available might regularly interrupt activities with family members to check their devices for incoming messages, or they might be distracted from activities because they feel the pressure to comply with availability expectations. They might also engage in behaviors that are only appropriate for the work role, e.g. checking their phone while talking to a family member. Second, according to boundary theory (Ashforth et al., 2000), integration norms increase the likelihood of work-related issues and problems spilling over into private life (Ashforth et al., 2000). Indeed, research shows that high expectations regarding availability are related to lower detachment (Barber & Santuzzi, 2015; Park et al., 2011) and integration norms and high availability expectations increase the chance of work home conflicts (Gadeyne, et al., 2018; Kreiner, 2006; Park et al., 2011). Diaz et al. (2012) also find that the more work-home conflicts people experience because of ICT use, the less satisfied they are. Additionally, high integration norms are associated with burnout (Barber & Santuzzi, 2015; Koch & Binnewies, 2015).

It is important to note that supervisor expectations are not necessarily the same as organizational expectations. While they may be in line with organizational norms, supervisor

expectations can also vary because of the specific job demands in their department and personal preferences regarding segmentation/integration. Moreover, because of their comparatively lower hierarchy level, when employees feel that staying available is expected by their supervisor, they have little choice other than to acquiesce to these demands (Butts, Becker, & Boswell, 2015; Coyle-Shapiro, Kessler, & Purcell, 2004). Therefore, we focus on supervisor expectations as we propose that their influence is more concrete and often more relevant for employees. As we already mentioned, studies specifically focusing on supervisors are still rare. However, Koch and Binnewies (2015) demonstrate that supervisors who show more segmentation behavior enable their subordinates to do the same. Their subordinates are also less exhausted and more engaged at work. Furthermore, according to a study by Derks et al. (2015) when supervisors expect their employees to stay available after hours, work-related ICT use is more strongly related to work home conflicts. We therefore expect that:

Hypothesis 2: Supervisors' availability expectations are negatively related to

subordinates' a) satisfaction with ICT communication and b) detachment, and

positively related to their c) work home interference and d) emotional exhaustion.

3.1.3 Availability ambiguity

Availability expectations are often not explicitly discussed in an organizational context which can lead to role ambiguity (Katz & Kahn, 1978), specifically availability ambiguity. Whenever formal organizational guidelines are missing and the topic is not addressed directly, individuals learn about the rules and norms in an informal way – by observing the behavior and communication habits of relevant people around them (Bandura, 1979; Koch & Binnewies, 2015; Yaffe & Kark, 2011). In work situations, supervisors are among the most important role models because of their influence on important work factors. They not only evaluate the

performance of employees, and make decisions about promotions and bonuses, they also allocate work tasks to their team members (Bauer & Green, 1996; Schyns, Paul, Mohr, & Blank, 2005), and represent organizational values (Powell & Mainiero, 1999; Scandura & Lankau, 1996). To ensure a positive evaluation and desired consequences employees will therefore try to behave in a way that is in line with their supervisors' expectations and preferences (Bandura, 1979; Derks et al., 2015; Paczkowski & Kuruzovich, 2016). To achieve this, they will closely observe the way their supervisor manages their own availability (Koch & Binnewies, 2015). They will also be receptive to the signals their supervisor sends about his or her expectations when it comes to subordinates' behavior, e.g., by praising someone for finishing a work task late at night. Still, even when employees closely monitor their supervisors' behavior, it seems likely that these observed expectations stay more ambiguous than clearly communicated ones and are prone to subjective perception (Park et al., 2011). Accordingly, Reid and Ramarajan (2016) conclude that "without clear direction, many employees simply default to the ideal-worker expectation, suppressing the need to live more-balanced lives". We thus propose that:

Hypothesis 3: Availability ambiguity are negatively related to subordinates a) satisfaction with ICT communication b) detachment, and positively related to subordinates c) work home interference, and d) emotional exhaustion, beyond to supervisors' availability expectations.

3.1.4 Differences for availability for supervisors and subordinates

In the case of work-related ICT use supervisor behavior might not be an ideal reference point for employees to mirror. First, supervisors often need to use ICT more outside of standard work hours because of their managerial function and higher hierarchy level. Second, they are

often confronted with a higher workload than employees without or with less managerial responsibilities. Third, many leaders have little room during their work-day to answer e-mails since they attend back-to-back meetings, and therefore do so outside of regular work hours (Rosen et al., 2019). Fourth, for supervisors staying connected via ICT is more closely connected to their central work goals – and thus of a higher personal relevance. After all, distributing work tasks to employees and communication with subordinates increasingly takes place via email (Butts et al., 2015). As the ability to reach central goals has been shown to buffer negative effects of job demands on well-being (Bakker, Demerouti, & Euwema, 2005) work-related ICT use might be less harmful for supervisors. Finally, ambitious people may see work-related ICT use as necessary for getting ahead in their careers and may thus do so with less negative consequences (Boswell & Olson-Buchanan, 2007). This is because autonomous motivation acts as a protective factor for work-related ICT use (Ohly & Latour, 2014). For these reasons, staying connected to work is associated with higher rewards and less negative consequences for supervisors than for non-managerial employees.

From the perspective of the employee with less or without managerial duties this means that the behavior around availability and work-related ICT use they observe and adapt to is often neither necessary, nor related to their work goals. In comparison to their supervisors, it might also be more harmful to their well-being (Ohly & Latour, 2014). Finally, extended availability and work-related ICT use are often behaviors that are not expected by the supervisor and can even be in contrast with their intentions.

3.1.5 The importance of clearly communicated availability expectations

The impact of sharing availability expectations has not been empirically investigated so far. Thus, communicating availability expectations represent an under-researched but

promising research gap in the domain of work-related ICT use. Demonstrating the usefulness and importance of explicit conversations about availability expectations provides supervisors with an efficient and easy way to improve ICT communication in their teams.

Setting goals and communicating clear expectations are common managerial duties. For example, setting performance goals is widely regarded as a useful tool to help recipients behave in line with expectations, and reach personal work goals, as well as organizational goals (Berson, Halevy, Shamir, & Erez, 2015; Steinmann, Klug, & Maier, 2018; Tett, Guterman, Bleier, & Murphy, 2000). One of the main findings of goal-setting theory is that setting specific and difficult goals consistently leads to higher performance than setting low goals or unspecific "do-your-best goals" (Locke & Latham, 1990). This can be explained by the reduced ambiguity of specific goals (Berson et al., 2015; Locke, Chah, Harrison, & Lustgarten, 1989; Locke & Latham, 2002). The same should be true when it comes to availability expectations. Therefore, managers could be encouraged to develop and communicate "clear expectations and policies that can facilitate ways for employees to better cope with work life conflict" (Wright et al., 2014, p. 510). Availability expectations can refer to specific times, topics, people, or even the communication medium that is chosen. For example, a supervisor might expect a subordinate working on an important project to stay available on weeknights for questions regarding this specific project and can make clear that he or she will call in case something important comes up, so that the employee does not have to check for incoming email.

Supervisors will often be relatively familiar with communicating their expectations in other domains, for example when setting performance goals. Communicating their availability expectations in an explicit way also allows supervisors to use work-related without fearing that their behavior is misinterpreted by employees as an expectation to mirror them in this regard. Based on the above discussion, we expect:

Hypothesis 4: The availability expectation intervention is effective in increasing the amount of directly communicated availability expectations between t1 and t2.

Hypothesis 5: Subordinates' perceived a) availability expectations and b) availability ambiguity decrease between t1 and t2.

Hypothesis 6: Subordinates a) satisfaction with ICT communication and b) work life balance and c) detachment will increase between t1 and t2; d) emotional exhaustion will decrease.

3.2 Method Study 2a

3.2.1 Procedure and participants

Participants were recruited by a Master student through an online newsletter and work-related social media sites, namely LinkedIn and the German equivalent Xing. A heterogeneous convenience sample was appropriate for this study.

Data was gathered using the German online survey tool Unipark. At the beginning of the questionnaire participants were provided with a short introduction, explaining that we were interested in work-related ICT use in general. Confidentiality of responses was assured. Participants participated in the study on a voluntary basis and did not receive any reward.

In total, the sample consisted of 235 knowledge workers from a wide range of professions and industries, such as the pharmaceutical industry, education, technology, and commerce. 38.3% of participants had less than 5 years of work experience, 19.1% had between 5 and 10 years, 12.3% had between 10 and 15 years, 8.9% had between 15 and 20 years, and 21.3% had more than 20 years of work experience. Almost half of the sample (44.7%) occupied a leadership position, with 43 (18.3%) of them leading a work group, 52 (22.1%) in middle

management and 10 (4.3%) in top management. Approximately half of our sample was female (51.9%). Respondents were between 18 and 68 years old, with an average age of 37.76 years (*SD* = 11.64). Participants tended to be highly educated, with 54.1% holding a university degree, 23.4% holding a high-school degree, 15.3% holding a middle-school degree, and 2.1% holding a general education secondary school degree.

3.2.2 Measures

Availability agreement. We first asked participants if they had an explicit agreement regarding availability outside of regular working hours with their supervisor. Participants who indicated that they did were then asked to describe the nature of the agreement in an open format.

Availability expectations and availability ambiguity. We measured supervisors' availability expectations with an adaption of two items of a subscale of the Work Family Culture scale by Thompson, Beauvais, and Lyness (1999) and an adaption of six items of the ICT Demands scale by Day et al. (2012). All items were changed to refer to supervisor expectations instead of the expectations of the organization. All items were answered on a 5-point Likert scale ranging from 1 (*do not agree at all*) to 5 (*completely agree*). One example of an adapted item from the scale by Thompson et al. (1999) is "My supervisor often expects employees to take home work at night and/or on weekends". One example out of the scale by Day et al. (2012) is: "My supervisor expects me to respond to e-mail messages immediately". In addition, to measure availability ambiguity for each item participants indicated how certain they were about the correctness of their estimation on a 5-point Likert scale ranging from 1 (*very uncertain*) to 5 (*very certain*). Participants were asked for each item: "How certain are you that your estimation is correct?". Answers were recoded so that a high number reflected

high ambiguity. Reliability for the supervisor expectation scale was α = .91. For availability ambiguity, reliability was α = .85.

Satisfaction with ICT Communication. We measured satisfaction with ICT Communication with a two-item, 5-point Face Scale (Kunin, 1955). One item referred to the supervisor, the other to ones' colleagues, asking "During the last week, how satisfied were you with work-related communication via new technologies with your supervisor/ colleagues?". Reliability was α = .84.

Work home interference. We used a German translation of the nine items referring to negative work home interaction of the Survey Work-Home Interaction – NijmeGen (SWING) questionnaire by Geurts et al. (2005) to measure work home interference. Participants indicated how often they experienced work-home interference on a 4-point Likert scale ranging from 1 (*never*) to 4 (*always*). A sample item for the scale is: "How often does it happen that your work takes up time that you would have liked to spend with your spouse/family/friends". Reliability was α = .94.

Emotional exhaustion. To measure emotional exhaustion, we used the five items referring to emotional exhaustion of the Maslach Burnout Inventory – General Survey in the German version (MBI-GS-D, Büssing & Glaser, 1999). The inventory comprises the dimensions emotional exhaustion, cynicism and personal accomplishment. Participants answered each of the five items on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item for this scale is: "I feel emotionally drained from my work". Average reliability was α = .91.

Detachment. Detachment was assessed with a German version of the four detachment items from the Recovery Experience Questionnaire (Sonnentag & Fritz, 2007). All items were

answered on a 5-point Likert scale ranging from 1 (*do not agree at all*) to 5 (*completely agree*). A sample item is: "During leisure time I forget about work". Average reliability was $\alpha = .89$.

3.3 Results Study 2a

Table 4 displays the means, standard deviations, and correlations among our study variables. We first calculated the percentage of employees who had an explicit agreement regarding availability with their supervisors. Only 49 (20.9%) of participants had an explicit and concrete agreement regarding availability, the majority (186, 79.1%) did not. Most of the explicit agreements either stated that no extended availability was expected (n = 16) or that the person was supposed to stay available without any time limits (n = 11). Thus, Hypothesis 1 is fully supported by our results.

We then tested Hypotheses 2 and 3 with a multiple regression approach in which we entered control variables (gender, age, availability agreement) in Step 1, supervisor expectations in Step 2, and availability ambiguity in Step 3. For satisfaction with ICT communication and detachment results are displayed in Table 5; for work home interference and emotional exhaustion results are displayed in Table 6. Supporting Hypothesis 2a and 2b supervisor expectations (added at step 2) contributed significantly to satisfaction with ICT communication ($\beta = -.22$, $p <.01$) and detachment ($\beta = -.40$, $p <.001$). As predicted in Hypothesis 2c and 2d, supervisor expectations (added at step 2) significantly contributed to work home interference ($\beta = -.46$, $p <.001$) and emotional exhaustion ($\beta = -.40$, $p <.001$). Thus, Hypotheses 2a-d were fully supported by our results.

Table 4

Study 2a: Correlations and Descriptive Statistics

Variable	M	SD	1	2	3	4	5
1. Availability expectations	2.62	1.25	—				
2. Availability ambiguity	1.65	.61	.18**	—			
3. Satisfaction ICT	3.71	.94	-.21**	-.15*	—		
4. Work home interference	2.05	.70	.46**	.28**	-.48**	—	
5. Emotional exhaustion	2.84	1.12	.23**	.15**	-.56**	.69**	—
6. Detachment	3.13	.97	-.40**	-.23**	.49**	-.57**	-.55**

Note. N = 235.

* $p < .05$; ** $p < .01$.

Hypotheses 3a stated that availability ambiguity would be negatively related to satisfaction with ICT communication beyond supervisors' availability expectations; however, this was not supported (Table 5; β = -.12, *p* = .09). However, supporting Hypothesis 3b, availability ambiguity significantly contributed to detachment (β = -.15, *p* <.05), as can be seen in Model 2, step 3 (Table 5). Hypotheses 3c stated that availability ambiguity would be positively related to work home interference; this was supported as can be seen in Model 3, step 3 (Table 6; β = .28, *p* <.001). Finally, as can be seen in Model 4, step 3, Hypothesis 3d was not supported by our results (Table 6; β = .11, *p* = .11). Thus, we find only partial support for Hypotheses 3, as availability ambiguity significantly contributed to detachment and work home interference but did not predict satisfaction with ICT communication and emotional exhaustion.

Table 5

Study 2a: Results from Multiple Regression Analysis Predicting Self-Reported Satisfaction with ICT Communication (Model 1) and Detachment (Model 2)

	Model 1			Model 2		
	Satisfaction with ICT communication			*Detachment*		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Variable	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*
Age	-.07	-.07	-.07	-.02	-.02	-.03
Gender	.04	.04	.05	.04	.04	.05
Availability agreement	-.04	-.04	-.02	-.10	-.11[a]	-.08
Availability expectations		-.22**	-.20**		-.40***	-.38***
Availability ambiguity			-.12			-.15*
R^2	.01	.05	.07	.01	.17	.20
F	.51	3.25*	3.22**	.95	12.12***	11.07***
ΔR^2	.01	.05	.01	.01	.16	.02
ΔF	.51	11.42**	2.99	.95	45.08***	5.84**

* $p < .05$; ** $p < .01$; *** $p < .01$.

Table 6

Study 2a: Results from Multiple Regression Analysis Predicting Work Home Interference (Model 3) and Emotional Exhaustion (Model 4)

	Model 3			Model 4		
	Work home interference			Emotional exhaustion		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Variable	Beta	Beta	Beta	Beta	Beta	Beta
Age	.04	.04	.05	-.04	-.04	-.04
Gender	-.03	-.04	-.05	-.07	-.07	-.08
Availability agreement	-.05	-.05	-.09	.07	.07	.05
Availability expectations		.46***	.42***		.23***	.21**
Availability ambiguity			.28***			.11
R^2	.01	.22	.26	.01	.07	.08
F	.36	15.81***	16.38***	.96	4.09**	3.80**
ΔR^2	.01	.21	.05	.01	.05	.01
ΔF	.36	61.87***	14.86***	.96	13.34***	2.52

* $p < .05$; ** $p < .01$; *** $p < .01$.

3.4 Discussion Study 2a

The findings of this cross-sectional study mostly confirm our expectations. We confirmed that most employees do not have an explicit availability agreement with their supervisor. We could also show that availability expectations significantly and negatively predicted satisfaction with ICT communication and detachment and positively predicted work

home interference and emotional exhaustion. While availability ambiguity did contribute to detachment and work home interference beyond availability expectations, it did not further contribute to satisfaction with ICT communication and emotional exhaustion.

Our results show that availability ambiguity had an additional impact on several well-being aspects that are closely related to extended availability, namely detachment and work home interference. Satisfaction with ICT communication was not assessed specifically for communication from the home domain and thus respondents might have used a different frame of reference which might explain the non-significant effect. Moreover, exhaustion is an outcome that is influenced by a wide range of work stressors. While meta-analytic results have found a significant effect of role ambiguity on exhaustion (Alarcon, 2011), availability ambiguity as a construct might be too specific for such a broad variable. Our findings suggest that the specific focus on supervisors may extend our understanding of the process by which availability expectations affect employees. For this reason, the goal of our second study was to confirm that educating supervisors in an availability expectations training about the impact of availability expectations and encouraging them to communicate them to their subordinates would reduce availability ambiguity and positively affect employees. For this purpose, we provided supervisors with the training and evaluated the effectiveness of the intervention by assessing the outcome variables from the first study in a pre-post evaluation with their subordinates. It was not possible to include a control group for practical reasons. Because of organizational reasons, we also needed to exchange the work home interference measure with a work life balance measure.

3.5 Method Study 2b

3.5.1 Procedure

An invitation to the availability expectation workshops was send out via email to all supervisors working at a specific location of a German transportation company. All supervisors working at this location could participate and had to formally register for one of four workshop session. Participation was free of charge, but participants were expected to provide us with the email addresses of their subordinates at least 10 days before their workshop session. Due to organizational limitations we could not assess sociodemographic data for workshop participants and are only able to link them to their subordinates via a code. However, similarly to their subordinates, supervisors were from a wide range of professions and departments.

3.5.2 Participants

The final subordinate sample consists of 33 employees from a wide range of professions, such as engineering, project management, IT, and consulting. 7 out of the 33 employees were holding a leadership position. Slightly more than half (60.61%) of our sample was female. Mean age of participants was 45.88 years ($SD = 10.73$). In total, 3.03% of the sample had a doctoral degree, 48.48% had a university degree, 24.24% had a high school degree, and 21.21% had a middle school degree. On average, participants had 24.81 years of work experience ($SD = 12.17$), and they had been working at their current company on average for 21.64 years ($SD = 12.39$). Average tenure at their current job was 7.38 years ($SD = 6.92$), average hours worked per day was 8.55 ($SD = 1.48$). In terms of their private life, 60.61% of our participants were married, 24.24% were single, 12.12% were in a relationship, 3.03% indicated they were divorced. About half (54.55%) of our sample had kids.

3.5.3 Training intervention

The availability expectation training consisted of a half-day workshop that consisted of three components. The first component was designed to provide participants with knowledge about the effects of extended availability and ICT use after hours on employee behavior, well-being and performance. Furthermore, this part of the training specifically focused on the role of the organization and supervisors to inform supervisors about the important role they play for ICT communication in their teams and motivate them to improve on it. The second part of the training focused on how supervisors can prevent unnecessary and unintended availability by setting and explicitly sharing expectations about availability. Here, participants reflected on their expectations around ICT use and transcribed these expectations into concrete statements. This was designed to provide participants with a sense of personal control. A final step in each workshop was to encourage supervisors to share their expectations with their employees.

3.5.4 Summary of training outcome measures

Kirkpatrick (1976) suggests four increasingly advanced levels of evaluation criteria: reaction criteria, learning criteria, behavior criteria, and results criteria. We moved beyond training reactions, which are the most commonly used measure to evaluate the effectiveness of trainings (e.g., Arthur, et al., 2003; Sitzmann et al., 2008). We extended our evaluation to also include *Behavior* and *Results* criteria, measured via participants' subordinates. More specifically, we a) measured participants reactions immediately after the workshop session (*Reaction* criteria); b) subordinate surveys before and after the training asking them if they had an explicit agreement regarding extended availability to measure if supervisors had shared their availability expectations after the training (*Behavior* criteria); c) subordinate surveys about availability expectations and health and well-being outcomes before and six weeks after the training (*Results* criteria). We did not include *Learning* criteria in our study.

3.5.5 Reactions to the training: Supervisor evaluation

We assessed supervisor data at the end of each of the four half-day workshops.

Reactions. We evaluated participants' reactions with evaluation questions that were adapted from suggestions by Kirkpatrick (n.d.) and Kauffeld (2016). We asked participants if the goals were clear to them and if their expectations were met (3 items; sample item: "The training met my expectations"; α = .91), if they were satisfied with the contents of the training (6 items; "I gained new knowledge in the training"; α = .91), and if they found it useful (3 items; "I can apply the training content to my work"; α = .87). We also asked participants to evaluate the trainer (3 items; α = .96) and the learning environment (2 items; α = .51). All answers were given on a 6-point scale ranging from 1 (*fully applies*) to 6 (*does not apply at all*). Finally, we assessed with one item how satisfied participants were overall. This scale ranged from 1 (*fully satisfied*) to 6 (*completely dissatisfied*).

Table 7

Study 2b: Descriptive Statistics and t-Test for Paired Groups Statistics

			Before Training			After Training			Paired t-test
	Variable	*n*	*M*	*SD*	*α*	*M*	*SD*	*α*	*t*
1.	Availability expectation	33	2.06	.72	.71	1.80	.87	.86	2.46**
2.	Availability ambiguity	33	1.53	.42	.80	1.40	.49	.91	1.56
3.	Satisfaction ICT	31	2.70	1.90	.95	3.11	1.89	.99	-2.04*
4.	Work life balance	30	3.75	.94	.91	3.67	1.00	.92	1.20
5.	Detachment	30	3.38	1.09	.92	3.60	1.07	.88	-.90
6.	Emotional exhaustion	29	2.40	1.12	.89	2.67	1.00	.84	-1.68

* $p < .05$; ** $p < .01$; *** $p < .001$.

3.5.6 Behavior and Results criteria: Subordinate surveys

We e-mailed all subordinates of the training participants one week before (t1) and six weeks after the workshop took place (t2) to invite them to participate in our surveys. Table 7 shows means, standard deviations and Cronbach's alphas for the study variables at both time points. Correlations between all study variables can be found in Table 8.

Availability agreement. We assessed this in the same way as in Study 1.

Availability expectations and availability ambiguity. We measured supervisors' availability expectations and availability ambiguity in the same way as in Study 1. For availability expectations, average reliability was $\alpha = .69$ at t1 and $\alpha = .86$ at t2. For availability ambiguity Cronbach's alpha was $\alpha = .81$ at t1 and $\alpha = .91$ at t2.

Satisfaction with ICT communication. We measured satisfaction with ICT Communication with the same two-item, 5-point Face Scale (Kunin, 1955) as in Study 1. Average reliability was $\alpha = .95$ at t1 and $\alpha = .99$ at t2.

Work life balance. To assess work-life balance we used the Trierer Kurzskala zur Messung von Work-Life Balance (TKS-WLB; *Trier Short Scale for the Measurement of Work-Life Balance*) that was developed by Syrek, Bauer-Emmel, Antoni, and Klusemann, 2011. Participants answered each of the five items on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item is: "I am satisfied with the balance between my work and private life". Average reliability was $\alpha = .88$ at t1 and t2.

Detachment. Detachment was assessed in the same way as in Study 1. Average reliability at t1 and t2 was $\alpha = .91$.

Emotional exhaustion. We measured emotional exhaustion with the same measure as in Study 1. Average reliability was $\alpha = .89$ at t2 and $\alpha = .84$ at t2.

3.6 Results Study 2b

A total of 23 supervisors participated in one of the four half-day workshops. Reactions of supervisors indicated that they found the intervention to be useful. They said the workshop met their expectations well ($M = 2.67$; $SD = 1.32$), indicated that they were satisfied with the content of the workshop ($M = 2.40$; $SD = .94$), and that it had a high degree of perceived usefulness ($M = 2.23$; $SD = 1.02$). Overall, they were satisfied with the workshops ($M = 2.35$; $SD = 1.30$). Finally, they also evaluated the trainers very positively ($M = 1.83$; $SD = .91$) and indicated that the learning environment was to their liking ($M = 1.59$; $SD = .79$).

3.6.1 Hypotheses testing

Behavior criteria were assessed collecting data from subordinates (Hypothesis 1 and 4). We again calculated the percentage of employees who had an explicit agreement regarding availability with their supervisors at t1. Only 4 subordinates (12.5%) of participants had an explicit and concrete agreement regarding availability, the majority (28, 87.5%) indicated that they did not. Thus, Hypothesis 1 is supported by our results.

We then tested Hypothesis 4, stating that the intervention would boost directly communicated availability expectations. The number of participants with explicit agreements regarding availability increased from 12.5% (4) at t1 to 43.8% (14) at t2, which means that the number of subordinates who had an agreement more than tripled. According to a Sign test, a test that can be used to detect changes in outcomes on a nominal scale level (Field, 2018), this change is significant ($p = .003$). Thus, we can confirm Hypothesis 4.

Results criteria were also assessed by surveying subordinates before and after the intervention (Hypothesis 5 and 6). We tested Hypothesis 5, stating that a) the perceived supervisor expectations and b) availability ambiguity will decrease between t1 and t2 with a t-test for paired samples. Results can be compared in Table 7. Supporting Hypothesis 5a),

perceived supervisor expectations decreased significantly between the two measurement points ($t = 2.46$, $p < .01$). Further, Hypothesis 5b) was not confirmed as availability ambiguity did not decrease significantly ($t = 1.56$, $p = .07$). Thus, Hypothesis 5 can only be partly supported in the full sample of employees.

Finally, we tested Hypothesis 6a – d using t-tests for paired samples (see also Table 7). Hypothesis 6a stated that satisfaction with ICT communication would increase between t1 and t2, which was supported by our data ($t = -2.04$, $p < .05$). Hypothesis 6b and 6c stated that work life balance and detachment would increase from t1 to t2. However, both hypotheses were not supported by our data (work life balance: $t = 1.20$, $p = .24$; detachment: $t = -.90$, $p = .38$). Finally, Hypothesis 6d, stating that emotional exhaustion would decrease between t1 and t2 was also not supported ($t = -1.68$, $p = .05$).

3.6.2 Additional analyses

Since it seemed likely that availability ambiguity would only decrease for those subordinates whose supervisors directly communicated their availability expectations, we repeated our analysis for Hypothesis 5 with the subsample of subordinates who had an explicit agreement regarding availability with their supervisors at t2 ($n = 14$; presented in Table 9). Because of the small sample size, results need to be interpreted cautiously. However, in this subsample supervisor expectations again decreased significantly (t1: $M = 1.97$, $SD = .66$; t2: $M = 1.52$, SD = .46; t-test: $t = 2.66$, $p < .05$). More importantly, availability ambiguity also decreased significantly (t1: $M = 1.51$, $SD = .38$; t2: $M = 1.11$, $SD = .22$; t-test: $t = 3.71$, $p < .01$).

Table 8

Study 2b: Bi - Variate Correlations

	Variable	1	2	3	4	5	6	7	8	9	10	11
1.	Availability expectations (t1)	—										
2.	Availability ambiguity (t1)	.48**	—									
3.	Satisfaction ICT (t1)	.29	-.03	—								
4.	Work life balance (t1)	-.40*	-.44*	-.06	—							
5.	Detachment (t1)	-.30	-.43*	.05	.75**	—						
6.	Emotional exhaustion (t1)	.15	.46**	-.25	-.65**	-.48**	—					
7.	Availability expectations (t2)	.71**	.42*	.20	-.44*	-.23	.26	—				
8.	Availability ambiguity (t2)	.35*	.44*	-.03	-.52**	-.34	.37*	.48**	—			
9.	Satisfaction ICT (t2)	.29	.02	.73**	-.19	-.09	.05	.20	.16	—		
10.	Work life balance (t2)	-.36	-.32	.01	.86**	.64**	-.52**	-.50**	-.44*	-.04	—	
11.	Detachment (t2)	-.22	-.38*	.01	.51**	.61**	-.63**	-.31	-.34	-.14	.51**	—
12.	Emotional Exhaustion (t2)	.22	.52**	-.31	-.51*	-.42*	.79**	.28	.37	-.26	-.54**	-.64**

* $p < .05$; ** $p < .01$; *** $p < .001$.

We also repeated our analyses for Hypotheses 6a) – d) (also presented in Table 9). However, the sample size was even smaller for this subsample as two participants skipped one or both scales at least once (n = 13 for satisfaction with ICT communication and n = 12 for work life balance, detachment, and emotional exhaustion). No significant changes were found for satisfaction with ICT communication, work life balance, detachment, and emotional exhaustion.

Table 9

Study 2b: Descriptive Statistics and t-Test for Paired Groups Statistics, Subsample

	Variable	*n*	Before Training		After Training		Paired t-test
			M	*SD*	*M*	*SD*	*t*
1.	Availability expectation	14	1.97	.66	1.52	.46	2.66[**]
2.	Availability ambiguity	14	1.51	.38	1.11	.22	3.71[**]
3.	Satisfaction ICT	13	3.00	2.20	3.12	2.26	-.54
4.	Work life balance	12	4.16	.74	4.08	.88	.78
5.	Detachment	12	3.73	.73	3.69	.95	.24
6.	Emotional exhaustion	12	2.25	1.10	2.56	1.15	-1.82

[*] $p < .05$; [**] $p < .01$; [***] $p < .001$.

3.7 Discussion Study 2b

The results of our evaluation partly confirm our hypotheses. Consistent with Study 1, we found that most employees do not have an initial explicit agreement regarding availability with their supervisors. After supervisors participated in the intervention the percentage of subordinates who indicated that they had an explicit availability agreement increased from 12.5

% to 43.8% %. We also found that the perception of supervisors' availability expectations was lower after the intervention. However, availability ambiguity did not decrease significantly after the intervention for all employees. Moreover, while satisfaction with ICT communication significantly improved, no training effects were found for detachment, work life balance, and emotional exhaustion. Additional analysis using a subsample of subordinates who reported that they had an explicit availability agreement revealed that both the perception of availability expectations and availability ambiguity significantly decreased between t1 and t2. Again, no significant improvement was found for satisfaction with ICT communication, detachment, work life balance, and emotional exhaustion. Workshop participants evaluated the intervention well and found the contents useful for their work.

The finding that the subordinates of workshop participants reported increased availability agreements and that availability expectations tended to be lower after the intervention is in line with our assumption that employees benefit from directly communicated availability expectations. This is also supported by our finding that satisfaction with ICT communication increased after the training. Our additional analysis suggests that for ambiguity to decrease, it is necessary that a conversation about availability expectations takes place.

3.8 General Discussion

The main purpose of this study was to specifically investigate supervisors' availability expectations and to examine if the concept of availability ambiguity adds to our understanding of the way in which availability expectations affect employees. In a cross-sectional study (Study 1) we were able to show that availability expectations contribute to our understanding of the influence of availability expectations. In an intervention study (Study 2), we were further

able to demonstrate that communicating availability expectations explicitly has benefits for ICT-related outcomes (satisfaction with ICT communication; availability ambiguity).

In line with Hypothesis 1, in both studies most supervisors did not communicate an explicit agreement regarding availability to their subordinates. In our first study, we were able to establish that availability ambiguity adds to our understanding of the impact of availability expectations on well-being outcomes. The results of Study 1 suggest that availability ambiguity is an important concept. The results of Study 2 suggest that communicating availability expectations can effectively be trained and that this positively impacts employees.

3.8.1 Theoretical implications

The present research contributes to the literature in several ways. First, we contribute by specifically focusing on supervisors' availability expectations. Previous studies have investigated a broader organizational perspective and have not yet differentiated between expectations from different sources. Our results indicate that supervisors' availability expectations play an important role for employees but are predominantly not communicated explicitly. Further, it is possible that the initial perception subordinates have of implicitly communicated expectations deviate from the actual expectations of supervisors. Perceived expectations decreased after the intervention, which could either be an indicator of supervisors lowering their expectations or subordinates overestimating them initially. We do not know yet if the decrease can be traced back to an actual decrease of expectations or to an initial overestimation by subordinates that was corrected by the implicit or explicit behavior of supervisors afterwards. This gap between the perception of implicitly communicated availability expectations and actual expectations could explain some of their negative effects because subordinates who perceive their supervisors' availability expectations as higher will

likely behave in line with overestimated expectations (Derks et al., 2015; Paczkowski & Kuruzovich, 2016). However, as this behavior might not actually be expected by their supervisors, it is likely not linked to subordinates' goal attainment and might predominantly not be rewarded. Alternatively, supervisors' availability expectations could have decreased after the intervention. Learning about the detrimental impact of high availability expectations might have encouraged them to lower their expectations to a level that they considered more manageable or appropriate for their subordinates. Either way, focusing on supervisors extends our understanding of the way in which availability expectations influences employees and identifies reducing availability ambiguity as a leverage for supervisors.

Second, by introducing the concept of availability ambiguity we contribute to research on availability expectations. Demonstrating that ambiguity is a relevant aspect of availability expectations extends our knowledge of the process by which availability expectations negatively affect employees and indicates different ways by which to alleviate them. Reducing availability ambiguity gives supervisors a leverage by which to change the negative impact of extended availability, even when they cannot lower the expectations themselves. Moreover, our results indicate that employees might overestimate implicit availability expectations. Consequently, employees benefit from explicit availability agreements for two reasons. First, it reduces ambiguity and makes it easier to behave in line with expectations. Second, as availability expectations are initially overestimated, employees have more opportunities to disconnect from work than they thought. Our results suggest that a combination of social learning theory (Bandura, 1979) and role theory (Katz & Kahn, 1978) can be a useful framework for research on availability expectations.

Third, by developing and evaluating an intervention targeting supervisors' availability expectations, we contribute to research on interventions concerning ICT use in organizations. While it is also important to explore the topic of work-related ICT use and availability from a

broader organizational perspective, the general culture cannot be easily changed by individuals. It is therefore necessary to focus research efforts on the individual and specifically on supervisors, as they act as important role models for their subordinates and can directly and indirectly influence their subordinate's behavior. Our second study (Study 2) shows that educating supervisors about the impact of work-related ICT use and extended availability on employees' well-being encouraged them to share their expectations with their subordinates. In turn, this influenced subordinates' perception of expectations and increased satisfaction with ICT communication. Thus, our research suggests that interventions targeting supervisors are effective in changing attitudes around ICT communication and support a more accurate perception of supervisors' expectations. Currently, very few studies have evaluated interventions targeting after hour ICT use and extended availability in a work context. Thus, the current study extends current research findings and can serve as a building block for future interventions to build upon.

3.8.2 Methodological contribution

Though it is well-known that evaluating interventions using non-same-source data with a within-subjects design measures training effectiveness more reliably, few evaluation studies use such a rigorous approach (Arthur et al., 2003). Still, using only immediate reaction criteria to evaluate trainings means that the evaluation is influenced by other factors besides the training, for example trainee criteria and organizational support for the intervention (Sitzmann et al., 2008). For this reason, we contribute to intervention studies by implementing a more thorough evaluation and by using multi-source data for the evaluation. We measured the effect of the training on participants' subordinates and were able to demonstrate a behavior change

(*Behavior* criteria) and an additionally beneficial effect (*Results* criteria), which strengthens the contribution of Study 2 (Kirkpatrick, 1976).

3.8.3 Practical implications

With regards to practical implications, our studies confirm that supervisors are a relevant source of availability expectations. We were able to confirm that the availability expectation intervention is effective in improving communication regarding availability expectations. Subordinates also perceived supervisors' availability expectations to be lower, after the training. As lower availability expectations are associated with higher well-being and lower work-home conflict, a few suggestions can be made. First, supervisors should be encouraged by HR departments to reflect on their expectations regarding availability and to communicate them directly to subordinates. Further, ICT-related trainings could be integrated into leadership trainings to encourage supervisors to learn about the consequences of organizational availability and to talk to their subordinates about their expectations. Since extended availability and work-related ICT use outside of regular work hours are on the rise in many organizations, providing supervisors and employees with guidelines on how to best implement these new practices, is an important goal for HR departments.

This research is also relevant for supervisors. The message they can take from the studies is that communicating expectations regarding availability can decrease their subordinates' availability ambiguity and increase satisfaction with communication via ICT. As availability ambiguity is related to various broader well-being outcomes, explicitly sharing expectations can potentially be beneficial for well-being. Therefore, even when the availability expectations themselves are not under personal control, supervisors can share their

expectations, which gives them a simple leverage to improve ICT-related attitudes and to reduce ambiguity.

3.8.4 Limitations

The present studies offered relevant insights into supervisors' availability expectations but have certain limitations. First, Study 1 only relied on cross-sectional data. Thus, no causal relationships can be deducted from this study, and relationships might have been affected by same source bias (Podsakoff et al., 2003; Spector, 2006). Thus, the results need to be replicated using different assessment methods, for example assessing the data from complete teams with a longitudinal design. In a similar vein, in our intervention study (Study 2) all subordinates worked at the same organization and some shared supervisors, which might have led to socially desired behavior and group pressure. For example, employees who might have initially evaluated their supervisor more positively, might have conformed to their more dissatisfied colleagues to be supportive. Further, if extended availability and work-related ICT use are openly criticized in the organization, a similar adjustment of individual answers might have occurred on an organizational level. Future interventions need to replicate our study among employees of multiple organizations.

A second limitation is the small sample size in our intervention study (Study 2). We decided to use data sources other than the workshop participants to ensure the practical relevance of our intervention. With only 33 subordinates participating at both timepoints our sample size is smaller than would be desirable. While using participants' subordinates for the evaluation is one of the strengths of our study, due to the small sample, we were not able to take the nested structure (employees nested in teams) into account in our analyses. Moreover, the number of participants who indicated that their supervisors had a conversation regarding

availability with them after the intervention was even smaller. A small sample size may lead to low statistical power. However, even with the small sample size we were able to demonstrate a significant impact of our intervention on some outcomes. Still, as these issues restrict the generalizability of our findings, future studies need to replicate this with bigger samples that allow for a consideration of interdependence between participants.

Additionally, we were not able to include a control group in our intervention study. Doing so would have been advantageous to gather evidence for causality but was not possible due to organizational constraints and the quite small sample of eligible workshop participants. To infer causality, it would be necessary to conduct an evaluation study where supervisors randomly participate either in a training group or a (waitlist) control group.

Finally, as we only assessed the availability expectations of supervisors, we were not able to compare their impact with that of organizational availability expectations and/or the expectations of colleagues. Thus, while supervisors' availability expectations play an important role, we cannot make conclusions about the impact of other sources in comparison to them. It is possible that the expectations of colleagues play a role of similar importance, as they could also serve as role models regarding availability (Bandura, 1979).

3.8.5 Directions for future research

Some suggestions can be made for future research. First, we recommend that future studies differentiate further between different sources of availability expectations. While for many employees their supervisor is an important source of availability expectations, their relative importance might depend on other factors. For example, for customer-facing roles, the expectations of customers might have a bigger impact on their behavior since they can only perform well when they satisfy their customers' expectations.

Second, even if a supervisor clearly communicates a preference leaning towards segmentation, in a team that predominantly consists of integrators integration norms might persist (van Knippenberg, van Knippenberg, Cremer, & Hogg, 2004). In a similar vein, could be explored how the preferences and communication norms in a team reversely influence other team members' and supervisors' own behavior and attitudes regarding ICT use and availability.

Third, our results clearly show that availability ambiguity had an impact on well-being outcomes beyond availability expectations. Still, participating in the intervention was not sufficient to reduce availability ambiguity. Instead, our data suggests that explicitly sharing availability expectations is crucial to effectively reduce ambiguity. It would thus be worthwhile to explore means by which supervisors can be motivated to directly communicate their expectations to subordinates. While Koch and Binnewies (2015) suggest that supervisors need to act as work-life-friendly role models and need to demonstrate segmentation behavior to support employees in segmenting life domains, this might not always be possible for supervisors. It remains unclear if making availability expectations explicit positively impact subordinates' own segmentation behavior and well-being as our subsample was too small to report meaningful effects. While our training was effective in increasing the percentage of explicit availability agreements, future studies need to explore conditions when sharing expectations can be effective for broader well-being outcomes.

3.8.6 Conclusion

There are two central messages that can be derived from this research. First, the perception of supervisors' availability expectations has an impact on subordinates' well-being and attitudes regarding communication via ICT. Second, subordinates experience ambiguity regarding these availability expectations. Thus, the perception of expectation changes when

supervisors communicate their expectations to subordinates explicitly, so that the perceived amount of expectations decreases and satisfaction with communication via ICT increases. For this reason, efforts to implement interventions that motivate supervisors to communicate their expectations to subordinates can effectively create mutually clear availability expectations and increase satisfaction with ICT communication.

4. Study 3: Interrupt Yourself! When it Comes to Creative and Planning Performance Switching Tasks at Your Own Pace Beats Concentrated and Externally Interrupted Work

4.1 Introduction

Knowledge workers today are not only expected to pursue several work goals at once (König, Bühner, & Mürling, 2005), they are also increasingly connected and available for incoming communication. The rise of information and communication technologies (ICT) makes it easy to access information and answer messages independent of location, but at the same time ICT offers more distractions and sources of interruptions than ever before. In fact, a representative survey of German employees states that 56% of participants think digitalization has increased the frequency of multitasking required at work (DGB-Index Gute Arbeit, 2017). This illustrates that, among other work demands such as time pressure and a high workload, frequent interruptions are one of the most common demands knowledge workers face (Baethge et al., 2015; Jett & George, 2003; Speier et al., 2003).

Interruptions can either arise from external sources (external interruptions) or internal sources (internal interruptions). Both types of interruptions involve switching to a secondary task temporarily. Literature normally treats task switching as a broad concept that describes switches between tasks for different reasons (González & Mark, 2004; König et al., 2005). We use the term task switching more narrowly to describe the switch from a primary to a secondary task after an external or internal interruption. External interruptions are usually defined as uncontrollable, unpredictable events, which temporarily shift the attention of an individual from his or her current primary task toward the interruption (Speier et al., 2003). Research shows that they generally impact performance and well-being negatively (e.g., Baethge &

Rigotti, 2013; Speier et al., 2003). In contrast, internal interruptions are self-initiated attention shifts and can be anticipated by the individual (Jett & George, 2003). Drawing on action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005), internal interruptions should not come with the same negative consequences as external interruptions as they can be included into an action plan which alleviates disruptive effects. Nevertheless, earlier research has mainly described internal interruptions conceptually (Jett & George, 2003) or has investigated external interruptions because internal interruptions "are not directly observable, [which] makes them difficult to study" (Baethge et al., 2015, p. 309), resulting in a lack of knowledge about the effects of internal interruptions on performance. Specifically, it remains unclear if the effects of internal interruptions on performance are distinct from the effects of external interruptions. Internal interruptions have often been blamed for depleting attentional resources and hindering task performance in the same way as external interruptions. However, this assertion has not been tested yet and it is unlikely that the two concepts are interchangeable as they are distinct on critical facets, for example the level of individual control associated with internal and external interruptions. Additionally, the underlying mechanisms by which both types of interruptions affect performance remain underexplored.

To address this gap in research, we investigate internal interruptions along external interruptions in two experiments with two different performance outcomes. We aim to integrate internal interruptions into a model based on German action-regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005) that has been successfully used to explain detrimental effects of external interruptions (Baethge & Rigotti, 2013). Building on action regulation theory, we develop and test a theoretical framework that describes how external and internal interruptions differently affect performance in a creative task and a planning task. While creative tasks require an individual to generate new ideas and use flexible thinking (Lu et al., 2017), for planning tasks it is necessary to correctly identify relevant information and think in strategic

ways (Funke & Krüger, 1995; Phillips, Kliegel, & Martin, 2006). These skills are required in most knowledge worker jobs. Specifically, we propose that in comparison to external interruptions, internal interruptions do not lead to a decline in performance due to their self-determined and advantageous timing. Additionally, we suggest that internal interruptions can improve performance by either an energy management process or a motivational process. First, when it comes to energy, one could assume that individuals initiate internal interruptions to replenish energy resources (Adler & Benbunan-Fich, 2015; Fritz, Ellis, Demsky, Lin, & Guros, 2013; Fritz et al., 2011; Madjar & Shalley, 2008; Zacher et al., 2014). Second, regarding the autonomy process, the ability to decide when and how to switch between tasks should be reflected in the level of perceived autonomy over tasks which has been consistently linked to improved performance (Langfred & Moye, 2004). We investigate and compare both possible processes.

Our paper makes several contributions to the literature. First, our study contributes to the broader literature on interruptions at work by directly comparing effects of internal and external interruptions on two different performance outcomes. Previously, both types of interruptions have only been investigated separately with only a few studies focusing on internal interruptions (Adler & Benbunan-Fich, 2013). In a similar vein, we investigate if the predominantly negative view on interruptions (e.g. interruptions must always be avoided as they reduce task performance) holds true for all types of interruptions in different tasks. More specifically, we examine the effects of interruptions on performance in a creative task as well as in a planning task. This extends our understanding of the conditions affecting the consequences of interruptions. Second, we contribute to theory by offering an insight into the process by which interruptions affect performance. Specifically, we examine both an energetic and an autonomy perspective that could be used to explain the distinct effects of both types of interruptions on performance. Finally, by allowing for only one interruption in both conditions,

we can ascribe the consequences of the interruption to the different characteristics of internal and external interruptions. As research by Baethge et al. (2015) has stressed, cumulative interruptions might affect outcomes in qualitatively different ways, which emphasizes the importance of keeping the number and frequency of interruptions constant when investigating qualitative differences of external and internal interruptions. Previously, the number of interruptions was not kept constant between conditions (Lu et al., 2017; Madjar & Shalley, 2008), making it difficult to compare the two concepts.

In the next sections of our paper, we build on action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005) as a theoretical framework to account for distinct effects of external and internal interruptions on performance and introduce external and internal interruptions as core concepts. Building on this, we offer two contrasting explanations for the different effects of external and internal interruptions on performance. First, we give an overview over the perspective that internal interruptions go hand in hand with successful energy management and thus contribute to task performance (Adler & Benbunan-Fich, 2013; Fritz et al., 2011). Second, we introduce an alternative motivational perspective which assumes that internal interruptions increase the perception of high autonomy and thus improve performance. To clarify this, we conducted two laboratory experiments to provide insights into the underlying processes and discuss our findings in detail.

4.1.1 Action regulation theory

Action regulation theory offers an explanation for the effects of interruptions on performance. The central aspect of action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005) is the action goal, since all human action is goal-directed. The action process is cyclical and can be subdivided into six phases. In addition to this cyclical action process, actions are also seen as hierarchical. Each goal can be subdivided into several sub-goals, which,

in turn, can again be subdivided. The more complex a goal, the more sub-goals and hierarchical levels exist for the action. Each sub-goal is again characterized by a cyclical process. Actions on different hierarchical levels require different levels of regulation. Goals on a higher hierarchical level need a more conscious regulation than lower level goals, as they are more complex and cannot be automated by the individual. For example, the complex goal of preparing a PowerPoint presentation for a conference consists of several steps. Planning how to communicate the research message requires regulation at the *intellectual level* since a conscious analysis is necessary. However, for sub-goals at a lower level the action might already be organized into a schema, e.g. when the sub-goal is to design a slide presenting the results of the study (*level of flexible action patterns*). Below that, on the *sensorimotor level*, the visible actions, e.g. pressing a key, are performed. Those visible actions do not require conscious regulation and can proceed automatically, unless something unexpected occurs.

4.1.2 Core concepts: External and internal interruptions

In the context of action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2005), external interruptions are classified as stressors – so-called regulation obstacles. Obstacles are defined as aspects of work that impede or prevent an employee from reaching a set goal. Supporting this view, past research supports the view that external interruptions require immediate reactions and thus suspend goal-directed action and force employees to change their focus at least for some time (Brixey et al., 2007; Speier et al., 2003). Coping with regulation requires the exertion of additional effort and time and can therefore lead to time pressure (Baethge & Rigotti, 2013; Frese & Zapf, 1994).

In contrast, internal interruptions have not yet been integrated into action regulation theory. They can be described as "internal decisions to stop an ongoing task to attend to another, due to personal thought processes or choices" (Adler & Benbunan-Fich, 2013, p. 1441). The

reasons for internal interruptions are diverse. Among others, boredom and overload have been shown to be internal triggers (Adler & Benbunan-Fich, 2013; Fischer, 1998). While external interruptions are by definition unpredictable, the timing of internal interruptions is under personal control (Speier et al., 2003). Due to their predictability and controllability, internal interruptions do not necessarily impede or prevent an employee from reaching a set goal. Therefore, in the framework of action regulation theory internal interruptions would not be classified as regulation obstacles.

4.1.3 Effects of external interruptions

A number of cross-sectional, experimental, and diary studies demonstrate the negative impact external interruptions have on performance (Baethge & Rigotti, 2013; Bailey & Konstan, 2006). External interruptions are detrimental to task execution as they are usually unexpected and often happen at inconvenient times (Jett & George, 2003; Nijstad & Stroebe, 2006; Nijstad, Stroebe, & Lodewijkx, 2003). But even the expectation of an unpredictable external interruption can have a negative effect, for example decreased task performance (Bailey & Konstan, 2006).

After an external interruption occurred and has been dealt with, individuals can only return to the primary uncompleted task after a so-called resumption lag (Brixey et al., 2007). A resumption lag describes the time needed to retrieve information to the working memory that is necessary for returning to the primary task. An employee might find it difficult to return to his or her primary task as he or she might need to repeat the whole action or repeat parts of the action process (Frese & Zapf, 1994), in which case the resumption lag would be longer adding up to a more disruptive interruption. Thereby, external interruptions can increase time pressure or even result in individuals resorting to more risky alternative actions to be able to complete the primary action on time (Baethge & Rigotti, 2013; Frese & Zapf, 1994). When individuals

can prepare for an interruption, for example, by writing down necessary information, the resumption lag is considerably shorter. Thus, the resumption lag slows down task continuation to different extents. Additionally, negative performance outcomes might be based on the fact that interrupted people forget about the intended next action steps for the primary task while being interrupted. Because of these reasons, external interruptions often decrease task performance.

Moreover, the effect of external interruptions is not limited to task performance. They also negatively impact well-being, affect and stress-levels (Bailey & Konstan, 2006; Sonnentag, Reinecke, Mata, & Vorderer, 2018). For example, individuals experience a higher level of annoyance when they are interrupted, during both the primary and secondary task (Bailey & Konstan, 2006). This detrimental effect can be partly explained by increased time pressure which is in turn experienced negatively (Baethge & Rigotti, 2013; Frese & Zapf, 1994; Sonnentag et al., 2018). Further, it is also likely that being interrupted is itself a negative experience (Jett & George, 2003).

With regards to moderating factors, the complexity and monotony of tasks influence the effect of external interruptions, with positive performance outcomes for less complex and more monotonous tasks (Baethge et al., 2015; Speier et al., 2003). Since the individual needs to reconstruct more, and more complex information related to the task, higher effort is needed to resume a primary task at a higher hierarchical level. Therefore, especially when the tasks are intellectually demanding and complex external interruptions impact performance negatively, as they affect both efficiency and performance quality (Baethge, 2013; Bailey & Konstan, 2006; Speier et al., 2003). Moreover, the specific timing of an interruption is crucial. To make an external interruption less disruptive it must not occur during an ongoing cyclical action process. Supporting this notion, it has already been shown that interruptions happening at a suitable time and between tasks are less disruptive (Adamczyk & Bailey, 2004; Bailey

& Konstan, 2006; Czerwinski, Cutrell, & Horvitz, 2000; McFarlane & Latorella, 2002). Ideally, an interruption occurs when a subset of actions has been completed and a sub-goal has been achieved. Goal achievement can then serve as a cue for task resumption and will make it easier for individuals to pick up the action process at the action step where they were interrupted (Adamczyk & Bailey, 2004).

While current research mostly focuses on negative effects of interruptions, evidence for positive performance effects of external interruptions can be found in the task switching literature focusing on creative tasks. These divergent findings demonstrate that the nature of the task affects the impact of external interruptions. Having to switch between several tasks has been shown to enhance creative performance in several studies (Dijksterhuis & Meurs, 2006; Madjar & Shalley, 2008; Sio & Ormerod, 2009; Zhou & Hoever, 2014). Lu et al. (2017) argue that setting aside a task to engage in a different one reduces cognitive fixation and thus improves performance. One example is the so-called incubation effect. It describes the unconscious continuation of information processing that occurs while individuals consciously focus on a secondary task which can result in an "aha" effect and improved performance for creative as well as decision-making tasks (Dijksterhuis, 2004; Madjar & Shalley, 2008). In some studies, performance benefits occur specifically when participants have to perform multiple switches between creative tasks (Lu et al., 2017). Based on these divergent findings and the incubation effect we examine two different types of task performance. We analyze the effects of interruptions on a planning task which we expect to be negatively affected by external interruptions and a creative task which we expect to be positively affected by external interruptions.

4.1.4 Effects of internal interruptions

To date, little research has focused on internal interruptions. For this reason, we mostly rely on the conceptual differences of external and internal interruptions and use theoretical arguments to support our hypotheses. Moreover, we draw upon some studies investigating the boundary conditions reducing the detrimental effects of interruptions.

Adler and Benbunan-Fich (2013) state that the main difference between external and internal interruptions lies within their cause. External interruptions result out of external or environmental clues, while internal interruptions are internally-motivated and are impacted by internal clues. Further, individuals can include anticipated interruptions into their action plan by adapting the action plan or the action goal during task execution. In contrast, whenever interruptions are unexpected the employee is not able to adapt his or her action plan and cannot prepare a resumption strategy in advance. Anticipation of and control over the timing of interruptions is mostly given in the case of internal interruptions but rarely given in the case of external interruptions. Therefore, it can be assumed that in the case of internal interruptions individuals are able to prepare for the accompanying task switch to the secondary task and the return to their primary task. This makes a crucial difference for performance outcomes. For example, an employee anticipating an interruption can write important information down or can plan how to resume the primary task. The employee still needs to step away from the primary task to deal with the interruption, but it significantly reduces the resumption lag and the mental effort needed to resume the primary task afterwards (Brixey et al., 2007; Frese & Zapf, 1994). Furthermore, individuals can interrupt themselves and switch to the secondary task at opportune or even favorable moments, e.g., when they have finished a sub task or achieved a distinct sub-goal at a higher level (González & Mark, 2005; Payne, Duggan, & Neth, 2007). Thereby, the task switch does not interrupt an ongoing action process and goal achievement can serve as a cue for task resumption, which will make it easier for individuals

to return to the primary task (Adamczyk & Bailey, 2004). For these reasons, even though a resumption lag also occurs for internal interruptions, they should be less detrimental to performance.

Empirically, the notion that anticipation reduces the negative impact of interruptions is supported by an experimental study by Carmeli, Ben-Hador, Waldman, and Rupp (2009) showing that the performance of participants who were able to anticipate interruptions suffered less. Additionally, Rouncefield, Viller, Hughes, and Rodden (1995) demonstrated less of a negative effect when interruptions in an office environment occurred only during set times of day and week as they could be better anticipated. In a similar vein, control over the timing of interruption reduces their detrimental impact (McFarlane, 2002). Finally, research by Adler and Benbunan-Fich (2015) provides evidence for a positive impact of being able to determine the switching between tasks. Since individuals can anticipate and control internal interruptions, which is rarely the case for external interruptions, we generally assume that compared to external interruptions, internal interruptions will lead to better performance outcomes. However, contrary to the general negative effect of external interruptions, we also expect a positive effect of external interruptions within a creative task due to the above-mentioned incubation effect (Madjar & Shalley, 2008) as the dissolution of cognitive fixation should exceed the negative consequences of external interruptions. To test this assumption, we therefore propose that:

Hypothesis 1a: For creative tasks, an internal interruption leads to improved performance compared with (a) an external interruption and (b) no interruption; and an external interruption leads to decreased performance ratings compared with (a) an internal interruption and improved performance ratings compared with (b) no interruption.

Hypothesis 1b: For planning tasks, an internal interruption leads to improved performance compared with (a) an external interruption and (b) no interruption; and an external interruption leads to decreased performance ratings compared with (a) an internal interruption and (b) no interruption.

4.1.5 Energy management perspective on interruptions

Action regulation theory can be used to explain why internal interruptions do not lead to diminished performance. However, we propose that internal interruptions in fact improve performance when compared with working without interruptions and being externally interrupted due to their positive impact on energy as suggested by Madjar and Shalley (2008). Energy describes an activated affect that is defined by its state of invigoration and the experience of vitality (Ryan & Frederick, 1997). Moreover, feeling energetic is consistently and positively related to higher performance at work (Carmeli et al., 2009; Dubreuil, Forest, & Courcy, 2014; Ryan & Deci, 2000). According to Hobfoll (2011), over the course of a work day transient resources such as energy are depleted due to work demands. Still, energy resources can be restored by certain energy management strategies (Fritz et al., 2011; Zacher et al., 2014). Internal interruptions can be used as energy management strategies. When employees fail to achieve a state of flow with an ongoing task (Adler & Benbunan-Fich, 2013) or when they feel overtaxed (Jin & Dabbish, 2009) they might interrupt themselves and switch to a secondary task to replenish energy resources. The work-related energy management strategies *making a to-do list* and *checking and updating one's schedule* increased feelings of vitality on a within-person level (Zacher et al., 2014). While Zacher et al. (2014) did not find a positive impact on vitality for switching tasks in general, switching to a task based on an internal interruption that is less complex and requires regulation at a lower hierarchical level (Frese & Zapf, 1994) might be the deciding factor for successful energy management (Ohly,

Göritz, & Schmitt, 2017). Thus, we suggest that internal interruptions (e.g. switching to a different work task) might increase energy and thus lead to higher performance outcomes if a low-complex secondary task is chosen.

Moreover, since external interruptions are regulation obstacles (Baethge & Rigotti, 2013; Frese & Zapf, 1994), they are typically experienced as demanding and will not have the same replenishing effect and even deplete energy resources further as regulation obstacles require the exertion of additional effort (Baethge & Rigotti, 2013). Further, employees who work uninterrupted deplete their energy resources to a higher extent than when they can initiate internal interruptions as they do not have the opportunity to switch to a less demanding task when they feel overtaxed.

To summarize, internal interruptions increase energy whereas external interruptions reduce energy which then boosts or hinders task performance. We expect that task switches from a primary task to a secondary task and back caused by an internal interruption increase feelings of energy which results in increased task performance. Further, we expect task switches caused by external interruptions to decrease energy and impair performance.

> **Hypothesis 2:** An internal interruption leads to higher energy after task completion compared with (a) an external interruption and (b) no interruption; and an external interruption leads to lower energy after task completion compared with (a) internal interruption and (b) no interruption.

4.1.6 Autonomy perspective on interruptions

In addition to potentially restoring energy resources, internal interruptions could also boost performance because they increase the perception of task autonomy. Task autonomy reflects the extent to which a job allows an individual to schedule work tasks, and to decide on

the method and strategy for executing them (Hackman & Oldham, 1975; Jackson, Wall, Martin, & Davids, 1993; Madjar & Shalley, 2008). In action regulation theory autonomy is seen as the most important external resource supporting individuals in dealing with regulation obstacles, such as interruptions as it "allows them to choose adequate strategies to deal with the situation, […] they can plan ahead better and [be] more flexible in the event that something goes wrong" (Frese & Zapf, 1994, p. 319). In general, having autonomy over ones' job has been shown to directly and positively impact performance (Humphrey, Nahrgang, & Morgeson, 2007; Karasek, 1979; Karasek & Theorell, 1990; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Thompson & Prottas, 2006).

In the context of external interruptions, having low autonomy means that an employee is exposed to external interruptions and cannot anticipate or influence them. In contrast, in work environments with high autonomy, an employee experiencing cognitive fixation or being stuck during a problem-solving/planning task or creative task can initiate an internal interruption. This reduces cognitive fixation and gets unconscious processes into motion. Being able to switch tasks at ones' own discretion and thus engaging in internal interruptions means that one can control task scheduling and task execution, which allows a more self-determined work flow. As internal interruptions can be integrated into the action plan, they support goal achievement and do not negatively impact the overall action plan. Therefore, internal interruptions can be used as a strategy because employees can initiate them at the right time to utilize incubation effects in the most effective way as proposed by previous research (Dijksterhuis & Meurs, 2006; Madjar & Shalley, 2008). Finally, employees who do not have the possibility to interrupt themselves experience lower levels of task autonomy compared to employees who are able to do so, but still do not have to handle external interruptions which would negatively impact performance compared to non-interruptions. Therefore, work environments where employees can engage in internal interruptions can be described as work

environments with higher levels of task autonomy, while external interruptions indicate lower levels of task autonomy compared to environments without interruptions. Further, task autonomy benefits performance through a motivational process (Ryan & Deci, 2000). It has been shown that high levels of autonomy can increase motivation which in turn positively impacts performance (Langfred & Moye, 2004).

In line with our reasoning above, we expect the type of interruption to not only affect performance but additionally the level of task autonomy individuals experiences during task execution as a result. We thus propose that:

Hypothesis 3: An internal interruption leads to higher perceived task autonomy compared with (a) an external interruption and (b) no interruption; and an external interruption leads to lower perceived task autonomy compared with (a) an internal interruption and (b) no interruption.

In the first experiment, we test Hypothesis 1a and Hypothesis 2. In the second experiment, we test Hypothesis 1b as well as Hypothesis 2 and 3 and thus contrast the two alternative processes by assessing both energy and perceived autonomy after task completion. Moreover, we aim to test our assumption that internal interruptions improve performance with a different performance outcome in our second experiment.

4.2 Method Study 3a

In our first experiment, we chose a creative task because a significant percentage of knowledge worker tasks can be defined as creative tasks and creative performance is highly relevant for organizational success (for reviews, see Hennessey & Amabile, 2010; Zhou & Hoever, 2014).

4.2.1 Participants

The sample included 134 student participants (M = 25.49 years, 64 women) from diverse courses of studies, including education (21.2 percent), business studies (18.2 percent), social sciences (16.1 percent), psychology (15.3 percent), natural sciences / computer science (13.9 percent), humanities (2.2 percent) and law (2.2 percent). Participants were randomly assigned to the experimental conditions of a 3 (interruption: internal vs. external vs. no) x 1 factorial design. Females and males were randomly assigned to the conditions, with an equal number of males and females in the internal interruption group (17 women and 18 men), slightly more women in the external interruption group (27 women vs 21 men), and more men in the control group (31 men vs 20 women). Participants received a snack and the opportunity to participate in a raffle for 25€ book vouchers.

4.2.2 Procedure

Participants took part in the experiment on a drop-by basis. Upon arrival, student assistants seated each participant in front of a computer and opened an online questionnaire, starting with written instructions for the overall procedure and the creative task. Participants learned that they would work on two tasks for 13 minutes, a 10-minute creative task, as well as a non-specified secondary task for 3 minutes. Participants in the external interruption group were informed that they would be redirected to the secondary task at a certain time and would have to finish this secondary task before being redirected back to the creative task. Participants in the internal interruption group were informed that they needed to switch to the secondary task during the 10-minute period but could choose a time to work on the secondary task themselves and would finish the creative task afterwards. In the control group participants were simply informed that they would first work on a creative task for 10 minutes and would afterwards work on a second task. In all conditions the procedure was presented as

advantageous for performance. After the instruction and filling out the questionnaire, participants started to work on the creative task. Depending on the experimental condition the further procedures varied (see Figure 5) but all participants had 13 minutes to complete both tasks. Participants in the external interruption group were automatically redirected to the secondary task (solving math problems) after five minutes. Participants in the internal interruption condition could choose when to switch to the second task themselves. Both groups were automatically redirected back to the primary task after working on the secondary task for three minutes. Participants in the control group worked on the primary task for ten minutes and afterwards were redirected to the secondary task (see Figure 5).
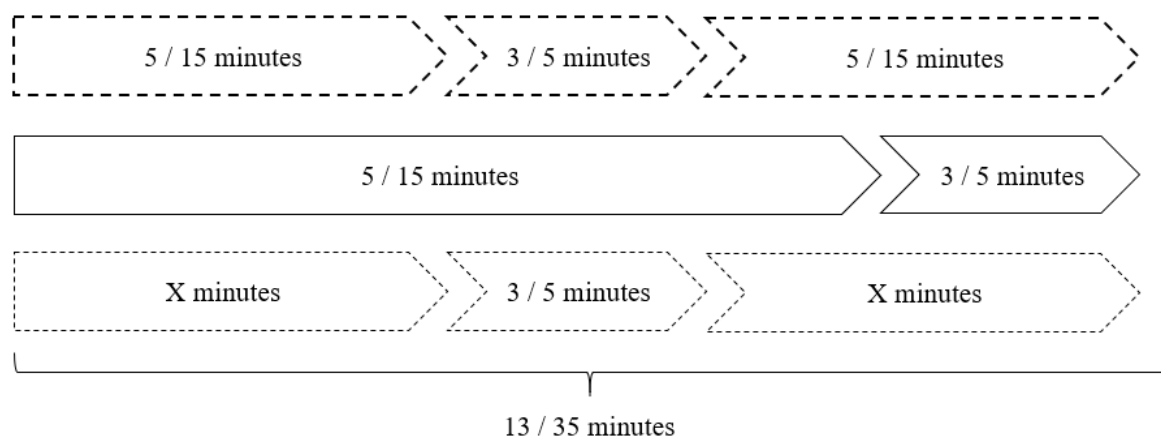
Figure 5. Procedure Study 3a (listed first); procedure Study 3b (listed second). Fat dashed line = external interruption group, solid line = control group, dashed line = internal interruption group.

4.2.3 Creative task (primary task)

The creative task is part of the well-established test for diagnosis of job-related creativity (Diagnose berufsbezogener Kreativität) by Schuler, Gelléri, Winzen, and Görlich (2013). During the task, participants were asked to make up as many games as possible for a children's birthday party with 24 listed objects. Two example games were given (a hockey match with two benches as goals and a can of soda as a ball; the game "hit the pot" using a stick and a soda can as the pot). As an indicator for creative fluency we followed the approach recommended in the test manual by counting the number of games participants developed as a performance indicator. We also measured the originality of ideas by following the procedure outlined in the manual (also called "output dominance", Ward & Kolomyts, 2010), indicating how common a given response is in the entire set of responses. To do so, a naïve coder, who was blind to the study preconditions and experimental conditions, counted the number of times a specific game was mentioned. The coder then divided the games into quartiles according to the quantity they were mentioned. Following this, the coder assigned points to each game depending on its rarity, with games that were mentioned less often earning higher points. The 25% of games that were mentioned least often were assigned one point, the next 25% 0.75 points, and so forth. As the approach is objectively and rational, only one coder coded the data.

4.2.4 Math task (secondary task)

The math task we used as the secondary task is part of a short German intelligence test, the Intelligenz-Struktur-Test Screening (Intelligence Structure Test Screening; IST-Screening) (Liepmann, Beauducel, Brocke, & Nettelnstroth, 2012). The IST-Screening is a short version of the well-established German Intelligenz-Struktur Test (Intelligence Structure Test) 2000 R (Liepmann, Beauducel, Brocke, & Amthauer, 2007). In the IST-Screening numerical reasoning is tested with a numerical series task. For this task, participants were asked to continue up to

20 numerical series that were each structured according to a specific rule. As the numerical task did not require participants to coordinate multiple rules or pieces of information, we assume that the task was demanding but less complex than the primary task. For each correct number participants received one point resulting in a maximum performance of 20 points.

4.2.5 Measures

Motivation. We measured motivation before the creative task with the German version of the fifteen-item Questionnaire on Current Motivation (QCM) developed by Rheinberg, Vollmeyer, and Burns (2001) to measure current motivation in learning situations and adapted the items to refer to the creative task. Participants responded on a Likert-type rating scale ranging from 1 *does not apply at all* to 7 *applies fully*. A sample item for this scale is: "I am eager to see how I will perform in the creative task". Average reliability was $\alpha = .71$.

Energy. To measure energy, we used the six-item version of the subjective vitality scale by Ryan and Frederick (1997). We assessed vitality before and after participants completed both tasks. Item target momentary feelings of vitality on a 7-point Likert scale ranging from 1 *does not apply at all* to 7 *applies fully*. An example item is: "I feel alive and vital". The scale showed good reliability (t1: $\alpha = .81$; t2 $\alpha = .89$).

4.3 Results Study 3a

Table 10 displays the means and standard deviations of all measured variables, separately for the three conditions.

Table 10

Study 3a: Between-Group Comparison Summary

Variable	Control group	External Interruption Group	Internal Interruption Group
Gender			
n (female)	20	27	17
n (male)	31	21	18
Age	25.04 (6.36)	26.52 (6.89)	24.71 (2.89)
Creative performance (fluency)	7.20 (2.98)	7.48 (3.01)	8.40 (3.28)
Creative performance (originality)	.15 (.08)	.16 (.07)	.19 (.09)
Math performance	5.87 (3.00)	5.24 (2.64)	4.97 (2.04)
Motivation (t1)	4.83 (.58)	4.79 (.59)	4.83 (.58)
Vitality (t1)	4.39 (.81)	4.44 (1.06)	4.46 (.96)
Vitality (t2)	4.14 (1.12)	4.29 (1.19)	4.46 (1.28)

Note. N(control group) = 51, *N*(external interruption) = 48, N(internal interruption) = 35.

4.3.1 Test of hypotheses

Analysis of variance (ANOVA) with additional contrast analysis were used to test Hypothesis 1a. A repeated measures ANOVA was used to test Hypothesis 2.

Hypothesis 1a proposes that external interruptions will lead to decreased creative performance when compared with internal interruptions and increased performance when compared with no interruptions. Moreover, Hypothesis 1a proposes that internal interruptions will lead to improved performance when compared with external interruptions and no interruptions. For the fluency measure, we first conducted a 1 x 3 (internal, external or no interruption) ANOVA to test differences between the experimental groups. The analysis revealed no significant overall effect of the interruption manipulation $F(2, 131)=1.66, p = 1.93$,

η^2_p =.025 between the three groups. Still, contrast analysis revealed that fluency in the external interruption group was not significantly different from the control group ($M_{EXTERNAL}$ = 7.48, SD = 3.01, $M_{CONTROL}$ = 7.20, SD = 2.98; $t(131)$ = .458, p = .32), and the internal interruption group ($M_{INTERNAL}$ = 8.43, SD = 3.28; $t(131)$ = 1.35, p = .09). However, there was a statistically significant difference in fluency between the internal interruption group and the control group, $t(131)$ = 1.79, $p < .05$. Additionally, we conducted an ANOVA test for originality. The analysis revealed no significant overall effect of the interruption manipulation $F(2, 131)$=2.44, p = .09, η^2_p =.036 between the three groups. Still, contrast analysis revealed that originality in the external interruption group was not significantly different from the control group ($M_{EXTERNAL}$ = .16, SD = .07, $M_{CONTROL}$ = .15, SD = .075; $t(131)$ = .35, p = .37), but significantly different from the internal interruption group ($M_{INTERNAL}$ = .19, SD = .09; $t(131)$ = 1.76, $p < .05$). Again, there was a statistically significant difference in originality between the internal interruption group and the control group, $t(131)$ = 2.1, $p < .05$.

Taken together, we find only partial evidence for our first hypothesis, as participant in the external interruption group did only perform worse than participants in the internal interruption group in one performance measure (originality) but not in the other. Moreover, while they tended to perform better than participants in the control group, the difference was not statistically significant. Further, participants in the internal interruption group performed significantly better than participants in the control group for both performance measures, supporting our hypothesis that interrupting oneself leads to better performance outcomes.

Hypothesis 2 proposes that energy after task completion is lowest in the external interruption group and highest in the internal interruption group. We performed a repeated measures ANOVA with baseline energy before task execution as a covariate to investigate if the type of interruption (internal, external or no interruption) influenced energy after task execution. There was no significant effect of the type of interruption on energy after controlling

for the baseline level of energy, $F(2, 133) = .921$, $p = .40$, $\eta^2_p = .014$. Additional contrast analysis also did not detect differences in energy levels between the three groups. Thus, we find no support for Hypothesis 2.

4.4 Discussion Study 3a

The results of our first experiment only partly confirm our expectations and previous research. We found partial support for Hypothesis 1a stating that internal and external interruptions will boost performance in a creative task. While participants in the internal interruption group indeed performed best, the performance of participants in the external interruption group was not statistically different from the other two groups, except for originality. Here, participants performed worse than the internal interruption group. Our results also do not support Hypothesis 2. Following Madjar and Shalley (2008, p. 789) we expected individuals to switch tasks "as a way of refreshing themselves", but we do not find an effect of the type of interruption on individuals' energy levels. It is possible that we found no significant effect on performance for external interruptions because we interrupted participants only once during task execution. An increased number of external interruptions might reduce cognitive fixation more effectively, resulting in higher fluency and originality (Lu et al., 2017). However, other experiments also find a boost in performance if participants are only interrupted once (for a meta-analytic review see Sio & Ormerod, 2009).

Alternatively, in our experiment staying focused on the creative task might have been helpful for performance. On the one hand ideas can be generated by switching between ideas and approaches and by exploring distant ideas (Nijstad, de Dreu, Rietzschel, & Baas, 2010) as this reduces cognitive fixation (Lu et al., 2017). On the other hand, Nijstad et al. (2010) argue that a "systematic and effortful exploration of possibilities, and in-depth exploration of only a few categories or perspectives" (p.44) can also generate creative outcomes. In our experiment,

both pathways could have been used to generate ideas. This might explain why we found no performance differences between the control group and the external interruption group as the external interruption group could generate games by using the first pathway, while the control group could generate ideas using the focused process, resulting in an equal creative performance. Since participants in the internal interruption group were additionally able to switch tasks at opportune moments, they could utilize both pathways depending on their perceived utility, for example by choosing a longer focused period in the beginning and switching to the secondary task when this pathway did not result in the generation of more games. Moreover, switching costs were lower in this group, resulting in better performance than in the control group for both performance measures.

After conducting the first study (Study 3a), the impact of internal interruptions compared to external interruptions remains inconclusive. Even though we found no differences in energy levels after task completion for the three groups, we explore the motivational pathway alongside the energy management pathway in our second experiment. As planned, we chose a complex planning task for our second experiment since a) performance on planning tasks is important in most knowledge worker jobs and b) external interruptions should be more disruptive in tasks with a high level of complexity (Adler & Benbunan-Fich, 2015).

4.5 Method Study 3b

4.5.1 Participants

The sample included 223 student participants (M = 23.66 years, 110 women) from diverse courses of studies, including natural sciences / computer science (28 percent), social sciences (17.8 percent), business studies (16.5 percent), law (11.9 percent), education (11 percent), psychology (7.2 percent) and others (7.5 percent). Participants were randomly assigned to the three experimental conditions (interruption: internal vs. external vs. no).

Females and males were randomly distributed across conditions, with a nearly equal number of males and females in most of the groups and slightly more men in the control group (35 men vs 26 women). Participants received six Euros reward for their participation.

4.5.2 Procedure

The procedure of experiment two is equal to our first experiment. Only a few modifications were applied. The time changed from 13 to 35 minutes which was equally instructed as in experiment one. Participants had 30 minutes to complete the planning task and 5 minutes to complete the secondary task (see Figure 5). Additionally, participants within the two experimental conditions were instructed that an auditive signal (beep) indicated that they needed to switch back to the planning task after the second task. Again, in all conditions the procedure was presented as advantageous for performance. This way we tried to persuade participants to follow the instructions properly. After completing both tasks participants answered a second questionnaire assessing not only the perceived difficulty of both tasks, and the vitality scale for a second time but also the perceived autonomy during task execution.

4.5.3 Primary and secondary task

Participants worked on a planning task which required the coordination of different tasks on a fictitious working day (a so-called plan-a-day task; Funke & Krüger, 1995). First, participants received a separate instruction listing the tasks they needed to do and a plan with the time it would take to complete each task and to travel between different locations. In addition, the instruction mentioned that some tasks could only be completed at a certain time of the day (e. g. a doctors' appointment). To complete all tasks, a critical component of planning was the consideration of travel times between locations. Specifically, participants needed to identify that the key task was to repair a scooter at a repair and assembling shop as

this shortened the time needed for subsequent travel to a third. The participants were asked to write down the order in which they would execute the tasks and when each task would be completed. To solve the planning task, participants needed to apply forward thinking and decision-making skills. To rate performance within the planning task, two naïve coders assigned points for each correct planning step of the task based on a predetermined coding scheme. Extra points were assigned for correctly identifying the crucial aspect of the planning task, the necessary repair of a fictitious scooter. To determine consistency among raters we performed interrater reliability analysis which was high with Kappa = .95 (p < 0.001), 95% CI (0.82, 0.99).

The secondary task was a formatting task in Windows PowerPoint. Participants opened an existing PowerPoint presentation and were asked to correct existing errors following set rules (e.g. all headings big and centered in the middle).

4.5.4 Measures

Motivation and Energy. We used the same questionnaires as in our first experiment. Reliability was satisfactory ($\alpha = .72$) for motivation and excellent for energy (t1: $\alpha = .90$; t2 $\alpha = .91$).

Autonomy. To measure autonomy, we used an adapted version of the autonomy scale of the German ISTA (Instrument for Stress-related Job Analysis) by Semmer, Zapf, and Dunckel (1999). The adapted measure consists of four items that refer to the degree of autonomy participants perceived to have on the way and methods of doing the two experimental tasks (sample item: "Could you influence the way of how you accomplished the tasks?"). Of the five original ISTA items, one was not applicable to the specific context of the experiment and was thus excluded. Items were rated on a 5-point Likert scale ranging from 1 *very little* to 5 *very much*. Analysis showed an acceptable reliability of $\alpha = .67$.

4.6 Results Study 3b

Table 11 displays the means and standard deviations of all measured variables, separated by condition.

4.6.1 Test of hypotheses

Analyses of variance (ANOVA) with additional contrast analyses were used to test Hypothesis 1b and 3. To test Hypothesis 2 we used repeated measures ANOVA.

Hypothesis 1b proposes that being interrupted internally will lead to improved performance on a planning task when compared with being interrupted externally and working on the task uninterrupted. Further, Hypothesis 1b assumes that being interrupted externally will lead to the worst performance on the planning task. To test Hypothesis 1b, we first conducted a 1 x 3 (internal, external, no interruption) ANOVA to test differences in planning performance. The analysis showed a significant overall effect $F(2, 230)=5.58$, $p < .01$, $\eta^2_p=.046$ between the groups. Additionally, contrast analysis revealed that participants within the internal interruption group ($M_{INTERNAL}$ = 20.85, SD = 7.07) performed significantly better than participants in both the external interruption group ($M_{EXTERNAL}$ = 17.02 , SD = 7.85; $t(230)$ = -3.33, $p < .01$) and the control group ($M_{CONTROL}$ = 18.67, SD = 7.74; $t(230)$ = 1.74, $p < .05$). Further, the external interruption group performed worst, but not significantly worse than the control group ($t(230) = 1.3$, $p = .10$). In summary, we again find partial evidence for Hypothesis 1b, as the internal interruption group performed significantly better than the other two groups, thus supporting our assumption that interrupting yourself improves performance. However, the external interruption group did not perform worse than the control group. Hence, being confronted with an external interruption did not interfere with performance.

Hypothesis 2 states that compared to the other two groups energy after finishing the two tasks will be lowest in the external interruption group and highest in the internal interruption group.

Again, we performed a repeated measures ANOVA with baseline energy before task execution as a covariate to investigate if the type of interruption (internal, external or no interruption) influenced energy after task execution. There was no significant effect of the type of interruption on energy after controlling for the baseline level of energy, $F(2, 223) = .383$, $p = .68$, $\eta^2_p=.003$. Thus, we again find no support for Hypothesis 2.

Table 11

Study 3b: Between-Group Comparison Summary

Variable	Control group	External Interruption Group	Internal Interruption Group
Gender			
n (female)	26	42	46
n (male)	35	42	42
Age	23.03 (3.24)	23.84 (3.85)	23.84 (4.01)
Planning performance (quant)	18.67 (7.74)	17.02 (7.85)	20.85 (7.07)
Formatting performance	44.09 (28.24)	43.98 (26.55)	43.83 (29.00)
Motivation (t1)	3.93 (.69)	3.92 (.55)	3.93 (.55)
Task autonomy	2.94 (.73)	2.78 (.74)	3.14 (.75)
Vitality (t1)	4.43 (1.28)	4.24 (1.14)	4.37 (1.20)
Vitality (t2)	4.28 (1.26)	4.16 (1.23)	4.38 (1.15)

Note. N(control group) = 61, *N*(external interruption) = 84, N(internal interruption) = 88.

Hypothesis 3 assumes that participants in the internal interruption group will experience higher task autonomy than participants in the two other groups. We again tested this hypothesis using a 1 x 3 ANOVA with added contrast analyses. The results of the ANOVA indicated that

perceived autonomy between groups varied significantly $F(2, 230) = 4.90$, $p < .01$, $\eta^2_p=.042$ with highest autonomy for the internal interruption group (M = 3.14, SD = .75), lowest autonomy for the external interruption group (M = 2.78, SD = .74) and perceived task autonomy in the control group in between (M = 2.94, SD = .73). Contrast analyses revealed a significant difference in task autonomy between the internal interruption and the external interruption conditions, $t(223) = -3.13$, $p < .01$, but no differences between the internal interruption group and the control group ($t(223) = 1.57$, $p = .06$) and the external interruption group and the control group ($t(223) = 1.23$, $p = .11$).

4.7 Discussion Study 3b

Again, the results of our second experiment only partly confirm our expectations. We found partial support for our first hypothesis stating that internal interruptions will boost performance whereas external interruptions will decrease performance on a planning task. While participants in the internal interruption group indeed performed better than the two other groups, the performance of the external interruption group was not statistically worse than that of the control group.

Further, we find no support for our second hypothesis. No differences in energy levels after task completion emerged between groups. Instead, the internal interruption group reports significantly higher task autonomy than the external interruption group which reports lowest task autonomy among the three groups. Thus, the results partly support our third hypothesis.

As Hypothesis 1b is supported by our results, external interruptions seem intrusive when it comes to planning tasks, which is in line with previous research. Thus, external interruptions do not have the same improving impact on planning performance as on creative performance. Nevertheless, we assume the negative effects of external interruptions are counteracted by a positive incubation effect on the decision-making part of the task, thereby

achieving a similar performance as the control group. Contrastingly, the internal interruption group not only benefited from an incubation effect but also from the favorable timepoint of the interruption.

We again found no differences in energy levels after task completion, therefor we reject Hypothesis 2. Moreover, the support for Hypothesis 3 indicates that the mechanism by which internal interruptions boost performance can be attributed to the increase in task autonomy.

4.8 General Discussion

The main purpose of this research was to examine if internal and external interruptions affect performance in different ways. In two laboratory experiments we found that internal interruptions boosted performance in both a creative task and a planning task.

Moreover, this beneficial effect seems to be due to higher levels of task autonomy, but not energy, supporting the view that effects are mediated by the level of autonomy. Our findings that performance can benefit from interrupting oneself are in line with conclusions drawn from action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005). However, for external interruptions contrary to our expectations and past research (e.g., Baethge & Rigotti, 2013; Bailey & Konstan, 2006), we did neither find an increase in performance for the creative task, nor a significant decrease in performance for the planning task when compared to the performance in the control group, a finding which we will explain below.

4.8.1 Theoretical contributions

The present research contributes to the literature in several ways. First, it directly compares the effects of internal and external interruptions and demonstrates a positive impact of internal interruptions on creative performance and planning performance. Previous studies

did mostly comment on internal interruptions on a conceptual level (e.g. Jett & George, 2003) but did not investigate the actual consequences of initiating an internal interruption. Our results indicate that internal interruptions differ from external interruptions in their impact on task performance and task autonomy. Contrary to external interruptions, internal interruptions consistently boost performance and increase task autonomy. Based on this, recommendations from past research that favor uninterrupted work on one task (Adler & Benbunan-Fich, 2013) cannot be extended to internal interruptions. Taken together, the results from our studies indicate that findings from research on external interruptions cannot be transferred to internal interruptions as the effects are divergent. Consequently, it needs to be clarified that current research on interruptions only applies to external interruptions. Further, internal interruptions need to be integrated into research on multitasking and interruptions as a distinct concept. Moreover, it is likely that internal interruptions also have an impact on other work-related outcomes (e.g. self-efficacy, job satisfaction, motivation) which is also expected by Madjar and Shalley (2008).

Second, our research is first to integrate internal interruptions into a theoretical framework by drawing on action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005) as well as research on energy management (Fritz et al., 2011; Zacher et al., 2014) and task autonomy (Humphrey et al., 2007). We proposed that internal interruptions can be integrated into the action plan and can thus not be classified as regulation obstacles. Additionally, our results suggest that effects are mediated by the task autonomy pathway. This perspective was supported by our finding that internal interruptions lead to higher perceived task autonomy. The alternative energy pathway was not supported by our data as we find no support for earlier assumptions that internal interruptions replenish energy resources (Madjar & Shalley, 2008). Thus, our research thereby extends earlier conceptual frameworks by Adler and Benbunan-Fich (2015) and Jett and George (2003) by offering a theory-based explanation

and providing empirical insight into the process by which internal interruptions influence performance.

Third, we focus on only one interruption of the primary task within our experiments. Previous work comparing internally and externally determined task switches prescribed the number of external interruptions, but did not control these parameters for internal interruptions, resulting in a different amount of task switches in both conditions (Lu et al., 2017; Madjar & Shalley, 2008). By keeping the number of interruptions constant, we can ascribe the boost in performance and perceived task autonomy to the difference between internal and external interruptions, which improves the validity of our findings. Moreover, focusing on the impact on only one external or internal interruption is important to allow for a consideration of the conceptual differences that determine the impact of the interruption. Nevertheless, multiple external interruptions are thought to have a qualitatively different impact than a single external interruption (Baethge et al., 2015) which is likely true for internal interruptions as well.

4.8.2 Practical implications

Our research also contributes to practice. Past research has consistently favored uninterrupted work (Adler & Benbunan-Fich, 2013). However, in a day and age when a growing amount of knowledge work is tied to ICT it becomes increasingly difficult to follow this advice. Based on this research we recommend, that employees should be able to interrupt themselves and switch to a second task in a self-determined way, for example when they are stuck or overwhelmed, and return to the first task after some time spent on the second task. This not only improves performance on the first task, our approach is also more compatible with the demands from today's knowledge work and thus might be easier to follow. Thus, we recommend that organizational policies and work design recommendations consider this advice and prompt employees to determine their work flow in a fashion that suits their needs and

preferences, specifically when working on task that require some degree of creative thought. While we did not find a negative effect on performance of being externally interrupted once, this finding should not be overestimated. Being externally interrupted, especially when external interruptions accumulate (Baethge et al., 2015), is still mostly associated with negative performance and well-being outcomes.

4.8.3 Limitations

Since external and internal interruptions are highly relevant characteristics of modern knowledge work, it is important to further our understanding of their impact on performance. The present experiments are helpful in this regard, but, of course, have certain limitations. First, our results stem from two laboratory experiments that only assessed performance on two relatively short primary tasks (Study 3a: 10 minutes; Study 3b: 30 minutes) and only for a single external or internal interruption. We do not know the extent to which the effects of both types of interruptions can be generalized for longer tasks and for multiple interruptions, though both are typical for knowledge work. For external interruptions Baethge et al. (2015) provide insight into the accumulating negative effect of multiple interruptions. In a similar fashion, multiple internal interruptions might be qualitatively different from a single internal interruption.

A second limitation is that we measured our proclaimed mediating variables, energy and perceived autonomy, after task completion. Participants might have inferred their level of energy and perceived autonomy from their self-perceptions of performance. Assessing the mediating variables while participants were working on the tasks without interrupting them further is difficult with an approach based on self-report questionnaires. In a similar fashion, it is also possible that the used measurement technique might explain the missing support for the energy management process. Participants might not have access to introspective insights for

fine-tuned changes in inner states (Wilson & Dunn, 2004) or might fall victim to self-presentation tendencies (Silvia & Gendolla, 2001) that could explain the non-significant effect of interruptions on energy levels. Future studies should consider alternative, less disruptive ways to measure these mediators.

Third, internal interruptions and task switching are closely related. While task switching is often investigated with a rather cognitive approach (Kiesel et al., 2010) we decided to base our assumptions primarily on action regulation theory. Based on this we did not consider important aspects of the cognitive approach (e.g. working memory) in our study. As a consequence, we cannot integrate our findings into the research on task switching that draws upon a cognitive approach yet.

Finally, we used a student sample in both experiments. Thus, we cannot be sure if our findings are transferrable to an organizational context. While it is difficult to perform experimental studies in an organizational setting, future research should try to investigate the impact of internal interruptions on organizational performance with field experiments and alternative designs. For example, it could also be informative to closely examine the effects of internal interruptions on daily work with an experience sampling design.

4.8.4 Directions for future research

Contrary to our expectations and past research external interruptions did not have a negative impact on planning performance. Our framing of the external interruption as positively impacting performance might have influenced participants perceptions of being interrupted. For this reason, while external interruptions did not positively affect performance due to their function as a regulation obstacle the expectation that the task switch would boost performance might have reduced their disruptive effect as they were not seen as something

inherently negative. Future research should investigate directly if framing an external interruption in a positive light can alleviate their negative consequences.

Additionally, similarly to external interruptions (Baethge et al., 2015) the frequency of internal interruptions might affect their impact. We suggest that there might be an optimal frequency for interruptions which should be investigated by future research.

Further, we did not integrate other moderating factors into our framework. Still, some aspects (e.g. self-efficacy) might have an impact on the observed effects. Task autonomy as proxy of internal interruptions might harm performance when employees are not familiar with a highly complex task resulting in low self-efficacy but can also boost performance when high self-efficacy is observed (Madjar & Shalley, 2008). Additional research is needed within this field to explore more relations and boundary mechanism.

To assess energy without creating additional demands and increasing validity as discussed earlier, future studies should consider physiological measurements. This might be a promising approach within future studies to achieve not only a less disruptive way to measure mediators, but also to gather valid data on energy levels and general cognitive activity in real time.

4.8.5 Conclusion

In conclusion, our research provides a theoretical framework that accounts for divergent effects of internal and external interruptions, namely action regulation theory and a task autonomy process. We were able to demonstrate their positive influence on two different performance outcomes. We also extend our understanding on the underlying processes, by assessing energy and autonomy as mediating variables. We conclude that being able to interrupt oneself serves as a proxy for high task autonomy and thus leads to positive performance outcomes. By demonstrating the positive impact of internal interruptions on

performance, we show that the common advice to focus on one task at a time might be misguided. Instead, switching between different tasks at ones' own discretion might not only be more representative of modern knowledge work, but also more beneficial for task performance.

5. General Discussion

5.1 Main Findings and Theoretical Contribution

Research on work-related ICT use has often focused on its negative side, for example the way in which it can impair recovery, lead to work life conflicts, and lower sleep quality. However, ICTs can also be used to make progress on unfinished tasks, stay available for urgent work issues from home, and to enhance performance when you are stuck at a task. The main purpose of the studies compiled in this dissertation was to present alternative ways of viewing ICT-related concepts. We also wanted to show how certain situational factors, as well as the specific characteristics of the observed concepts, and the behaviour of individuals can reverse or change the impact ICTs have. Further, we did this by implementing appropriate research designs that allowed us to investigate our research questions in a more thorough manner than many prior studies. In the first study (Study 1), we investigated the direction of effects between detachment and work-related ICT use and its relationship to task progress with a cross-lagged panel diary design. In our second study (Study 2a and 2b), we focused on a way to clear up misconceptions regarding availability expectations between supervisors and subordinates and evaluated the effectiveness of making expectations explicit with the thorough evaluation of an intervention targeting supervisors. Finally, in our third study (Study 3a and 3b), we used two laboratory experiments to confirm that internal interruptions improved performance on different work tasks.

The next section is divided into three parts. In the first subsections, the shared contributions of the three studies regarding alternative ways of thinking about ICT-related concepts are discussed (Section 5.1.1). The second subsection will expand on factors that mitigate the impact of ICT-related concepts (Section 5.1.2). In the third part the methodological advances that were a valuable contribution of all three studies will be described (Section 5.1.3).

5.1.1 Alternative ways of thinking about ICT-related concepts

In all three studies we extended current perspectives on concepts related to ICT. In Study 1, we changed the perspective of looking at work-related ICT use from its status as a work stressor to a behavioral consequence of detachment. In Study 2, we moved beyond the organizational perspective and viewed availability expectations with a focus on the role of the supervisor. In Study 3, we explored internal interruption as an alternative type of interruptions that has beneficial consequences for task performance.

First, contrary to current research consensus, in Study 1 we found no evidence that work-related ICT use impairs detachment from work as suggested by research based on the stressor-detachment model (Sonnentag & Fritz, 2015). Instead, low levels of detachment led to higher work-related ICT use later in the evening, which reverses the direction of effects. Formerly implemented research designs assessed detachment and work-related ICT use at the same measurement points, which means that causal claims were not warranted. Our results change the perception of work-related ICT use as a work stressor and emphasize that research on work-related ICT use needs to consider alternative explanations to investigate its impact on well-being outcomes. It seems likely that ICT are the means by which employees deal with underlying work stressors, for example unfinished tasks.

By using a leadership perspective in Study 2, we identify measures supervisors who cannot lower availability expectations can take to support their subordinates. In Study 2b, we find that after supervisors participated in a half-day workshop focused on work-related ICT use and extended availability, subordinates' perceived availability expectations as lower and were more satisfied with ICT-mediated communication. Thus, the recommendations by Derks et al. (2015) and Derks, van Mierlo et al. (2014) can be insofar confirmed by Study 2b that when perceived availability expectations decreased, satisfaction with ICT-mediated communication increased.

Further, we show that supervisors can support their employees by explicitly sharing their expectations. Prior studies often recommended lowering organizational availability expectations and strengthening segmentation norms to protect employees' well-being and leisure time (e.g., Derks et al., 2015; Derks, van Mierlo et al., 2014; Gadeyne et al., 2018; Koch & Binnewies, 2015). While following these recommendations can certainly be beneficial for employees, it is often not possible for supervisors to do so on their own. The findings of Study 2b suggest that when availability expectations cannot be adapted, supervisors still have tools that are under personal control, for example explicitly sharing availability expectations with their subordinates. Thus, by focusing on the perspective of supervisors we were able to identify an alternative way to alleviate potential negative consequences of availability expectations.

In Study 3, investigating internal interruptions as an alternative type of interruption allowed us to gain insight into their benefits for employees in the work domain. We demonstrated that self-determined switching to a secondary task boosts performance on a creative task (Study 3a) and a planning task (Study 3b). Long-lasting recommendations to focus on one task and to avoid switching between tasks (Adler & Benbunan-Fich, 2013) are incompatible with the results of Study 3. By showing that individuals benefitted from instructions to switch to another task when they were stuck or tired, we thus contribute to knowledge about effective work strategies. By investigating internal interruptions, we could identify self-determined task switching as an effective work strategy that is opposed to the common recommendation to focus on one task.

Moreover, we were also able to gain some insight into the underlying process by building on research on energy-management and task autonomy (Fritz et al., 2011; Humphrey et al., 2007; Langfred & Moye, 2004; Zacher et al., 2014). Studies on energy management previously suggested that task switching might replenish energy resources (Zacher et al., 2014), but we were not able to replicate this effect for internal interruptions. Our findings suggest that

the boost in performance can best be explained by the positive impact of internal interruptions on perceived task autonomy. Past studies concluded that individuals who can work in a self-determined manner perceive to have more control over their work flow, which in turn positively affects performance (e.g., Humphrey et al., 2007; Langfred & Moye, 2004). We thus conclude that initiating internal interruptions can be beneficial for employees as they increase the perception of task control, which extends our knowledge about the underlying process.

With the three studies, we contribute to research on work-related ICT use, extended availability, recovery, and interruptions. Taken together, the results from our studies suggest that expanding our focus to different perspectives and investigating processes that oppose the current research consensus contributes to our knowledge on aspects of ICT in a work context. Considering the three studies, we conclude that prior research has sometimes drawn conclusions about work-related ICT use, high availability expectations, and interruptions that seem unjustified or too narrow.

5.1.2 Identifying context factors

In all three studies, our goal was to identify additional context factors that impact the effects of ICT-related concepts. In Study 1 and Study 2, we focused on situational factors that alleviate or change the impact of work-related ICT use and availability expectations to move beyond person-level characteristics. In Study 3, we identified the type of interruptions as relevant for their impact.

In Study 1, we showed that for a same-evening timeframe ICTs can support employees in managing certain underlying work stressors. A wide range of studies have covered work stressors that can impair detachment, among others, a high workload, social stressors, time pressure, and unfinished work tasks (Sonnentag & Fritz, 2015; Weigelt & Syrek, 2017). In Study 1, as expected unfinished work tasks impaired detachment and increased work-related

ICT use. However, we demonstrated that ICTs could be used to make progress on unfinished tasks from home without detrimental effects on detachment. When using ICTs for work cannot be linked to goal attainment, using them likely does not come with the same positive consequences. Thus, Study 1 demonstrates that when employees can use ICTs to manage work stressors it is linked to achieving important work goals, which is beneficial for employees.

The findings from Study 2 contribute to research on availability expectations, by identifying ambiguity as an aspect of availability expectations by which their negative impact can be managed through explicit communication. In Study 2a, we found that availability ambiguity impacts well-being outcomes beyond the extent of expected availability. Further, Study 2b demonstrates that availability ambiguity can be effectively reduced when supervisors share their expectations with subordinates. The findings of Study 2 suggest that focusing on the more nuanced characteristics of availability expectations expands our knowledge on the tools and behaviors that support employees facing high availability expectations. By investigating availability ambiguity, we were able to identify an aspect of availability expectations that is under the personal control of supervisors and can thus be more easily decreased than organization-level characteristics.

Regarding Study 3, we used action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005) to identify the conceptual differences of internal and external interruptions. Based on these, we then formulated different expectations regarding their impact on performance in a creative task and a planning task. While external interruptions are classified as regulation obstacles in action regulation theory (Frese & Zapf, 1994; Hacker, 1973, 2003, 2005), internal interruptions would be classified differently. This is because internal interruptions are self-determined and therefore do not occur at inconvenient times and do not disrupt the action process. By showing that an internal interruption increased performance on both tasks and an external interruption was only detrimental to performance on the planning

task, we contribute to research on interruptions by demonstrating that the specific characteristics of the interruption and the task influence the outcome. As past studies did not differentiate between the impact of different types of interruptions on performance, the different characteristics of internal and external interruptions were not taken into account. To sum it up, conceptually differentiating between the type of interruption and directly comparing them allows us to expand our knowledge on the impact of interruptions in the workplace.

With the three studies, we contribute to research on work-related ICT use, extended availability, unfinished tasks, and interruptions. Taken together, identifying additional context factors on different levels contributes to research by offering new ways in which work-related ICT use, availability expectations, and interruptions can be investigated. We thus provide researchers with additional factors that can be taken into account, when conducting studies on the three concepts in different situations.

5.1.3 Methodological advances

In all three studies we contribute to research by using research methods that offer a more thorough understanding of the ICT-related concepts, the underlying processes, and well-being or performance outcomes.

In Study 1, we conducted a cross-lagged panel diary study to determine the direction of effects between work-related ICT use and detachment. By doing so, we were able to untangle the same-day effects of the two variables on a within-person level. Prior studies assessed both variables at the same measurement point and could thus not make empirically based statements on the direction of effects. Our results indicate that for same-day effects detachment affects later ICT use, but ICT use does not predict later detachment, which contradicts prior assumptions. Due to our research design, we were able to move closer towards causal claims than past studies and could corroborate our assumption that work-related ICT use is a

behavioral consequence of impaired detachment with appropriate data (Finkel, 1995; Zapf et al., 1996).

In Study 2b, we evaluated our intervention by collecting data from participants' subordinates. By focusing on *Behavior* and *Results* criteria, which are the most advanced evaluation criteria (Kirkpatrick, 1976), we move beyond assessing the reactions of workshop participants to measuring the real-life impact of our intervention on the work life of participants' subordinates. Since extended availability and work-related ICT use are highly relevant aspects of modern knowledge work, it is valuable to demonstrate that educating supervisors about steps they can take to support their subordinates in this regard has beneficial consequences, even though we are not able to make causal claims due to the lack of a control group. Still, we contribute to research on the impact of ICT-focused interventions by implementing advanced evaluation criteria and using second-source data. Thereby, we extend most evaluation studies in work and organizational psychology (Arthur et al., 2003; Sitzmann et al., 2008).

In Study 3, we conducted two laboratory experiments directly comparing the effects of internal and external interruptions on two different tasks. The few studies that focus on internal interruptions are conceptual (Adler & Benbunan-Fich, 2013; Jett & George, 2003). Prior experiments did not include internal interruptions into their designs, because they "are not directly observable, [which] makes them difficult to study" (Baethge et al., 2015, p. 309). This means that internal and external interruptions have not been empirically compared before. However, only by establishing the conceptual differences of internal and external interruptions, formulating hypotheses based on these differences, and testing them in an appropriate manner, we can properly integrate internal interruptions into research. By implementing two fully controlled laboratory experiments, we contribute to research in interruptions by demonstrating that the type of interruption causes the different impact on performance.

Taken together, the methodological rigor we applied to our three studies, allowed us to significantly contribute to research on work-related ICT use, recovery, extended availability, and interruptions. Our findings show that implementing appropriate research designs allows researchers to come to improved conclusions about the direction of effects (Study 1), to investigate if our intervention efforts have an impact that extends immediate reactions (Study 2b), and to make confident assumptions on how different types of interruptions affect performance. We could thus integrate internal interruptions into established research on external interruptions (Study 3).

5.2 Directions for Future Research

While prior research and the three presented studies have aimed to answer some of the pressing questions regarding ICT at work, many open questions remain. Research does not yet do justice to the complex interplay of processes and dynamics between ICT-related concepts and the differentiation of concepts has only just begun. However, research in this area will significantly progress if these issues are considered in future studies. Building on the three studies compiled in this dissertation, many ideas for future research come to mind. Some of these ideas have been introduced in each of the three papers. However, by integrating our findings into a broader research agenda, some issues stand out as particularly promising.

5.2.1 Research agenda for work-related ICT use at home

When it comes to availability expectations, research has predominantly focused on their negative impact on detachment and work-life conflict. However, combining our findings from Study 1 and Study 2 we suggest that appropriate availability expectations might in fact be beneficial for employees when engaging in work-related ICT use from home. When a supervisor communicates specific expectations regarding ICT use from home, ideally the

employee knows which tasks to finish and which to leave unfinished. Ohly and Latour (2014) showed that individuals who use ICT out of autonomous motivation did not suffer negative consequences from it and Fenner and Renn (2010) demonstrated that setting goals and priorities for ICT use buffered negative effects. Building on this, finishing tasks by using ICT that are closely tied to important work goals might serve a similar function or even have positive consequences.

On a process level, we have investigated the impact of work-related ICT use on same-evening detachment in Study 1. This has been a step in the right direction for learning more about the temporal dynamics between work-related ICT use and detachment. However, to make significant predictions about the impact of using ICT for work continuously and for a long time, we also need studies focusing on long-term effects. While the benefits of ICTs might outweigh their potential risks for occasional use, the balance might shift when individuals stay connected to work regularly for longer time periods. This might be true even when they are able to finish work tasks by doing so.

It would also be valuable to further investigate the role of supervisor availability expectations for these long-term effects. As we learned in Study 2, in general it is helpful for employees if their supervisors share their expectations regarding availability. But when supervisors expect employees to complete unfinished tasks from home, this specificity could also mean that employees feel overburdened by supervisors' expectations as suggested by Reid and Ramarajan (2016). Gadeyne et al. (2018) demonstrated that people with segmentation as well as integration preferences benefit from segmentation norms as integrators want to perceive integration as a self-determined choice, not an expectation. A similar relationship might develop if supervisors expect their subordinates to always finish work tasks from home.

5.2.2 Research agenda for availability expectations

Research on availability expectations has only focused on quite broad questions. With Study 2, we have started to differentiate between different sources of expectations. However, in addition to the sources of expectations, it is also important to investigate the context factors under which extended availability is least disruptive to employees. For example, the medium on which availability is expected could play a crucial role. Combining research from Study 2 and Study 3, one might conclude that availability expectations will be experienced as less disruptive when employees can react to incoming requests on asynchronous ICT like email or messenger services. However, a study by Braukmann et al. (2018) suggests that the opposite is true. They found that among the different ways of contacting employees after hours, only work calls were unrelated to detachment. They suggest that this might be because employees have more control over the flow of information with calls than with emails. An alternative interpretation could be that employees who stay available via asynchronous forms of communication will constantly check their ICTs to ensure that they do not miss incoming messages and have to screen all messages to detect the important ones. While work calls are more disruptive in the moment, they do not require the same kind of vigilant checking. Future studies might compare the contrasting interpretations to determine the reasons for the advantage of work calls over asynchronous communication. These findings are highly relevant for research on supervisors' availability expectations, as different recommendations for the content and communication media will result. They can further serve as a basis to explore ways to make availability on asynchronous communication forms less impairing for detachment, for example technological solutions that only deliver emails and instant messages from certain senders.

5.2.3 Research agenda for ICT use at work

It seems worthwhile to combine research on availability expectations with research on interruptions. While it is well-known that external interruptions are detrimental to well-being and performance on many tasks, little is done to protect knowledge workers from them, even though technical and behavioral solutions could be implemented. For example, on a very basic level, employees could only open their email client periodically instead of leaving themselves constantly open to distractions from incoming messages. One of the reasons why these solutions do not catch on might be the high response expectations that prevail in modern knowledge work. Knowledge workers often feel that they are expected to check and respond to their emails constantly and swiftly (Mazmanian, Orlikowski, & Yates, 2013). Research on interruptions could benefit from findings from availability expectations to differentiate between the perceived and actual extent of expectations in terms of response times for emails. Building on Study 2, it would be particularly interesting to learn if employees implement more strategies to protect themselves from external email interruptions, when the expectations are less ambiguous.

Further, if decreased ambiguity leads to employees checking and responding to emails in a more self-determined fashion, they perform internal interruptions. From Study 3 we know already that in a laboratory experiment, internal interruptions had a positive impact on performance and perceived control, but not on energy levels. Baethge et al. (2015) argued that for cumulative external interruptions effects are qualitatively different from a single external interruption. The same might be true for internal interruptions and the behavioral change away from external interruptions towards internal interruptions might have a big impact. It would be interesting to see how an intervention study that focuses on teaching employees to check their email periodically (internally interrupting themselves) affects their performance, perceived control, and energy.

5.2.4 Integrating person-level variables into research

Prior studies have demonstrated that person-level variables play a significant role for employees' evaluation and the impact of work-related ICT use and availability expectations on them (e.g., Boswell & Olson-Buchanan, 2007; Butts et al., 2015; Derks et al., 2016; Gadeyne et al., 2018). Still, in all three studies, we have paid little attention to the influence of personal traits and preferences as they were not at the heart of our research questions. Future studies might want to integrate person-level variables to build on the findings of our three studies.

To develop research on work-related ICT use further, researchers could take the finding from Study 1 that work-related ICT use did not predict later detachment and investigate if this relationship is moderated by the person's ability to detach. We suggest that individuals who are able to detach easily could benefit from finishing work tasks via ICT and even improve their levels of detachment by doing so. As a consequence, improving employees' ability to detach from work by offering recovery trainings (Hahn et al., 2011) could support them when they need to engage in work-related ICT use. It could be especially helpful to integrate specific strategies for ICT use into the training.

Further, segmentation preferences might influence the impact of availability expectations and availability ambiguity we explored in Study 2. It has already been shown that for employees who prefer to segment work and life high availability expectations are particularly detrimental (e.g., Gadeyne et al., 2018). We propose that high availability expectations might be even more detrimental to employees with segmentation preferences when they are also explicit. Ambiguous expectations could give them more leeway to behave in line with their own preferences as they can utilize boundary strategies (Barber & Jenkins, 2014), but when expectations are explicit there might be less room for them to do so.

Finally, it has been shown that employees engage in internal interruptions at different rates (Dabbish et al., 2011). It is also likely that not all employees will equally benefit from

internal interruptions, especially not in a field setting. For example, for individuals who are prone to procrastination interrupting themselves during an important task might go awry (van Eerde, 2000). They might use internal interruptions to procrastinate and following an internal interruption defer returning to the primary task. In a similar vein, individuals who get easily distracted might lose track of time and thus not benefit from the internal interruption.

5.3 Practical Implications

In this section some practical recommendations for supervisors, and employees regarding ICT use for work in the work and home domain, and boundary-spanning availability expectations are outlined. It will focus on the recommendations that can be made from integrating the findings of the three studies. Recommendations concerning the specific studies are presented in the respective sections of each study.

Reviewing the findings of the three studies, we recommend for supervisors to consider the specific circumstances to adapt their expectations regarding availability appropriately. This means that they ask themselves if their expectations regarding availability after hours are appropriate for the specific position and then communicate expectations clearly (Study 2). They should also keep in mind that while occasional work-related ICT use might not be detrimental to detachment on the same evening (Study 1), over time, excessive work-related ICT use probably impairs recovery and in turn well-being, as it reduces the time available for recovery. This is particularly true for subordinates who prefer to segment work and life. In a similar vein, it could be suggested that supervisors communicate clear expectations regarding availability and response times during work hours to their subordinates. If supervisors make it clear that instant responses to incoming messages are not required, this could reduce external interruptions, which are detrimental to performance on planning tasks. Ideally, employees

could then change to a more self-determined pattern of email checking, that would be in line with internal interruptions at opportune moments and thus, boost performance (Study 3).

For employees, a recommendation they can implement is that they consider their situation and their goals when they use ICT to work from home, and when they interrupt themselves. While we did not find that work-related ICT use had a negative effect on detachment the same evening (Study 1), from a long-term perspective certain precautions might be important to ensure that recovery and well-being are not negatively affected. It has already been shown that boundary tactics and time management are important to alleviate potential negative effects of work-related ICT use after hours (Barber & Jenkins, 2014; Fenner & Renn, 2010). Further, it might be beneficial for employees to review what specific action is expected of them and in what way it is tied to their work goals (Study 2) so that it is easier for them to engage in recovery activities after complying with the expectation or finishing the task (Derks & Bakker, 2014; Derks, ten Brummelhuis et al., 2014; Weigelt & Syrek, 2017). When it comes to internal interruptions, employees might implement them into their work habits, but need to keep track of the situations and frequencies that are useful to them. As research on internal interruptions is still in its initial stage, we do only know that a single internal interruption during creative and planning tasks boosts performance (Study 3). It is likely that there are individual and situational factors that moderate effects, for example the propensity to procrastinate and time pressure (Jett & George, 2003; van Eerde, 2000). Therefore, employees might find utilizing internal interruptions useful but should proceed with caution and common sense.

5.4 Conclusion

Work-related ICT use is still at a stage where many questions remain unanswered and concepts have not yet been fully explored. The overarching purpose of this dissertation was to present alternative ways of looking at ICT-related concepts to expand research and introduce

new perspectives into this research stream. We conducted three studies, to investigate work-related ICT use in the work and home domain, as well as the ability of ICT to make boundaries between life domains more permeable. While the research questions we asked and the research methods and designs we implemented allowed us to gain more insight into the temporal processes of ICT-related concepts and well-being and performance outcomes, our findings also initiate new questions that remain unanswered. Thus, I am confident, that my colleagues investigating ICT-related concepts have much more productive and insightful work in front of them. We hope that our findings can form the basis for some future studies on work-related ICT use, availability expectations, and internal interruptions.

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Appendix

Table A1 displays the schedule of the supervisor workshops from Study 2b that we developed. Table A2 gives an overview over the items we administered at the end of each workshop to assess participants immediate reactions.

Table A1

Study 2b: Workshop Schedule

Methode/Thema	Inhalt	Dauer
Modul 1: Was Sie über neue Technologien wissen sollten		**75 Minuten**
Einstieg: Vorstellung und Seminarrahmen, Erwartungsabfrage	Informationen zum Seminarrahmen und Trainer Kennenlernen der Teilnehmer Erwartungsabfrage	20 Minuten
Einzelarbeit: Eigene Technologieerfahrungen	Teilnehmer erinnern sich an und berichten von eigenen Erfahrungen mit der Erreichbarkeit über neue Technologien.	20 Minuten
Expertenreferat IKT Nutzung	• Was ist mit erweiterter Erreichbarkeit bzw. der Kommunikation über neue Technologien gemeint? • Wie häufig werden neue Technologien außerhalb der Arbeitszeiten genutzt?	5 Minuten
Gruppendiskussion Chancen und Risiken	Wie wirkt sich erweiterte Erreichbarkeit und die Möglichkeit über IKT zu arbeiten auf Menschen aus?	10 Minuten
Expertenreferat: Auswirkungen der IKT Nutzung und unterschiedliche Präferenzen – Forschungsergebnisse	• Wie wirkt sich die IKT Nutzung auf Gesundheit, Erholung etc. aus • Das Kontinuum: Segmentation – Integration • Wie gestalten „Segmentierer" Arbeit und Privatleben? • Wie gestalten „Integrierer" Arbeit und Privatleben? • Selbsteinschätzung & Einschätzung der Mitarbeiter	20 Minuten

Pause 10 Minuten

Modul 2: Erreichbarkeitserwartungen kennen und überprüfen   45 Minuten

Expertenreferat: Der Einfluss der Führungskraft	• Führungskräfte als Integrierer • Einfluss der Führungskraft auf Mitarbeiter • Gründe für und Auswirkungen des eigenen IKT-Verhaltens • Wichtigkeit der gegenseitigen Erwartungsklärung	15 Minuten
Einzelarbeit: Erreichbarkeitserwartungen reflektieren und überprüfen	Was sind meine Erwartungen an bzw. Merkmale einer guten bzw. zufriedenstellenden IKT-Erreichbarkeit?	30 Minuten
Reflektion/Einzelarbeit 3. Teil	Teilnehmer schreiben ihre eigenen Erreichbarkeitsregeln auf	10 Minuten

Pause 15 Minuten

Modul 3: Erwartungen erfolgreich kommunizieren   65 Minuten

Zweiergruppen: Vorbereitung Team-Meeting	• Vorbereitung auf Teammeeting • Gemeinsame Diskussion und Vorbereitung	50 Minuten
Termin im Kalender eintragen	Teilnehmer tragen sich Termin für Gespräch(e) mit Mitarbeitern in Kalender ein	5 Minuten
Abschlussrunde	• Teilnehmer teilen 1-2 Take Home Messages im Plenum • Evaluationsbögen austeilen!	15 Minuten

Table A2

Study 2b: Supervisor Reaction Sheet

	Trifft voll und ganz zu					Trifft überhaupt nicht zu

Erwartungen und Lernziele

Das Training hat meinen Erwartungen entsprochen.	☐	☐	☐	☐	☐	☐
Die Lernziele wurden zu Beginn klar benannt.	☐	☐	☐	☐	☐	☐
Die benannten Lernziele wurden erreicht.	☐	☐	☐	☐	☐	☐

Lerninhalte

Ich habe neues Wissen erworben.	☐	☐	☐	☐	☐	☐
Die Inhalte waren praxisnah.	☐	☐	☐	☐	☐	☐
Ich konnte meine Fragen und Anliegen einbringen.	☐	☐	☐	☐	☐	☐
Die Inhalte wurden durch Übungen vertieft.	☐	☐	☐	☐	☐	☐
Die Schwierigkeit der Trainingsinhalte war angemessen.	☐	☐	☐	☐	☐	☐
Die Trainingsunterlagen waren für mich hilfreich.	☐	☐	☐	☐	☐	☐

Transfer

Das Training wird nützlich für meinen Arbeitsalltag sein.	☐	☐	☐	☐	☐	☐
Ich kann die Inhalte in meinem Arbeitsalltag anwenden.	☐	☐	☐	☐	☐	☐
Ich fühle mich auf das Mitarbeitergespräch gut vorbereitet.	☐	☐	☐	☐	☐	☐

Trainer

Der Trainer vermittelte die Inhalte fachlich kompetent.	☐	☐	☐	☐	☐	☐
Der Trainer stellte die Inhalte klar und verständlich dar.	☐	☐	☐	☐	☐	☐
Der Trainer hat die Inhalte motivierend vermittelt.	☐	☐	☐	☐	☐	☐

Lernatmosphäre

Die Zusammensetzung der Gruppe war angemessen.	☐	☐	☐	☐	☐	☐
Im Raum war eine angenehme Lernatmosphäre.	☐	☐	☐	☐	☐	☐

	Völlig zufrieden					Überhaupt nicht zufrieden

Gesamturteil

Wie zufrieden waren Sie insgesamt mit dem Training?	☐	☐	☐	☐	☐	☐

Publication Status and Scope of Responsibility

Universität Kassel, Fachbereich Humanwissenschaften

Erklärung zur kumulativen Dissertation im Promotionsfach Psychologie

Erklärung über den Eigenanteil an den veröffentlichten oder zur Veröffentlichung vorgesehenen wissenschaftlichen Schriften innerhalb meiner Dissertationsschrift, Ergänzung zu § 5a Abs. 4 Satz 1 der Allgemeinen Bestimmungen für Promotionen an der Universität Kassel vom 13. Juni 2011

vom Antragsteller/von der Antragstellerin einzutragen:

1. Heißler, Clara Charlotte

Fachgebiet Wirtschaftspsychologie

Thema der Dissertation

2. & 3.: Vgl. Table A3

Table A3

Publication Status and Scope of Responsibility

Study	Publication	Scope of responsibility
1	**Conference Contributions:** Heissler, C., & Ohly, S. (2017). Is ICT use the cause or result of reduced detachment? Investigating reversed causality in a diary study with a cross-lagged panel design. Presentation at the European Congress of Work and Organizational Psychology. Dublin, Ireland. Heissler, C., & Ohly, S. (2018). When thinking about work makes employees reach for their devices. A cross-lagged panel diary study. In G. Atinc (Ed.), *Proceedings of the Seventy-Eight Annual Meeting of the Academy of Management.* Chicago, IL. Online ISSN: 2151-6561.	Primarily responsible for conceptual development, data collection, data analyses, and manuscript development.

	Submitted for publication: Heissler, C., & Ohly, S.. When thinking about work makes employees reach for their devices. Submitted at the *Journal of Occupational Health Psychology* (11/23/2018): Under review.	
2	**Conference Contributions:** Heissler, C., & Ohly, S. (2017). Evaluation eines Führungskräfte-Trainings zur effektiven Kommunikation von IKT-Erreichbarkeitserwartungen. Presentation at 10. Tagung der Fachgruppe Arbeits-, Organisations- und Wirtschaftspsychologie (AOW) der Deutschen Gesellschaft für Psychologie (DGPs). Dresden, Germany.	Study 2a: Solely responsible for conceptual development, data analyses, and manuscript development. Data collection by Master's student. Study 2b: Primarily responsible for conceptual development and manuscript development. Solely responsible for data collection and data analyses.
3	**Conference Contributions:** Seipp, A.-K., Heissler, C., & Ohly, S. (2018). Reduzieren Unterbrechungen die Arbeitsleistung? Ein experimenteller Vergleich selbst- und fremdbestimmter Unterbrechungen. Presentation at 51. Kongress der Deutschen Gesellschaft für Psychologie (DGPs). Frankfurt, Germany. **Submitted for publication:** Seipp, A.-K., Heissler, C., & Ohly, S. Interrupt yourself! When it comes to creative and planning performance switching tasks at your own pace beats boncentrated and externally interrupted work. Submitted at *Organizational Behavior and Human Decision Processes* (12/20/2018): Under review.	Jointly responsible for conceptual development, data collection, data analyses, and manuscript development.

4. Anschriften (E-Mail oder Fax) der jeweiligen Mitautoren:

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Die Angaben zu Punkt 3 müssen von den Mitautoren schriftlich bestätigt werden.

Ich bestätige die von Frau Clara Heißler unter Pkt. 3 abgegebene Erklärung:

1. Prof. Dr. Sandra Ohly: ....

2. Ann-Kathrin Seipp: ....