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# Does the Approach Matter? A Qualitative Study on Differences Concerning Time Pressure in Agile and Sequential Information System Projects

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# DOES THE APPROACH MATTER? A QUALITATIVE STUDY ON DIFFERENCES CONCERNING TIME PRESSURE IN AGILE AND SEQUENTIAL INFORMATION SYSTEM PROJECTS

*Research Paper*

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## Abstract

*While time pressure is a both common phenomenon and a critical issue in information system (IS) projects, consensus concerning time pressure's impact on IS project outcomes is still lacking. To address this shortcoming stemming from focusing on quantitative assessments of time pressure's role in sequential projects, we identify seven themes concerning time pressure in IS projects based on in-depth insights gained by conducting semi-structured interviews using the critical incident technique. Considering the different approaches to managing requirements in sequential and agile IS projects, 13 interviews were conducted with requirements engineers working on both IS project types in Germany. Our study reveals a number of differences between agile and sequential projects concerning time pressure, including causes and severity of time pressure as well as requirements engineers' perceptions of time pressure. Insights from a requirements-engineering context advance our understanding in this domain. While our contribution is limited due to its narrow sample, we suggest several directions for future research. Furthermore, we provide guidance for addressing time pressure in IS projects.*

*Keywords: Time Pressure, Information System Projects, Requirements Engineering, Project Management, Qualitative Field Study, Semi-structured Interviews, Critical Incident Technique.*

# 1 Introduction

Time pressure considerably affects information system (IS) project performance (Linßen et al., 2018; Malgonde et al., 2014). It is commonly defined as "scarcity of time available to complete a task, or set of tasks, relative to the demands of the task(s) at hand" (Maruping et al., 2015, p. 1315).

While the critical role of time pressure in IS projects is widely acknowledged, a recent review (Basten, 2017) reveals an inconsistent picture of its effects on project outcomes. According to available findings, time pressure can have both positive (e.g. Mäntylä and Itkonen, 2013) and negative (e.g. Deak et al., 2016) impacts on IS projects. Considering the diverse project contexts analysed in previous research, in most extant studies, the focus is on quantitative assessments of time pressure's role in IS projects relying on sequential development approaches (Basten, 2017). In an attempt to advance our understanding of time pressure's role in IS projects, in this work, we adopt a qualitative approach to gain in-depth insights into the role of time pressure for both agile and sequential IS projects. For this purpose, we choose the context of requirements engineering, since related activities constitute a major difference between agile and sequential approaches (Palmquist et al., 2013). We thus pose the following research questions:

*(1) What is the role of time pressure in requirements engineering?*
*(2) How does the role of time pressure differ between agile and sequential development approaches?*

When conducting semi-structured interviews (Myers and Newman, 2007) based on the critical incident technique (Norman et al., 1992), we asked requirements engineers working on both sequential and agile projects to share their perceptions of time pressure's role in IS projects. Due to the lack of pertinent prior research, we adopted a qualitative research approach that is grounded in data. Thus, the present study contributes to the literature stream on time pressure in IS projects by juxtaposing insights gained from sequential and agile IS projects.

This paper is structured as follows. In Section 2, we introduce the central concepts of our study and review previous research on time pressure in IS projects. We describe our research approach in Section 3. While we present the themes concerning time pressure's role in IS projects in Section 4, we discuss differences between sequential and agile IS projects in Section 5, along with our study's limitations and implications. Our paper ends with a short conclusion given in Section 6.

# 2 Theoretical Background and Related Work

## 2.1 Sequential and Agile Information System Projects

IS "are implemented within an organization for the purpose of improving the effectiveness and efficiency of that organization" (Hevner et al., 2004, p. 76). As a project is "a temporary endeavour undertaken to create a unique product, service, or result" (Project Management Institute, 2008, p. 5), we define an IS project as a project aiming to implement an IS in an organisation. For measuring success of such projects, organisations commonly rely on the iron triangle comprising of costs, time and quality (Atkinson, 1999; Joosten et al., 2014; Thomas and Fernández, 2008). While the fulfilment of these criteria is clearly important, stakeholder satisfaction should be considered as well (Basten et al., 2016). Accordingly, we evaluate IS project success in terms of the criteria of the iron triangle, as well as the satisfaction of the project team with the project's outcome.

Authors of previous works differentiate between agile and sequential development approaches, while it is noted that both aim "to deliver a quality product in a predictable, efficient and responsive manner" (Palmquist et al., 2013, p. 15). A major difference between agile and sequential development approaches stems from the requirements management (Palmquist et al., 2013).

When a sequential development approach is adopted in IS projects, all project phases are accomplished in a sequential order (Palmquist et al., 2013). As the plan is sequential, the elicitation of all requirements for the IS takes place before the analysis phase starts (Sommerville, 2011). Consequently, it is implicitly presumed that the customer can define all requirements, which remain stable (Palmquist et al., 2013).

As the time lag between requirements engineering and project end increases, so does the likelihood of developing a system that does not meet customer requirements once delivered (Palmquist et al., 2013). In the sequential approach, the customer merely provides the requirements at the project's outset and is not involved in the process until the test phase starts (Palmquist et al., 2013). Consequently, the customer can detect errors made in the requirements engineering phase in the operation and maintenance phase at the earliest (Sommerville, 2011). Detecting errors in this late phase leads to high costs and may require considerable effort to implement subsequent modifications (Sommerville, 2011). Thus, it is worthwhile to detect errors as early as possible.

The agile development approach is "an iterative and incremental (evolutionary) approach to software development which is performed in a highly collaborative manner by self-organizing teams within an effective governance framework with 'just enough' ceremony that produces high quality software in a cost effective and timely manner which meets the changing needs of its stakeholders" (Palmquist et al., 2013, p. 9). Therefore, uncertainty is part of the approach, as it is implicitly presumed that not all requirements will be known at the beginning of the project (Dingsøyr et al., 2012). In other words, project participants not only accept but expect requirements changes as the project evolves (Palmquist et al., 2013).

## 2.2 Time Pressures' Role in Information System Projects

It is acknowledged that time pressure in organisational environments, such as IS projects, is a determinant of job stress. Job stress "refers to a situation wherein job-related factors interact with a worker to change (i.e. disrupt or enhance) his or her psychological and/ or physiological condition such that the person (i.e. mind-body) is forced to deviate from normal functioning" (Beehr and Newman, 1978, p. 670). Deviation from normal functioning is critical in IS projects, since time pressure's different forms might lead to changes in the level of performance (Chong et al., 2011; Pearsall et al., 2009). Prior literature sheds light on time pressures' influence on both individual and team-level behaviour and performance (e.g. LePine et al., 2005; Pearsall et al., 2009).

Authors of extant studies acknowledge the influence of stressors, such as time pressure, on health. On the one hand, short periods of stress cause physiological responses that help overcome pressure by sustaining a high level of performance (Sonnentag and Frese, 2004). Empirical evidence also shows that time pressure can motivate employees to be more engaged, leading to higher performance (Maruping et al., 2015; Sonnentag and Frese, 2004). On the other hand, over a long period, recurrent stress may result in illness, such as burnout, higher blood pressure, increased heart rate or depression (Roxburgh, 2004; Sonnentag and Frese, 2004). In the organisational context, stress leads to sabotage, aggression and hostility, all of which reduce worker commitment, thus increasing the likelihood of absenteeism or resignation (Sonnentag and Frese, 2004).

According to the findings reported in extant literature, the inconsistent conclusions regarding time pressure's influence on IS projects are underpinned by an inverted U-shaped relationship between time pressure and performance (Basten, 2017; Maruping et al., 2015) or the challenge-hindrance framework (LePine et al., 2005; Podsakoff et al., 2007). According to the supporters of the inverted U-shaped relationship, the degree of time pressure is the main reason for different performance outcomes (Chong et al., 2011). The model suggests that absence of time pressure leads to lower employee engagement, whereby moderate time pressure motivates employees to engage in their work (Maruping et al., 2015). However, high degree of time pressure is detrimental to employee performance (Maruping et al., 2015). On the other hand, those adopting the challenge-hindrance framework suggest that the type of stress, rather than its degree, determines performance (LePine et al., 2005; Podsakoff et al., 2007). In this framework, a distinction is made between challenge stressors and hindrance stressors. Challenge stressors are defined as "work-related demands or circumstances that, although potentially stressful, have associated gains for individuals" (Pearsall et al., 2009, p. 26). Conversely, hindrance stressors are "work-related demands or circumstances that tend to constrain or interfere with an individual's work achievement, which do not tend to be associated with potential gains of the individual" (Pearsall et al., 2009, p. 26). Moreover, challenge stressors, such as time pressure, "trigger positive emotions and an active or

problem-solving style of coping (e. g. increasing effort)" (LePine et al., 2005, p. 765). Hence, they have a positive influence on motivation, enhancing both employee and team performance (LePine et al., 2005; Pearsall et al., 2009). However, time pressure is not always a challenge stressor, as it can be a hindrance (Chong et al., 2011). This may be the source of the inconsistencies in the findings yielded by prior studies on time pressure (Chong et al., 2011). Hindrance stressors "trigger negative emotions and a passive or emotional style of coping (e.g. withdrawing from the situation, rationalizing)" (LePine et al., 2005, p. 765). They are thus not conductive to optimal performance (LePine et al., 2005; Pearsall et al., 2009).

According to a recent literature review, time pressure is rarely defined in extant studies, and the few definitions offered are inconsistent (Basten, 2017). In addition, qualitative studies are needed to gain in-depth insights into the effects of time pressure on performance and project outcomes, as the current findings are inconsistent (Basten, 2017; Chong et al., 2011; Maruping et al., 2015; Sonnentag and Frese, 2004). The authors also reach different conclusions, suggesting that time pressure affects performance both positively (Basten, 2017; Karau and Kelly, 1992) and negatively (Basten, 2017; Karau and Kelly, 1992; Maruping et al., 2015). While many aspects of IS projects have been examined in prior research, requirements engineering remains insufficiently explored (Basten, 2017). Particularly, there is a lack of empirically grounded research (Fernández et al., 2017). Answering the call for qualitative studies on time pressure in IS project contexts (Basten, 2017), we thus aim to provide in-depth insight into the time pressure's role in the requirements engineering aspect of both agile and sequential projects.

# 3 Research Approach

The data required to meet our research objectives was obtained through qualitative semi-structured interviews (Myers and Newman, 2007), during which we sought IS professionals' perspectives on time pressure. Interviews are typically used when the aim is to obtain in-depth insights into a particular phenomenon based on the participants' experiences and perspectives (Schultze and Avital, 2011). To ensure process flexibility, in our interview guide, we broadly differentiated between key questions and those used when opening and closing the interviews (Myers and Newman, 2007). We employed the critical incident technique as an established approach for our interviews (Butterfield et al., 2005; Creswell, 1998; Flanagan, 1954).

As critical incidents do not have to start or end at precisely defined points, this procedure makes it easier for interviewees to remember a single critical incident (Cheek et al., 1997; Norman et al., 1992; Reed, 1994). Additionally, a critical incident may cause another situation that is critical, but not deemed an incident (Norman et al., 1992). It is also possible for the interviewees to recount multiple experiences, or even multiple critical incidents, while describing a single incident (Norman et al., 1992). That is why we encouraged our interviewees to discuss longer periods of time, beyond the critical incident itself (Norman et al., 1992). The critical incident has to make a clear contribution to the activities' objective (Flanagan, 1954; Norman et al., 1992), which is engineering of requirements in the present context.

In our interviews, we started with general questions and proceeded toward more specific ones. We used open-ended questions to facilitate broader discussions (Myers and Newman, 2007). The first author conducted all interviews, which commenced with the discussion of interviewees' project experiences that are related to time pressure (i.e. critical incidents), followed by their insights into time pressure in requirements engineering not related to the critical incidents (see Appendix A).

## 3.1 Data Collection

During the interviews, we followed widely adopted guidelines for researchers (Myers and Newman, 2007). We collected the data in June 2017 via 13 interviews (with 14 participants, two of whom were interviewed together). We stepwise increased the number of interviews until we gained no new insights from critical incidents (Flanagan, 1954). The interviews ranged from 35 to 86 minutes, lasting 55 minutes on average. Each interview terminated when the interviewee was not able to identify further critical incidents and all questions were answered. In some cases, the participant ended the interview,

due to time restrictions (Norman et al., 1992). All interviews were audio recorded and were subsequently transcribed (Myers and Newman, 2007). To ensure communicative validity (Flick, 2009), the interviewees had the opportunity to review the transcriptions and provide feedback. Five interviews were conducted face-to-face, while the remaining eight were performed via Skype.

The interview sample comprised of experts that have experience with requirements engineering in agile or sequential software development approaches, or both. We interviewed experts of diverse hierarchical status and performing different roles, as this allowed us to 'represent various voices' of the phenomenon of interest (Myers and Newman, 2007, p. 17). We interviewed business analysts and consultants working on sequential software projects. We presumed they would be able to offer the most valuable input regarding time pressure in requirements engineering, because they are responsible for requirements engineering and would be affected by time pressure. We next interviewed department heads and project leaders. They were able to explain whether time pressure has been used deliberately, as well as provide more information on the project success in terms of the iron triangle. In order to assess the role of time pressure in agile projects, we interviewed experts involved in the business analysis or programming, as they would be able to provide input regarding customer satisfaction with project outcomes. In sum, we interviewed 14 individuals holding the following job titles: Consultant (5), Project Manager (4), Developer (3), Head of Department (1) and Chief Operations Officer (COO) (1).

On average, the interviewees had 9.4 and 7.2 years of experience in software engineering and requirements engineering, respectively. In addition, 85 percent of the interviewees had sequential software development experience, while 54 percent of the sample had previously worked on agile software development projects. The interviewee characteristics are summarised in Table 1.

| **Pseudonym** | **Job Title** | **Experience (Number of Years)** | | |
|---|---|---|---|---|
| | | **Software Engineering** | **Agile Requirements Engineering** | **Sequential Requirements Engineering** |
| Adrian | Consultant | 10 | 10 | 6 |
| Brad | Project Manager | 10 | 3 | 5 |
| Curt | Developer | 4.5 | 0.5 | 0 |
| Daniel | Consultant | 5 | 2 | 3 |
| Eric | Consultant | 4 | 4 | 0 |
| Frederic | Project Manager | 5 | 5 | 3 |
| George | Developer | 5 | 0 | 5 |
| Ian | Head of Department | 24 | 12 | 0 |
| James | COO | 8 | 4 | 4 |
| Jeffrey | Developer | 3.5 | 0 | 1 |
| Kate | Consultant | 12 | 12 | 0 |
| Leon | Project Manager | 8 | 2 | 0 |
| Marc | Project Manager | 8 | 3 | 5 |
| Norah | Consultant | 25 | 17.5 | 0 |

Table 1. Interviewee Characteristics.

## 3.2 Data Analysis

We used thematic analysis (Braun and Clarke, 2006) as the qualitative analytic method due to its flexibility. This method allowed us to identify, analyse and report themes in our data. It was also beneficial in conveying the interviewees' experiences and reflecting their practical realities (Braun and Clarke, 2006). When examining the interview data, we inductively applied thematic analysis (Braun and Clarke, 2006).

The interviewees discussed 18 critical incidents. After coding each relevant passage in the data, we derived seven themes pertaining to the interviewees' descriptions of critical incidents. The findings indicated that time pressure is viewed similarly by those involved in requirements engineering, irrespective of the level of experience or development approach.

# 4 Results

In the following sections, we present our seven themes pertaining to time pressure in IS projects, namely quality, deadlines and working speed, costs, overall project, satisfaction, emotions as well as creativity and other projects.

## 4.1 Quality

Our interviewees did not mention any critical incident concerning time pressure's positive influence on project quality. Nevertheless, Frederic, George, Ian and Leon stated that the influence is not necessarily negative. According to Leon, time pressure can simply arise due to the need to deliver high-quality results, which can, in turn, adversely affect project cost or duration. Adrian, Frederic, Jeffrey, Marc and Norah debated on both positive and negative influences, depending on its level, thus supporting the inverted U-shaped relationship. Similarly, Leon considers time pressure to have a negative influence on deliverables in the requirements engineering phase, but to have no influence on the overall project success.

Six interviewees exclusively mentioned negative influences of time pressure on quality in requirements engineering (Curt, Daniel, Eric, Ian, Kate and Leon). According to Curt, the negative influence is a contagious, as if one employee's work is of poor quality, the quality of the overall project suffers as well. Leon observed that, as he cannot find the best solution when under time pressure, his work becomes less structured and his thinking less detailed. Leon nonetheless believes that the overall project's quality does not suffer due to time pressure, as the mistakes that occur in the requirements engineering phase are rectified in the subsequent phases. Both Kate and Ian believe that this negative influence only arises if the time pressure persists for a long period. The most frequently cited negative influences relate to the quality of deliverables, such as requirements. Jeffrey reported on an agile project: *"The quality of the user stories was low. […] We knew what should happen roughly, but we had to clarify it in a later step. As a result, we had to redefine or eliminate half of the initial user stories"*. Jeffrey also noted that time pressure *"inevitably leads to a poorer quality, that is for sure"*. Norah provided an example related to both requirements' quality deterioration and decisions not to implement them: *"For example, a complete interface has been forgotten because we did not think or talk about it enough […]"*. Norah similarly stated: *"Solutions found under time pressure are usually not the most optimal, but [those are] solutions that work somehow because the deadline exists. However, they are not reflected upon or conceptualised. We often know beforehand that it is a solution that will be eventually abandoned"*. Norah and her project team create a list of those solutions in order to consider them at a later point of time, but the correction is implemented in very few cases due to the lack of time.

The interviewees reported not only on negative influences of time pressure on deliverables in the requirements engineering phase, but those pertaining to the overall project success as well. When discussing effects of neglecting quality aspects, James mentioned that time pressure not only deteriorates code quality, but may also introduce vulnerabilities into the whole system and the project outcome. Furthermore, Daniel described a reduction in the solution quality due to poor communication with service contractors stemming from time pressure.

Only three interviewees discussed a potentially positive influence of time pressure on the overall project (Eric, George and James). George, for example, noted that having strict deadlines increases the probability of having meetings with the customer and the manager when scheduled, rather than postponing them from one date to another. Brad, Ian and Kate, on the other hand, felt that quality in requirements engineering is unaffected by time pressure.

## 4.2 Deadlines and Working Speed

Time pressure is commonly perceived to exert negative influence on project deadlines (Curt, Daniel, Frederic, James, Jeffrey, Marc and Norah). Time pressure shortens the time available for reflecting on relevant topics in early project phases, which results in having to dedicate extra time to resolving self-made issues at the end of the project (Daniel). However, time pressure is also seen as positive by Curt, Frederic, George and James, since it leads to making use of resources from other projects. George observed that, under time pressure, more time is dedicated to the focal project in order ensure that it is on schedule. Curt also shared that, time pressure prompts the developers to focus on essential issues, such as documenting only the most critical aspects.

Time pressure can have a positive influence on working speed, as it may lead to faster responses from the customer (e.g. when the vendor requests information; Frederic). Kate provided a simple example of increased working speed over a short period by saying that, on the day before holiday, most team members expedite their work due to high focus. Ian was of view that this short-term time pressure has to be related to a specific objective that has to be accomplished, such as finishing work before holiday.

Nevertheless, several caveats should be noted in relation to these assertions. First, time pressure can only have positive influence on performance if it persists for a short period, as ongoing time pressure is detrimental for work quality. Second, time pressure intensity is inversely related to its positive influence. Thus, statements noted above support the inverted U-shaped relationship. Curt refers to the inverted U-shaped relationship in the following statement: *"Well-known patterns exist. It is fine if you are a little bit over-challenged steadily. If you are over-challenged too often, [the working speed] decreases drastically. […] And then the performance decreases, in terms of quality"*. Third, error rate increases in requirements engineering if intense time pressure persists, and some of these issues may extend to the overall project (Marc). As Norah explains, *"the more time pressure is present, the slower I am in other projects' phases due to aspects that have not been considered in the requirements engineering phase because of time pressure, or that have not been considered sufficiently. I have to clarify these aspects somewhere in the other projects' phases. As a result, the speed of other phases decreases due to the need for clarification of many issues"*. Fourth, several interviewees stated that time pressure exerts only negative influence on working speed. For example, Adrian explained that it is not possible to make employees work faster, not even under time pressure.

## 4.3 Costs

While there is agreement among our interviewees that time pressure generally does not have a positive influence on project costs, several participants focused on its negative effects (Curt, Daniel, Frederic, George, Ian, Jeffrey, Kate, Leon and Norah) while a few noted that time pressure had no effect on costs (Eric, James and Marc).

Costs are rarely directly affected by time pressure, but can increase due to extending deadlines or because resources from other projects have to be allocated to the focal project to ensure that it meets the schedule (Curt, George). This allocation makes the project successful in terms of time and scope (George). Leon describes a similar effect where more money has been spent in order to ensure a certain quality level. Daniel described a project in which time pressure led to high costs, because time pressure in the analysis phase led to the skipping of discussions about concepts. Thus, as the project evolved, many of the processes had to be redesigned or discarded completely. Frederic reported on a project in which costs increased due to time pressure, because multiple developers had to review the code in order complete this phase as fast as possible. Every single developer had to become acquainted with the code others had worked on, thus increasing the time required for the review. Frederic also highlighted that those costs cannot be invoiced completely to the customer.

## 4.4 Overall Project

Most interviewees discussed negative influences of time pressure on the overall project (Adrian, George, Ian, James, Jeffrey, Kate, Marc and Norah). Jeffrey shared: *"[Requirements engineering] is the first*

*step and has a domino effect on everything that follows. If one domino falls, so will all that come behind it. Having time pressure influences the development phase too. You cannot have everything there. The best solution would take too much time. […] but this is an issue in the development phase"*.

On the other hand, several participants were of view that time pressure has no negative influence or has only positive influence on the overall project (Curt, Frederic, George, James and Leon). Frederic reported that time pressure has been beneficial for his whole project: *"I am happy. I like to work in a way where I contact somebody and get an answer instantly. That is more fun to me than if I had to wait three days and look for other things to do because you never sit on your hands. Alternatively, you work three or four days on another project, and then the customer calls and gets angry because you did not make any progress, even though it is clear that you do not work solely for him. […] Overall, it worked very well"*.

## 4.5 Satisfaction

Time pressure exerts both positive and negative influence on customer and team member satisfaction (Adrian, Curt, Daniel, Frederic, Ian, James, Jeffrey, Leon, Marc and Norah). Time pressure may increase customer satisfaction while team member satisfaction decreases and vice versa. Similarly, a customer representative may not be satisfied during the project, but is satisfied in the end even though the result has been scoped down.

Norah described the two types of influence as follows: "*High customer satisfaction, but not on developer side, not on the IT side. Inside the IT department, employees were frustrated and stressed out after finishing the project and just wanted to leave the project*". However, Norah acknowledged that the project team could not have reached this high level of customer satisfaction without time pressure.

Concerning team member satisfaction, Jeffrey explained that, although the planned scope could not be reached in a focal project, the IT employees were happy. In contrast, Leon stated that customer satisfaction tends to be higher with time pressure due to flexibility in managing the project as a consequence of no self-imposed time pressure.

Marc provided the following example of customer satisfaction: Marc and his team show a version of the product that has been scoped-down as a consequence of time pressure to a group of customer representatives. They are satisfied and do not even notice the scope reduction.

James explained that customer satisfaction may decrease because the product is not developed as fast as the customers wanted it to. Frederic noted that time pressure led to decreased customer satisfaction in some cases: *"I had to argue the customer out of some features he wanted to have in the first version. He would have been happy with its realisation. […] That would have been more positive for him"*.

## 4.6 Emotions

Regarding the time pressure duration, Norah stated that working under time pressure for six months, "*really takes it out of you.*" Although the customer was satisfied at the end of this period, the project team members were *"frustrated and stressed out and just wanted to leave the project"* (Norah). Curt talked about the 'sword of Damocles', which was omnipresent during the three months of time pressure that he perceived as a hard and stressful period of time. According to Marc, it is possible to get used to the time pressure and to perceive this stressor only if it relates to the possibility of high financial damage. He further stated that it is hard to preserve distance to time pressure and that a service contractor should not handle the time pressure indifferently (Marc).

Prolonged periods of time pressure have a negative influence on employee motivation and satisfaction, according to Ian. When this working environment persisted for four years, Ian found that absenteeism rate increased. Frederic stated that he has worked under time pressure caused by unrealistic deadlines for more than two years, during which he often worked until eleven o'clock in the evening to keep the project on schedule. He explained, "*It's no fun and the dissatisfaction increases*." In contrast, Frederic does believe that a certain level of time pressure is beneficial, as it keeps a project in its flow.

According to our study participants, time pressure is neither very positive nor very negative. Only two interviewees have an exclusively negative view (Curt, George), while one particular interviewee felt that time pressure was detrimental under all circumstances (Eric). Overall, in requirements engineering, time pressure is deemed as positive, as most interviewees seem to prefer to work under time pressure. Daniel argued that he needs time pressure in order not to get bored. Curt stated that his productivity increases under time pressure, but he does not attain happiness in those situations. Nobody claimed to like time pressure, although George stated it could have a positive influence on project success.

### 4.7 Creativity and Other Projects

Time pressure may lead to increased creativity, as George described: *"I believe that time pressure leads to an unleashing of creativity. […] The feeling of having to start again, to think in a very different way because it does not operate the way we thought it would, […] I believe it helped us […]".*

According to Frederic and James, time pressure may lead to the postponing of other projects: *"As the project manager, I swayed from one project to another. Normally, I like to work two days a week on a project and then two days on another project. Because of the haste, I always left the other projects when new input came. I dealt with it and gave information to the developers. They posed many questions to me […]. Hence, I focused primarily on the focal project and I believe that the other projects suffered in their effectivity or efficiency".*

## 5 Discussion

### 5.1 Contribution

As a primarily empirical contribution (Ågerfalk, 2014), in this work, we expand upon extant research on time pressure in IS projects by providing results yielded by analysing semi-structured expert interviews. We thereby respond to recent calls for in-depth insights on time pressure (Basten, 2017) and advance the understanding of time pressure's impact on IS project outcomes by juxtaposing insights from sequential and agile projects (see Table 2).

| **Theme** | **Sequential** | | **Agile** |
|---|---|---|---|
| Quality | Postponing work assignments to subsequent phases | Quality reductions | Imprecise user stories |
| Deadlines and Working Speed | Reduced working speed in case of high levels of time pressure | Increased working speed; lack of time for reflecting on the overall project path | No change in working speed |
| Costs | Negative impact due to increased use of resources to meet time and scope constraints | | |
| Overall Project | Positive or negative impact depending on the level of time pressure | | |
| Satisfaction | High customer dissatisfaction if project cannot be completed | Both positive and negative perceptions on behalf of the interviewees; customer satisfaction rated higher than team satisfaction | Lower customer dissatisfaction due to potentially shippable product after each increment |
| Emotions | Lower preference to work under time pressure | Need for a specific level of time pressure; strong rejection of high, long-term time pressure | Higher preference for work under time pressure |
| Creativity and Other Projects | Increased creativity; postponing other projects | | |

Table 2. Juxtaposition of Insights Concerning Time Pressure's Role in Requirements Engineering.

We found time pressure to be a common issue in requirements engineering. We identified seven themes pertaining to how the interviewed experts consider time pressure to influence IS projects. Keeping in mind these influences, we provide guidelines for project leaders, who should reconsider time pressure as a management tool. Specifically, under certain conditions, project leaders may consider increasing/decreasing time pressure to execute projects more efficiently.

Our results show predominantly negative influences of time pressure on projects, especially on quality and costs, which are common measures of IS project success (Joosten et al., 2014; Thomas and Fernández, 2008). Accordingly, costs are typically raised to ensure quality, or quality is reduced to maintain the budget. The decision on which aspect to prioritise is made in the given project context. If time pressure is prevalent, which results from commonly underestimated development effort (Basten and Mellis, 2011), project managers need to sacrifice one for the other.

Our results also show positive effects of time pressure on IS projects. In particular, respondents working on both agile and sequential projects report that working speed can increase due to time pressure. However, there are also differences concerning the deadlines and working speed, when comparing sequential and agile projects. In sequential projects, we found that time pressure in requirements engineering lowers working speed. This was aptly surmised by Norah, wo stated: *"[Time pressure] hinders everything. The greater the time pressure, the slower I am in the other project phases, because I have to clarify those requirements that have been forgotten or those requirements that fell short in the requirements engineering phase, in later project phases. That means, it slows down the other phases of the project because many, many more processes of clarification become necessary"*. On the other hand, the effect of time pressure on agile projects might be less strong. As Adrian explained: "*Basically, time pressure does not matter […] You cannot change a healthy working frequency*". Given that requirements engineering is the foundation for the subsequent phases in sequential projects (Palmquist et al., 2013), this can be considered a plausible explanation for the reduced working speed that results from time pressure in such projects. In agile projects, the problem might be less severe because the teams are self-organised and requirements (e.g. imprecise user stories; see Table 2. ) can be specified in greater detail if they are part of later sprints (Schwaber and Sutherland, 2016).

While we did not find evidence for differences concerning time pressure's impact on costs, the overall project, as well as creativity and other projects, emotions concerning time pressure and the satisfaction of project stakeholders paint a differentiated picture. In particular, we highlight a tendency of the experts to have a positive view of time pressure in requirements engineering, as well as a higher preference for working on agile projects under time pressure. Respondents from the agile world perceive time pressure less negatively, as they see it as a necessity (Kate, Leon and Norah). However, time pressure that comes at a disadvantage of the project team to satisfy the customer (see Section 4.5) can be short-sighted and in turn problematic for the vendor. Customer dissatisfaction with the development process can lead to discontinuance of the client-vendor relationship (Basten et al., 2016; van Ekris, 2009).

Finally, we noted a difference concerning the causes of time pressure depending on the development approach. While underestimating time or poor planning of resources are the most commonly mentioned reasons for time pressure in the sequential world, time pressure in agile projects is often caused by external factors. Our findings are thus in line with those yielded by recent research that highlights the importance of adhering closely to the principles of agile approaches, such as Scrum, to reduce time pressure (Linßen et al., 2018). As Adrian observed, time pressure declines if the team follows the agile principles.

## 5.2 Limitations and Future Research

Besides general limitations concerning qualitative interviews, such as misusing the attention retrieved through the interview to achieve political objectives in their company (Schultze and Avital, 2011), and the critical incident technique, such as subjectivity concerning criticality of incidents (Norman et al., 1992), we acknowledge the following limitations of our research.

First, our definition of time pressure allowed the experts to interpret the term in their own way, as everybody perceives this stressor differently. In other words, we asked for self-measured time pressure, rather than measuring it in an objective way (Sonnentag and Frese, 2004). To countervail this bias, authors of future studies in this field should examine different data sources (e.g. other team members such as project lead or documents such as progress reports) pertaining to the same project to enable data triangulation. We also suggest applying other qualitative methods, such as surveys, observations, case studies or ethnography to make the results more reliable (Ellinger and Bostrom, 2002).

Second, we asked the interviewees to answer questions related to the projects' success dimensions of quality and scope, time and costs. As most of the interviewees did not work in the project leader role, they likely extrapolated their experiences from the requirements engineering phase and applied these to the projects in their entirety. Longitudinal research designs (Basten, 2017) support investigating time pressure across project phases and sprints, respectively, and enable researchers to assess time pressure for the overall project as well.

Third, the generalisability of our results is limited by the number of interviewees and critical incidents discussed. However, in our data gathering and analysis process, we reached theoretical saturation, that is, from the last interviews, we did not gain substantial new insights on our study's context of requirements engineering activities in IS projects in Germany (for theoretical saturation see Glaser and Strauss, 1967). Nevertheless, we cannot rule out the possibility that more interviews would have resulted in more insights. For example, although we found no evidence of effects originating from socio-cultural differences, aspects such as age, gender and geographical location might have an influence on lifestyle and time perception. Concluding, we recommend that authors of future studies should attempt to recruit a larger and more diverse sample to deepen the understanding of the role that time pressure plays in requirements engineering.

## 5.3 Practical Implications

The following three recommendations on how to deal with time pressure may be of use for practitioners, as they are directly derived from the interviews with experts in IS project development.

Team Spirit and a Common Objective

We found team spirit and a common objective of the project team to be the most important factors in alleviating time pressures' negative effects (Adrian, Brad, Curt, Daniel, Eric, Frederic, George, Ian, Kate and Leon). George observed: *"I believe you need a team that you can rely on. Well, I must have the feeling that we all act in concert. That means you can have hot discussions on the methods and approaches, but you should have the common feeling that you work on the project together and that everybody gives their best"*. Daniel stated that, while this is true for sequential projects, it is particularly relevant for agile projects because the team spirit is an integral part of every agile method. Eric also observed: *"Scrum affords optimal conditions for a strong team that is in harmony, because the teams are limited to nine members and not to twenty"*. Project leaders and project teams can enhance their team spirit and mitigate the time pressures' negative effects by going for a drink. As Leon explained: *"We try to catch up a little by going for a drink on projects' costs; it depends on how planned the time pressure is"*. Those celebrations can be a way to appreciate accomplished objectives too. According to Brad, milestones and their celebration by the project team have an important function and can mitigate the negative effects of time pressure. He also noted: *"Of course, you sometimes take the stress to your home; this is inevitable. But if you have sense of achievement now and then, where you can look back on the achieved work and be proud of it, then it unburdens you"*. Because dissatisfaction of the project team may lead to a higher attrition rate both in a project and in the company, according to Adrian, it may be a good practice to ask the project team members how they would like to handle time pressure. Adrian explained: *"It is erroneous to think that you can make employees step beyond their personal limits for a medium or long period. That can work for a short period, but in doubt, the employees leave*

*the company. You cannot do that in the IT, in my experience. That is my practical experience. IT employees can choose where they want to work. […] That is, you can raise the performance somehow, but it is not sustainable for the project and, above all, for a company"*.

Transparency and Appreciation

Making time pressure transparent to the management, to the customer and to the project team itself is helpful, as is the appreciation of personal dedication (Adrian, Brad, Eric, Frederic and Leon). In Leon's view, it is important to convey to external parties what it means for the project team members to work under time pressure. He elaborated on this as follows: *"They could all say 'eight-hour day', drop the pencil and go home. Ordered overtime is very, very, very rare at our house. It is primarily a personal dedication and one has to be grateful to the team and has to show that. […] That is why it is about team spirit. So, we say, 'okay, we are one team, we achieved a great result despite the time pressure, and we met the deadline.' This calls for a celebration"*. Appreciation of a project team member's work can have a positive effect on the his/her attitude toward the need to work on weekends. Brad explained that he and his team would be much more likely to work overtime on a Saturday if their work is appreciated and their dedication is transparent.

Prioritisation

Prioritisation is helpful when working under time pressure (Brad, Ian and Jeffrey). Jeffrey explained that prioritisation is not only important, but it needs to be done in the right way too: *"It happens often that somebody says 'Everything is Prio 1' and by that we are not a step further. Because it is not possible [to realise] everything and to make everything important in order to make it real, that does not make anything. Prioritisation is important, as is acknowledging the time pressure. We should aim to progress as far as possible and should use this prioritisation to mitigate the time pressure to a healthy level"*.

# 6 Conclusion

Our interviews with requirements engineering experts working on projects following sequential or agile development approaches allowed us to advance the current understanding of time pressure's role in IS projects. While time pressure is a common issue in requirements engineering activities, the insights from the semi-structured interviews revealed some notable differences concerning time pressure's impact on IS project success criteria. While quality, scope and costs are commonly said to be negatively impacted by unrealistic deadlines, working speed is widely acknowledged to improve due to time pressure. A comparison of the effects of time pressure on sequential and agile development approaches revealed that team members of agile projects seem to prefer working under time pressure. Additionally, agile IS projects are less prone to time pressure, if the projects follow the agile principles in their entirety. Moreover, consequences of time pressure in agile IS projects are less severe, since each increment results in a potentially shippable product. While time pressure in sequential projects commonly results from poor internal processes, in agile projects, it typically stems from external factors. While acknowledging the specific context of requirements engineering and potentially biased perspective of our study participants, we contribute to the extant time pressure literature by providing directions for future research and guidance for practitioners on time pressure management strategies.

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# Appendix A

| **Time Pressure in Requirements Engineering: Experiences** | |
|---|---|
| Part One | Please remind yourself of a concrete situation that involved requirements engineering, where you were affected by or have observed time pressure. It must be important to you and to the quality of requirements engineering practice. |
| | What was the objective of requirements engineering or its task? |
| | When did it occur? Who was involved? Why did it occur? |
| | What happened in detail? What effects/ consequences did occur? |
| | How was time pressure managed?<br>Did you perceive this strategy as the optimal one?<br>*In case of 'No':* What would the optimal approach be in your view? |
| | How long was the time pressure present? |
| | How do you think the time pressure affected the whole project? |
| | How do you think the time pressure affected the project's overall success in terms of time, costs, quality or customer satisfaction? |
| | How would the situation evolve without time pressure? |
| **Specialised Questions on Time Pressure in Requirements Engineering** | |
| Part Two | For the following questions, please concentrate on requirements engineering only. |
| | Do you relate positive or negative emotions with the term 'time pressure'?<br>*Please rate your response on a scale from 1 to 5, where 1 is only positive, and 5 is only negative.* |
| | Do you prefer to work under time pressure?<br>*Please rate your preference on a scale from 1 to 5, where 1 is always, and 5 is never.* |
| | How does time pressure influence your individual work quality? |
| | How does time pressure influence the projects' overall quality? |
| | How does time pressure influence your individual working speed? |
| | How does time pressure influence the projects' overall completion speed? |
| | Imagine a situation when time pressure is present for whatever reason. What do you think can mitigate its negative effects? |

Table 3. Interview Guide.