

From Implementation to Integration: How employees stabilize additional ERP functionalities in existing routines

Master Thesis for the specialization of Strategic Management at the Radboud University

Radboud Universiteit



Student information:

Name: Sjors Wolters

Student number: S1061378

Wordcount: 12857

Supervisors

Supervisor: S.T.E. Bruls MSc.

Second Reader: Dr. M. Goudsmit

Date

06/16/2025

Abstract

As ERP systems like SAP increasingly structure organizational routines, understanding how users incorporate new functionalities remains a crucial challenge. While current literature has emphasized the role of technological artifacts in stabilizing routines (D'Adderio, 2011) and the mutual shaping of human and material agency (Leonardi, 2011), less is known about the stabilization process of additional functionalities being layered upon already existing routines, and how different user perceptions shape this process. This thesis investigates how employee perceptions shape the stabilization of SAP Scheduling functionalities within existing work routines at a pharmaceutical company.

Through interviews and observations, the study found that affordances and constraints alone cannot explain user behavior. Instead, four perception-based user groups emerged: positive, negative, mixed, and passive. Each group followed a distinct stabilization trajectory. Surprisingly, passive users, who showed low engagement and limited expectations, were most likely to reach full black-boxing. In contrast, highly engaged positive users remained stuck in loops of adaptation and disappointment.

These findings challenge the current literature, which saw active engagement as a facilitator for stabilization. They also demonstrate that stabilization is not a static endpoint but a recursive process, shaped by evolving user perceptions. The thesis introduces the concept of *re-black-boxing* and highlights how imbrication mediates shifting user-system relationships over time.

Keywords: Black-Boxing, Imbrication, ERP, routine stabilization, affordances and constraints, user perception

Table of Contents

Chapter 1: Introduction	3
1.1 Introduction and Research Focus	3
1.2 Goal and Research Question	5
1.3 Thesis outlines	5
Chapter 2: Theoretical Background	7
2.1 Routine dynamics and the role of technology	7
2.2 Imbrication Theory and the Role of Material Agency	9
2.3 Linking Black-Boxing and Imbrication Theory	10
Chapter 3: Methodology	12
3.1 Research Approach	12
3.2 Case Description	13
3.3 Data Collection	14
3.4. Data analysis	17
3.5 Ethical Considerations	18
Chapter 4: Findings	19
4.1 Perception-Based User Groups	19
4.2 The different paths to stabilization	21
4.2.1 Positive Users' black boxing trajectory	22
4.2.2 Negative Users' black-boxing trajectory	23
4.2.3 Mixed Users' black-boxing trajectory	25
4.2.4 Passive Users' black-boxing trajectory	27
4.3 Imbrication as the Mediating Mechanism in Re-Black-Boxing	28
Chapter 5: Conclusion & Discussion	31
Conclusion	31
Discussion	32
Limitations	34
Suggestion for future research	34
Practical implications and recommendations	35
Reflexivity	36
References	38
Appendix A: Interview Format	43
Appendix B: Observation Format	46
Appendix C: Codebook	47
Appendix D: ChatGPT prompts	48

Chapter 1: Introduction

1.1 Introduction and Research Focus

Enterprise Resource Planning (ERP) systems are a key component of modern organization and their strategic digitalization plans, since these systems help companies connect business processes, make their operations more effective, and improve decision-making (Kindness, 2024). By combining the organization functions such as finance, supply chain management, and human resources into one system, ERP solutions make procedures easier and offer structured data formats to organizations, especially in industries where coordination across complex workflows is essential (SAP, 2025). The use of these ERP systems therefore has grown increasingly important in today's dynamic and complex corporate landscapes, where digital transformation is a primary driver of organizational performance and ambitions (Kraus et al., 2021).

Yet, despite their potential, ERP systems often fail to live up to expectations (AlMuhayfith and Shaiti, 2020). Reports show that organizations often struggle to realize the maximum value of their ERP investments. According to Nieto-Rodriguez (2014), firms capture only about 56% of the anticipated benefits, whilst costs are 45% higher than expected beforehand. These failures are not technical, since the technology works as it should. The problem lies in the fact that the workforce fails to see the efficiencies in the same way as management intended it (Boudreau & Robey, 2005). Many causes for this problem are found after the initial implementation phase, where ERP functionalities are supposed to become part of routines. Rather than seamlessly integrating into workflows, ERP systems are frequently avoided, selectively used, or worked around (Marsch et al., 2021). This suggests that ERP implementation is not the end point of this process but rather an ongoing and nuanced adoption process between user and technology.

While ERP research has predominantly focused on the technical and managerial aspects of implementation (Gupta & Kohli, 2004; Teittinen et al., 2012; Menon et al., 2019; Zeebaree et al., 2020), less attention has been paid to how the system is adopted by the users by looking at what actually happens when users start using the system. Current literature tends to overlook the bottom-up processes through which employees interact with technologies, such as ERP systems, resulting in scholars calling for a better understanding of this process (Parmigiani and Howard-Grenville, 2011). Therefore, a more nuanced approach is needed, one that investigates

how employees translate new functions onto their existing routines over time and how these interactions influence whether a system stabilizes or remains unstable.

This call for further exploration has been increasingly recognized in organization studies (Parmigiani and Howard-Grenville, 2011), which have moved away from viewing technology as something static to a more dynamic and practice-based understanding. Recent work in this field argues that technologies not only support work but also have the ability to shape routines itself in unpredictable ways (Da Costa Junior et al., 2024; Leonardi, 2023). Routines, in turn, are not fixed actions, but evolving ways of working shaped by the interactions of users with tools and materials (Feldman & Pentland, 2003). When new technologies are introduced, they interact with routines in ways that may create resistance, require adaptation, or require adjusting current ways of working. Therefore, stabilization should not be seen as a given outcome, but as an ongoing process.

This study builds on two theories to better understand this process. First is D'Adderio's (2011) concept of black-boxing, which describes how technologies can become taken-for-granted parts of routines and part of the subconscious. The second is Leonardi's (2011) theory of imbrication, which describes how human, and material agencies become interwoven due to actors repeatedly adjusting their actions in response to technological features. While Black-boxing theory highlights how technologies can eventually become embedded so deeply, this theory often fails to answer the following questions: *how* is such stabilization achieved, why does it differ among users despite having the same material properties and what happens to a routine when an already black-boxed routine experiences changes in material properties. On the other hand, imbrication theory conceptualizes the recursive entanglement of material and human agency over time, offering tools to explore the dynamic nature of routine formation. However, within imbrication theory scenarios where technologies are forced upon users remains underexplored (Leonardi, 2011), which is the case with most SAP users (Wagner et al., 2006). Current literature therefore lacks nuance regarding why black-boxing differs among users in contexts where already established routines undergo changes in material properties, and where these technologies are rigid and forced upon the user. This is especially important for ERP implementations, where standardized rigid systems interact with different interpretations and varying levels of user adoption (Wagner et al., 2006).

1.2 Goal and Research Question

The goal of this thesis is to contribute to a deeper understanding of how and why additional ERP functionalities which are forced upon users become stabilized or fail to stabilize within

already existing routines. Although ERP systems are typically implemented to streamline and formalize work processes, their actual use is often more contested and dynamic than intended. This thesis investigates these dynamics by combining D’Adderio’s (2011) black-boxing theory with Leonardi’s (2011) theory of imbrication. While black-boxing helps to explain how technologies eventually become taken for granted and become part of the subconscious way work is done, imbrication provides us a perspective on how routines and technologies co-evolve through ongoing interaction between human and material agency. This thesis aims to bring them together to better understand the nuanced, recursive nature of stabilization processes and explain the possible variation in stabilization outcomes in contexts of new functionalities being layered upon already existing routines.

Besides this, scholars showed that employees often perceive ERP systems as externally forced upon them that disrupt their way of working (Wagner et al., 2006). Despite ERP systems’ main goal is to increase efficiency, their complexity and perceived constraints can lead to failed stabilization. However, little is known about how users’ perceptions influence stabilization outcomes when new functionalities are layered upon existing routines, and how these perceptions evolve over time (Parmigiani and Howard-Grenville, 2011). Therefore, the practical goal of this thesis is to shift attention to how the routines are actually stabilized in practice, exploiting how users navigate these imposed functionalities creating a better understanding for implementation strategists to implement additional ERP functionalities more efficiently. Additionally, understanding how and why black-boxing fails can help managers and system designers create support or training programs to support users’ routine stabilization and help realize more of the anticipated benefits than the current 56% mentioned by Nieto-Rodriguez (2014).

To reach these goals, the thesis will try to answer the following research question:

How do employee perceptions of an ERP shape the stabilization of new ERP functionalities within existing routines?

1.3 Thesis outlines

This study was conducted at NSP Animal Health, a pharmaceutical company that has used SAP for several years and implemented a new SAP module, SAP Scanning, in the beginning of March 2025. The theoretical framework looks at black-boxing and imbrication theory to see how additional ERP functionalities are integrated into already existing routines, and how this differs among users. The third chapter presents the qualitative research approach that was followed during this study, showing how information was gathered from the employees that

use SAP in their everyday routines through semi-structured interviews and workplace observations. The research presented in this paper was guided by grounded theory and template analysis, which, while highlighting data-driven research, also used existing theoretical perspectives as a starting point for developing fresh insights on the topic (Symon & Cassell, 2012; Thornberg, 2012). Afterwards, the findings within the data are presented in chapter four. To conclude this thesis the conclusion and discussion will be presented in chapter five, providing an answer to the research question, and discussing how the findings fit in the current literature.

Chapter 2: Theoretical Background

This chapter introduces the relevant theoretical framework and links it to existing literature. The first section discusses routine dynamics, which explains how routines evolve over time because of human agency. Routine dynamics alone do not account for the role of technology within routine formation. This is addressed by introducing D'Adderio's (2011) black-boxing, which demonstrates how organizational behaviors are affected by technological artifacts that are rooted in routines.

While black-boxing explains how technological artifacts become embedded within routines, it does not explain what happens when already black-boxed routines undergo change, and why the black-boxing trajectory may differ per user. As a result, Imbrication theory (Leonardi, 2011) is used to describe the dynamic influence of affordances and constraints on routine stabilization and flexibility. In conclusion, the chapter will explain the overlap, differences, and connections of black-boxing and imbrication theory to propose a model for how additional ERP functionalities possibly stabilize within already existing routines.

2.1 Routine dynamics and the role of technology

In prior research, routines have been described as sources of stability (March & Simon, 1958). Feldman and Pentland (2003) expanded on this prior theory of routines by emphasizing the role of human agency in challenging the traditional view that routines are inflexible, repeated patterns. Instead, they argue that organizational routines are flexible and subject to change because they are "a repetitive, recognizable pattern of interdependent actions, involving multiple actors" (Feldman and Pentland, 2003, p. 96), highlighting the importance of understanding human agency in the context of routine performance.

While human agency continues to be a significant source of routine change, researchers have increasingly emphasized the importance of technology in influencing routine formation (D'Adderio, 2011; Feldman & Pentland, 2022). Recent research indicates that technological artifacts are actually performing routines, influencing how routines get embedded, changed, or become immune to changes, in contrast to earlier ideas that viewed technology as an external artifact that remained outside the routine (D'Adderio, 2011). To conceptualize technology and routines, D'Adderio (2011) proposed the black-boxing concept, which shows how technological artifacts get embedded in routines resulting in these routines becoming unnoticeable and part of the subconscious. This procedure involving the integration of technological artifacts and systems into work practices takes place over time through

continuous interaction (D'Adderio, 2011). Because of this, users eventually stop questioning how technology shapes their behavior, demonstrating stabilization and embedding into routines. D'Adderio builds upon Latour's (1987) black-boxing theory to account for the way technology fades from conscious attention over time, after it has been implemented in routine organizational practices. Although D'Adderio does not specifically use the term "black-boxing" in her 2011 study, she does explain how technology's core mechanisms become black-boxed as they are used often in repeated routines. Over time, this method reinforces the perception of technology as a given and unquestioned force that impacts routines without conscious awareness. From now on, this process will be referred to as "black-boxing".

The process of Black boxing goes through 4 phases before an artifact can become black boxed: recognition of technological artifacts, inscription, translation, and coevolution (D'Adderio, 2011). The first mechanism, recognizing technological artifacts, involves users acknowledging the potential of the new technology and how it can influence their work. If the technology is not recognized, then there is no possibility for black-boxing. The second phase, inscription, involves the incorporation of strict rules, limitations, and expectations into artifacts that guide and shape user actions. These inscriptions structure routines by saying which actions are necessary and how activities should be carried out. The third mechanism, translation routines, is an iterative process in which users and artifacts adapt, follow the default path, or resist the technology, based on their personal view on the technology due to the personal sensemaking in this phase. The fourth mechanism, coevolution, refers to the alignment and negotiation of technological use, as actors might adapt, reinterpret, or question given structures. These interactions determine whether an artifact becomes stable as an unquestioned part of routines or if it remains open to resistance and change. When all 4 phases move smoothly without resistance, the technology will be fully embedded resulting in the routine becoming black boxed.

Though black-boxing describes the stabilization of routines via technological artifacts, it does not imply that routines are permanently set. According to D'Adderio (2011), routines and artifacts co-evolve through ongoing enactment and performative struggles, therefore stability is dependent on ongoing negotiations and is an outcome of alignment between the users' goals and the technical structure. When this alignment is achieved, but disrupted again, through for example the introduction of new functionalities within the routine, the black-boxed routine is re-opened. While D'Adderio acknowledges this possibility (2011), her theory lacks understanding on how reopened black-boxes possibly stabilize again in the future, how this differs from her original four phases model and how this process may differ among users.

In sum, black-boxing shows how routines become taken for granted as a result of the reinforcement of technological artifacts, but it lacks understanding when describing the context in which stabilization fails, why they fail, and what happens when an already black-boxed routine needs to be reopened, for example due to an additional technology being implemented into an already stable routine. Leonardi's (2011) imbrication theory can be used to enrich this perspective by analyzing the interplay of material agency and human agency in the development of organizational routines.

2.2 Imbrication Theory and the Role of Material Agency

Imbrication theory explains how technology and routines stabilize together over time, with a focus on the joint shaping of material and human agency. Leonardi (2011) defines material agency as what technology (non-human) is capable of to influence human agency, but this cannot be separated from the one who programmed it. Imbrication theory argues that technical objects actively contribute to the development of organizational routines, impacting how people complete tasks and make decisions, as opposed to seeing technology as an external artifact. Imbrication is the process of overlapping layers of human and technical agencies that creates a historically dependent system in which past configurations impact future adaptations.

The idea that stabilization is a process rather than an event is one of the fundamental principles of imbrication theory. For Leonardi (2011), "it is arbitrary to look for beginning or end points in an imbricated system. Instead, the analyst should be more interested in explaining how imbrication occurs and the effects that prior sequences of imbrication have on future actions" (p. 155). This viewpoint differs from other linear theories where technology adoption and stabilization is thought to happen through repetitive interactions, with every event of routine enactment pushing back or reconfiguring the relationship between users and technology.

The second main assumption of imbrication theory, which incorporates Gibson's (1979) concept of affordances, is that routines are influenced by technological artifacts through the sense of affordances and constraints. According to Gibson's original definition, affordances are the opportunities for action that an object or environment presents to an actor, whether or not the actor has the ability to perceive them. In organizational technology, affordances are the capabilities or features that technologies provide to users to enable or facilitate specific work practices (Leonardi, 2011). Constraints, on the other hand, are the limitations imposed by a system's structure or design, which limit or affect how users may use technology in their work

practices. Crucial to know is that both affordances and constraints are dynamically perceived by users within unique organizational contexts, impacting whether technological artifacts become stable in work routines or are constantly being revised.

While imbrication theory provides a framework for analyzing regular development in terms of material agency, it does not imply that stabilization is solely due to repetition. Rather, stability is a recurrent process of negotiation between human and material action, based on historical relationships and technological imbrications. Because affordances and constraints perception is dynamic, routine stabilization is dependent on how technological artifacts structure possible future actions in the long-term.

2.3 Linking Black-Boxing and Imbrication Theory¹

While D’Adderio’s model (2011) provides a valuable processual view of black-boxing due to its four phases model towards this outcome, it leaves several key questions underexplored. First, it treats the path toward black-boxing as a result of interaction with the artifact itself, without taking variation across users into account. D’Adderio’s model shows how black-boxing occurs, but not why it fails for some users and not for others, even when technological inscriptions are the same for all users. Second, it is unclear how stabilization unfolds when users experience the same system as simultaneously affording and constraining. The model demonstrates a straightforward path towards black-boxing, but does not fully explain cases where routines remain un-black-boxed, or where black-boxes reopen. Lastly, the model mainly focuses on situations where routines are formed from scratch, resulting in a lack of understanding of the process by which technologies are layered upon already black-boxed routines, requiring reopening and adjusting these already black-boxed routines.

Imbrication theory (Leonardi, 2011) offers a way to address these blind spots. Rather than focusing on the artifact’s stabilization, imbrication highlights the ongoing interaction and negotiation between human and material agency in shaping routines. From this perspective, stabilization is not a final phase but a historically layered process, in which new imbrications are always influenced by prior ones. Crucially, this theory brings perception to the center: how users experience a system’s affordances and constraints actively shapes whether and how they adapt their routines. This lens is particularly relevant when researching situations where users

¹ The Initial text was written by me, afterwards the following ChatGPT prompt was used to delete any possible confusing terminology to make the linkage between the theories clear, structured, and not a loop or brief summary: “Hey chat, where do you see any possible confusing sentences, and how would you minimize confusion for the reader?”. Afterwards I took this as inspiration and revised the text where needed with careful consideration. To see the ChatGPT answer, see Appendix D.

must adjust already existing routines to new technologies. In these situations, the new routine is not built from scratch but requires updating the previous routine and modifying previous imbrications. The recursive nature of this process can explain the differences in black-boxing trajectories, due to the assumption that imbrication is a layered process that differs for each user depending on perception and prior inscriptions.

Taken together, these two theories they offer a complementary lens to look at the data. While black-boxing explains how technologies become embedded within routines, imbrication theory explains why stabilization may differ across users, even when material properties are the same for all users.

Chapter 3: Methodology

3.1 Research Approach

This study used a qualitative single-case study approach to assess employee perceptions and experiences with ERP functionality when these systems were implemented into organizational routines. Rather than assessing a priori hypothesis, the goal of this study was to uncover how ERP systems were used in practice, how they facilitated, constrained, or modified work, (Yin, 2018). Therefore, a case study was most suitable as it allowed for comprehensive contextual understanding of how ERP was implemented in actual scenarios, this approach was well-suited for revealing these complex socio-technical processes.

The study's underlying paradigm (Ontology & Epistemology) was interpretivism, which acknowledged that people co-create social reality through their everyday enactment with technology, such as ERP systems (Schwartz-Shea & Yanow, 2013). The study acknowledged the concept that perceptions are negotiated rather than fixed, and that subjectivities were introduced to the field by both personnel and managers, but also researchers, whose presence and focus on the topic of ERP implementation could also shape perceptions. Since imbrication theory and black-boxing highlight the mutual influence of human and material agency in creating organizational routines, they therefore see routines and theory formation as an emergent outcome of these interactions (Leonardi, 2011; D'Adderio, 2011). This makes interpretivism the most suitable lens for this study, as this view explores how varying user experiences and contextual perceptions lead to different constructions of reality (Schwartz-Shea & Yanow, 2013).

In line with interpretivism, an abductive inquiry was followed which entailed a continuous travelling back and forth between theory and data, creating conceptual ideas while remaining open to emerging empirical patterns (Timmermans & Tavory, 2012). The goal of this study was to help refine the current understanding of ERP re-stabilization by investigating how new technological artefacts were embedded in existing routines, while allowing for the emergence of new dynamics from the field, rather than to strictly test theory and frameworks. This way of researching also boosted credibility by allowing flexibility and depth in the understanding of complex organizational realities.

Because ERP adoption is a complex, context-dependent process, surveys or only quantitative designs would make it hard to capture the complexity of the topic and it would limit nuances within the results and analysis (Myers, 2020). This made qualitative methods like

observations and interviews the best fit to observe and ask how workers encounter system constraints and create workarounds or/and modify routines over time, which allowed to capture both the differences in stabilization processes and perception of affordances and constraints regarding the system. As Symon and Cassell (2012) highlighted, this level of richness is essential when researching emergent sociotechnical systems

To ensure quality, this research was designed with credibility, transferability, reliability, and confirmability in mind as these ones were the most appropriate for qualitative research (Symon & Cassell, 2012).

3.2 Case Description

The research took place at NSP, a multinational pharmaceutical company specializing in veterinary products. The organization used the SAP-based ERP system to improve workflow efficiency and standardize business operations, with continuous add-ons being introduced to increase this efficiency like SAP-scheduling and SAP-scanning. However, as is common in ERP implementations, employees encountered difficulties in aligning system functionalities with their daily work routines. This difference between intended use and actual user interaction provided an opportunity to study how ERP adoption unfolded in practice. During the research I mainly focused on the implementation of the add-on SAP-scheduling, since this was introduced in the beginning of March 2025, meaning that researching the re-opening of the black-boxes of users were fresh and the differences among users regarding their black-boxing trajectories could clearly be seen.

The research focused on three actor groups. First, there were two senior managers in charge of overseeing the deployment process and ensuring that the ERP system aligned with company goals. Their perception on the ERP implementation was valuable, since they are the ones that needed to legitimize the change and create urgency for the other employees. The next group were ERP implementers, who set up the system and assisted employees during the transition. Their vision was crucial, since they were responsible for the employees' understanding of the technology. The third group consisted of frontline employees, or end users who often interacted with ERP features. Observing these respondents offered insights into the actual integration of the technology, and the differences between how the technology was perceived.

3.3 Data Collection

This research followed a multi-method qualitative data collection approach, including semi-structured interviews, real-time observation within the workplaces, and a-priori document analysis. This mix of methods allowed for triangulation which increased credibility and allowed for a more nuanced understanding of how ERP functionalities became embedded or resisted, into organizational routines (Myers, 2020).

Semi-structured interviews were the foundation of the data for this thesis. These interviews took place on-site and face-to-face, allowing for interaction, body language observation, and in-depth contextual understanding (Opdenakker, 2006). With a focus on scenarios where the system afforded or constrained everyday routines, the interviews looked at employee experience, expectations, and perceptions of the SAP Scheduling module. This structure provided insights on how the technology was initially seen, either as an affordance or constraint. The main goal was to see if the new technology was black-boxed or not, and why this could be the case.

The interview questions (see Appendix A) were drawn on the narrative approach developed by Pentland (1999), which breaks down narratives into event-based structures, which allows researchers to trace how routines develop over time and develop theoretical explanations for organizational dynamics. This approach encouraged participants to discuss instances where in this case ERP-use afforded or constrained their routines, capturing narratives and actual experiences (Pentland, 1999). This event-based method provided detailed information about routine breakdowns, workarounds, and stabilization whilst also assuring that we could capture context, nuances and perceptions as needed since the study followed an interpretivist perspective. Event-narratives also showed how routines were formed and changed through repetition making them a good fit for this study.

In total, seven interviews were conducted with eight participants, audio recorded with permission from the participants, transcribed, and anonymized for confidentiality to protect the identities of participants. After every interview, an additional memo was made to document participant feelings and potential biases on the topic, but also the biases and possible improvements of the researcher, which are not specifically mentioned during the interview. This reflectivity is used to increase credibility and reliability, allowing for clarity later in the analysis.

Along with the interviews, workplace observations were conducted in real time and in the field. I shadowed five frontline workers and observed how the SAP Scheduling system was

used or worked around, whilst performing daily work activities. This provided me the chance to truly see the embedding of the technology within routines with all contextual factors at play. Observations were focused on capturing instances of routine adjustments, adaptation and integration, or resistance, which provided insights on topics that were not openly discussed by participants in interviews. Fieldnotes documented both the direct interaction with the ERP system and the broader contextual elements that shaped its use, thereby enabling transferability by documenting the complexity of the work environment (Schwartz-Shea & Yanow, 2013). Besides these active observations, I also conducted around 50 hours of shadow observations whilst being present at the office during my internship, writing down conversations and possible expressions about people's path to stabilization.

These forms of data were complemented by document analysis and provided insights into the organization's planned design of ERP-enabled routines. I completed and studied 40 internal e-learnings and work instruction manuals and compared expectations with employee's actual practices. These documents defined the expected process and demonstrated how the organization explicitly planned to integrate the new module into everyday procedures. Reading these documents helped me understand how the implementation of the technology was intended to look by top management. By having this contextual knowledge, comparing this to actual employee work performance helped me identify areas of mismatch or changes and motives behind these mismatches.

There is one additional unexpected theme that emerged during interviews and observations, user perception. Perception became a key finding when analyzing how users responded to the same technology, influencing if stabilization happened or not. It is therefore essential to already make this distinction here and to adjust the lens we use when analyzing, to solve the theoretical puzzle of this study following an interpretivist approach. All data-types are summarized in Table 1 below.

Table 1.
Overview of Data Collection

Participant Number	Participant Name	Data Type	Perception on SAP Scheduling	Duration (min)	Transcript Pages
1	Irene	Interview	Positive	31	23
2	Ruben	Interview	Positive	31	11
3	Karin	Interview	Mixed	38	13

4 & 5	Ron & Daniel	Interview	Mixed & Negative	29	12
6	Paige	Interview	Negative	30	12
7	Aron	Interview	Mixed	42	15
8	Anne	Interview	Passive	24	11
9	Ruben	Observation	Positive	50	
10	Randy	Observation	Negative	40	
11	John	Observation	Passive	40	
12	Karin	Observation	Mixed	60	
13	Paige	Observation	Negative	75	
	General Observations	Observation		3000	
	E-Learnings	Document		600	
	Work-Instruction	Document		600	
Total				4454	109
Average (Per participant)				38	14

This study was guided by several sensitizing concepts that provided a focus when collecting data while remaining open to new emerging findings. These concepts were used to organize the interview questions (see Appendix A) and structure the observation template (see Appendix B), ensuring theoretical relevance. These concepts were perceived affordances and constraints (Gibson, 1979; Leonardi, 2011), real time imbrications (Leonardi, 2011), and the black-boxing process (D’Adderio, 2011).

The concept of perceived affordances and constraints showed how users perceive system features, such as whether SAP Scheduling enabled efficient work or limited their ability to perform their routines. The interviews went deeper into how employees perceived SAP Scheduling as affording or constraining their work by asking them to provide feedback on specific instances when the system improved their performance or prevented them from performing a task in an efficient way. With examples of how system capabilities enabled or hindered daily functioning, these reflections raised awareness of affordances and perceived constraints, but also within the initial steps of the black-boxing process. Observations went beyond this and revealed how those perceived affordances or constraints took shape in reality.

This study also explored how black-boxing determined whether and how specific ERP features became so embedded into daily routines that users no longer noticed its presence. Observation and interviews allowed the tracing of whether, when and how technology got taken for granted, or if it became a source of active resistance or workarounds. In addition, the narrative format of the interview questions enabled the tracing of prior imbrication, whilst also discovering current imbrications as well. By combining these events into a trajectory of imbrications, the study was able to see how these imbrications influenced the stabilization outcomes over time.

3.4. Data analysis

Data analysis followed an informed grounded theory approach, combined with template analysis, to investigate in a systematic way how ERP functionalities became embedded or contested in work practices (Symon & Cassell, 2012; Thornberg, 2012). This study started with broad sensitizing concepts of perceived affordances and constraints, black-boxing, and imbrication. These initial guiding themes provided direction without being closed off to emerging patterns in the empirical data (Gioia, Corley, & Hamilton, 2013).

The analysis started simultaneously with data gathering and progressed iteratively, which was in line with the constant comparison principles. This involves comparing newly collected information from interviews and observations with earlier findings to refine codes and guide further data collection where necessary. This process enhanced analytical flexibility and dependability by documenting and reflecting on theoretical sampling decisions, which also increased the confirmability.

Through a first round of open coding and a second round of iterative coding, three analytical themes emerged that structured the analysis of this study (see Appendix C). First, the variations in how users engaged with the ERP system revealed four distinct user groups. These groups were not predefined but emerged inductively due to varying patterns of imbrication. Second, these user groups showed different ways of interacting with the technology, ranging from adaptation and co-evolution to resistance or fallback on shadow systems. Each group therefore followed a different path in how routines were resisted, debated, or adopted. Third, the concept of re-black-boxing required new codes and analytical distinctions, as it involved re-engagement with technologies that previously were already stabilized. These dynamics were different from traditional black-boxing interactions like re-translation and routine inertia. The full coding structure can be found in Appendix C.

3.5 Ethical Considerations

This thesis followed the Netherlands code of conduct for research integrity guidelines (NWO, 2018), which ensured that the study was conducted ethically and with respect for participants' rights and privacy.

Prior to collecting any data, participants were presented with a detailed informed consent form that outlines the purpose of the study, the type of data being collected, and that participation was voluntary. Participants' right to withdraw from the study at any point without consequences was emphasized but was not used by any participant. To protect people's privacy and protect their identities, the consent process also clearly outlined how data will be processed, stored, and anonymized. Interviews were only audio recorded with explicit agreement and were held securely by me.

The dynamics of entering and researching the organization are also carefully considered, with the understanding that how I entered the field influenced the research site (Schwartz-Shea & Yanow, 2013). Due to my internship, access to the case company was made possible. Although this entry point made access to data easier, it also required careful evaluation of potential bias and power dynamics that influenced participants' honesty. Therefore, I made participants aware that their responses would remain anonymous throughout the reporting process, were not shared with management or used to identify them and that the goal of my study was not to rate their work but only study their trajectory to stabilization, so the participants were not fearful of answering truthfully.

Chapter 4: Findings

This chapter presents the findings found within the data during the analysis. The findings are organized around the core themes found abductively during the coding process, which are supported by the black-boxing model and imbrication theory. The chapter begins with a description of how users interact with the SAP system, either as an affordance or as a constraint, and how these interactions differ between user groups. After that, it looks at how each user group reacts to these experiences, showing differences in adaptation and resistance patterns, each with a unique black-boxing trajectory. These patterns eventually influenced whether SAP functionalities were stabilized or not within user routines and to which extent. The chapter ends with using imbrication as a mediator for changes in black-boxing trajectories, creating a theoretical model of re-black-boxing.

4.1 Perception-Based User Groups

When analyzing how employees engaged with SAP Scheduling, it became clear that user perceptions could not be captured in a simple distinction between affordance and constraint. Instead, SAP was experienced along a spectrum with some users who emphasized its affordances, others its constraints, and others who experienced both. These distinctions were not only captured in interviews, but also when observing their daily practices like whether they questioned or helped others, and how they utilized SAP in their work practices. The difference created four user groups: positive, negative, mixed, and passive. These groups are combined with their black boxing outcome in table 2 below:

Table 2.

User Groups as Perceptual Positions

	Strong Affordance	Weak Affordance
Strong Constraint	<u>Mixed group</u> Partial-Black-Boxing	<u>Negative group</u> No-Black-Boxing
Weak Constraint	<u>Positive group</u> Partial-Black-Boxing	<u>Passive Group</u> Full-Black-Boxing or No-Black-Boxing

The table shows how the differences in perceived affordances and perceived constraints created four unique user groups, each with different trajectories for black-boxing outcomes.

The first group, positive users, showed significant amounts of enthusiasm and initiative. These individuals described SAP usage as something they had developed over time, through effort and experimentation. One of these users, Irene, reflected that: “I've always been interested in these systems... So I think I've put a lot of effort into learning the system myself. I think that's why I now know exactly how to use it.” These users showed proactive engagement and willingness to embed the additional technology into their routines. Their dialogues were also dictated by strong affording scenarios. They described SAP as an affording tool that they could learn to understand rather than something they were forced to use, which demonstrated a strong affordance and weak constraining perception. These users tended to help others, looked for better methods to use the technology, and even created guides for others. This type of active interaction, both social and cognitive, distinguished them from other user groups.

In contrast, the negative user group viewed SAP as disruptive, confusing, and unsuitable to their way of working. They had internalized Excel-based practices that they felt were preferable and dominated their perception on what SAP constrained rather than what it afforded. One employee, quoted by Daniel, captured this clearly: “I don't have an Excel file anymore, so I don't have the info I used to have. I have less info, it's hard to read, it's new, it's a change, it's hard, it's tricky. I still use Excel.” These users did not reject SAP due to incapacity; they recognized it but did not embrace it. Observations and interviews revealed that they were dependent on key users and other colleagues to fix difficulties or help them interpret the system, and they complained frequently about the same issues. Their involvement with SAP remained low and emotionally charged, which suggested an ongoing gap between their expectations and the system.

The third group, the mixed perception users, switched between seeing the technology as affording or constraining depending on the situation. These people were both enthusiastic and frustrated about a single added functionality. Their opinions were task-specific and frequently changed from day to day. Karin captured this perception in the following way: “It's 50/50 for me. You have all the data up-to-date in SAP. And if something needs to be adjusted, it's implemented immediately... But on the other hand, Excel is easier to read. So that's actually a bit 50/50.” These users described themselves as “still learning” or “not quite there yet.” Observations revealed that individuals tried to embed SAP in their routines but sometimes fell back on old routines when stressed or feeling constrained. When speaking, they would describe a recent example in which SAP clearly afforded their routines, followed by an instance of

confusion or failure which demonstrated constraints. Their engagement was fragmented, modular, and dependent on the context. This back and forth among users revealed a group that was still undecided, but willing to engage with the technology and try to make it embedded in their routines.

Finally, the passive users stood out for their lack of expressed emotions surrounding if the additional technology was perceived as affording or constraining. They described SAP as "part of the job," used it only when necessary, and rarely went beyond basic interaction. Anne's quote illustrated this perception: "I don't really feel like I should be the one to do that. I do try to solve it... but then you have to take a detour again, then I don't know what to do anymore." These users didn't refuse SAP, nor did they actively try to embed the module into their routines, they solely did what was expected of them. Their engagement with the system was dictated by neutrality, and their quotations were often short, neutral, and low in affective tone. This group therefore differed from mixed perception users due to their lower engagement and willingness to actively embed the additional technology into their routines.

These four user groups highlighted the existing diversity in perceived constraints and affordances concerning SAP Scheduling. Differences between groups were not forced by management but rather emerged gradually through repeating patterns of user translation and co-evolution with the system. These patterns of how user groups perceived additional functionalities and the differences among them in turn resulted in different trajectories of black-boxing for each user groups. In the next sections, each group is analyzed in more depth to see how these different views create different patterns of use, resistance, and embedding over time.

4.2 The different paths to stabilization

Before analyzing the four user groups, it is important to note that all participants experienced the first two stages of black-boxing (recognition and inscription) in nearly identical ways. SAP was an universally recognized artifact across the firm, and its inscriptions were fixed at launch, leaving little room for user adjustment. Therefore, this analysis focuses on the final two phases, where user variation was seen.

Additionally, at NSP, SAP Scheduling was integrated into existing analog and Excel-based procedures, not empty ones, which required users to update existing routines rather than to invent new ones. To capture this, the concept of *re-black-boxing* was introduced, which highlighted how already stabilized routines were selectively reshaped by newly added ERP

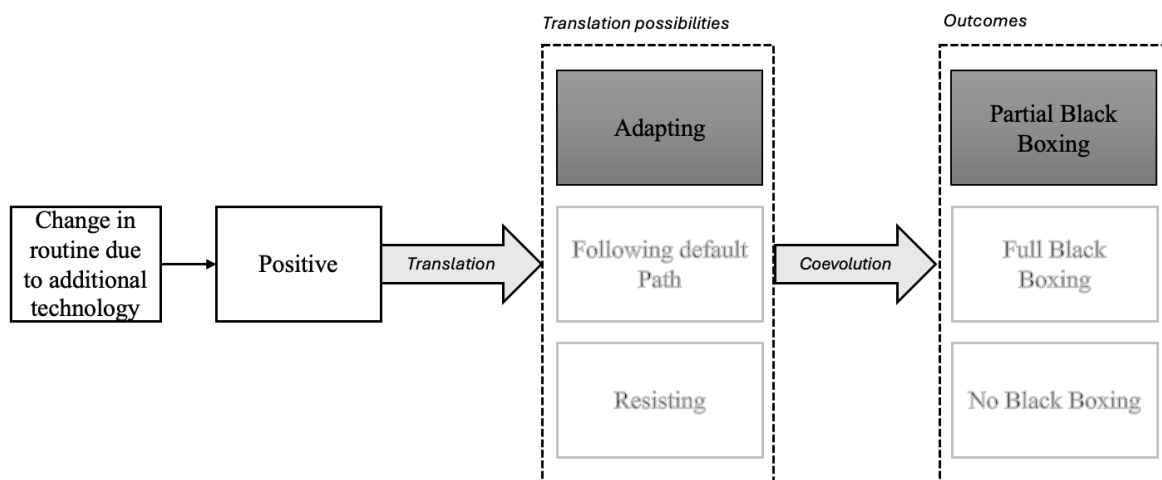
functionalities, which differed among user groups. The following four sections detail these divergent trajectories of re-black-boxing as observed across the user groups.

4.2.1 Positive Users' black boxing trajectory

First when looking at the trajectory of the positive users (see table 2), we can see that they showed the clearest acceptance and strongest engagement during the SAP implementation. The users saw SAP Scheduling as a tool that became more useful when mastered and were willing to learn the module, which is contrasting to other user groups who saw the technology as externally forced upon them. These users were aware of the rigid inscriptions within SAP, like interface logic and mandatory steps, still they accepted the system as it was and tried to adapt their own routines to fit with SAP's logic, instead of resisting it due to their unique level of engagement with the new SAP module, as mentioned in 4.1. The stages of this group's re-black-boxing process from the initial disruption of the old routine to a partial black-boxing outcomes of the new technological feature, are visualized in Figure 1 below:

Figure 1.

Positive users' trajectory



During the *translation phase*, positive users showed an active approach by updating their already embedded routines to align with the new SAP module. During this process, they also encountered hiccups, mainly when translating the excel-based routines into SAP, still they perceived these challenges as manageable. Irene described this perception clearly: “I have to do my work differently... And I think it will take some effort. But for me, I think it should be pretty easy.” This quote reflects both a willingness to learn and an intrinsic motivation to digitize their existing routines. Additionally, these users experimented, tried, failed and

succeeded with different functionalities of the technology, which resulted in translating SAP's structure into something meaningful and worth learning. Ruben's quote captured this proactive attitude: "You really need to know what you are doing. And keep a close eye on what is on your screen and then it is really doable."

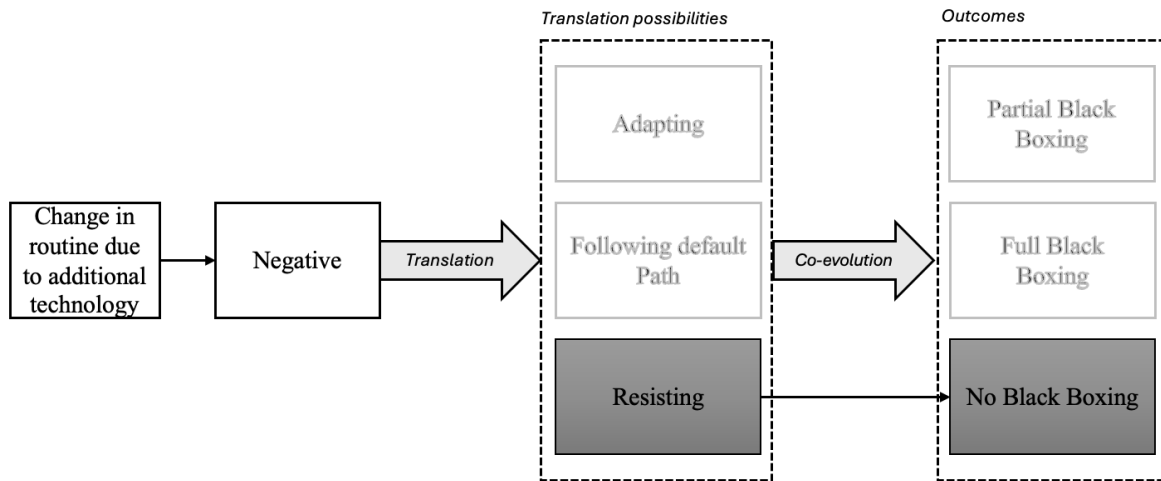
Once the new module is initially translated into adaptation, these users went through the *coevolution* phase where they interacted with the system through repetition, discussion with colleagues and self-learning. These users had high expectations that the system would make their work more efficient, leading to an intensive co-evolution process, shown by Ruben when observing him. He expressed that SAP is hard to learn, and that it takes time and effort to do so, sometimes longer than he wanted to admit, but therefore it also felt rewarding when he managed to understand the functionality of the new module. In this phase SAP started to embed itself into routines and hinting at the first steps of stabilization. Irene reflected on this ongoing process clearly: "I actually think that it happens quite automatically... Some days it's definitely more than others. But It does happen sometimes." This move from conscious interaction to doing the work subconsciously is a sign of routine stabilization. However, this quote also suggested that this stabilization remained partial, since she still required conscious attention in some cases, which resulted in the absence of full black-boxing. In sum, their strong engagement and high expectations motivated them to seek complete alignment between the new module and their routines, but this very engagement also made them more sensitive to system imperfections pulling them into an ongoing cycle of adaptation. As a result, some friction remained, preventing SAP Scheduling from becoming actually fully-black-boxed.

4.2.2 Negative Users' black-boxing trajectory

When looking into the second group, the negative users (see table 2), they are characterized by their constant critical look on SAP Scheduling. This also dominated their re-black-boxing trajectory as they experienced frustration and distantiation. Rather than seeing SAP as a useful tool to learn, they instead saw the system as an externally imposed constraint that clashed with their existing routines, causing disruption. The re-black-boxing trajectory of this group from the initial disruption of the old routine to no-black-boxing is visualized in Figure 1 below:

Figure 2.

Negative users' black-boxing trajectory



When looking at the *translation phase*, these users were mostly resisting, and they engaged with the system to a minimal degree. Besides, this engagement was often mandatory and therefore only procedural, which contrasted with the active engagement of the positive users. When observing Paige when she was making the planning in SAP for that month, she showed me many inefficiencies of the new module whilst highlighting how Excel handled this more efficiently. This shows us that these users are heavily focused on the affordances of the old system, which made them unable to see the possible affordances of the new system, which resulted in that the system was translated into resistance. These frustrations resulted in these users falling back easily to the old routines, like Daniel mentioned when he had an interaction with Paige: “When I ask things like "Hey, how does this need to be done", Paige always takes me back to the Excel planning.”. When people immediately reached for workarounds or shadow systems, the co-evolution phase was skipped, which directly resulted in no black-boxing. They rejected the system beforehand and made no serious attempt to adapt.

On the other hand, sometimes this resistance was less absolute, and users also went through the *co-evolution phase*. Users complied due to the mandatory use of SAP, but they failed to embed the system into their routines and to internalize its functionalities. When observing Randy during his interactions with SAP Scheduling to look at the planning of next week, he told me that he acknowledged he was not using SAP at full potential, instead he only used it to ‘manage small crisis’ since he always skipped the use only until it could not be postponed anymore without consequences. This was because he did not see the added value of the new module, as mentioned during the observation. Their interaction lacked active problem-solving, resulting in sub-optimal co-evolution. Also, Paige reported pasting all her data into SAP only at the end of the day, once everything was finalized in Excel to work around the new

module as much as possible. This shows a clear indication that SAP was not part of her routine, but rather a post hoc requirement that needed to be checked off.

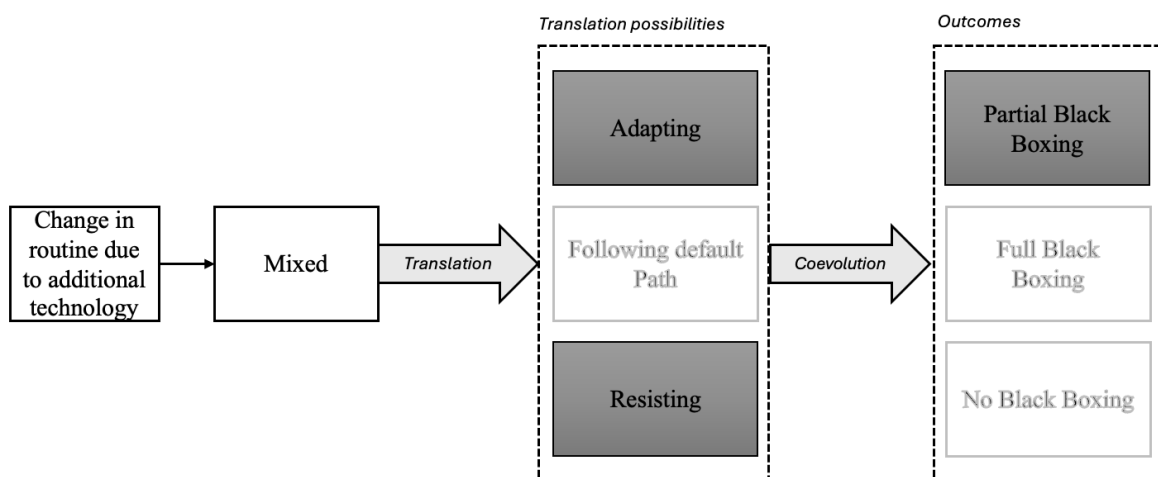
This shallow form of coevolution led to a fragile engagement with the system. These users did not build new routines around SAP, instead, they shaped SAP Scheduling use around their pre-existing routines, reducing its use to a box-checking exercise. Therefore, even this forced coevolution led straight to no stabilization and an outcome of no-black-boxing since the users never internalized the new module as routine infrastructure.

4.2.3 Mixed Users' black-boxing trajectory

The third group, mixed perception users (see table 2), was characterized by their changing and context dependent engagement with SAP Scheduling. Rather than holding a stable positive or negative stance, these users shifted their perception of SAP Scheduling based on the specific task at the time, the usability of the module, and how it aligned with their personal routines. What set this group apart was their situational and pragmatic thinking: how they used SAP was significantly affected by whether the technology was performing efficiently in a given situation. Figure 3 below visualizes this group's re-black-boxing trajectory from disruption to their partial black-boxing outcome:

Figure 3.

Mixed users' black-boxing trajectory



During the *translation phase*, mixed users showed a selective approach. They engaged with SAP functionalities of the SAP Scheduling module they found beneficial for themselves, while resisting or ignoring others, often experienced by the same user, as Karin explained when working with the module: “Once you learn the tricks of the trade, it's doable. But sometimes it's hard for some to get across. It's not very user-friendly in that respect.” Her quote reflects

how this group could recognize SAP's value but also felt constrained by its perceived usability issues. Additionally, Ron expressed disinterest in one part of the module "I think I haven't looked at that in the past months", while shortly after defining another functionality of the same module as affording: "That certain functionality really did not disappoint" These examples reflected how users selectively translated SAP into their routines when it offered clear affordances, but was overlooked when adapting became more complex and required much effort for them to change. Rather than fully adapting or rejecting, translation was case-by-case based on their perception at that time, switching between adapting and resisting based on this perception.

In the *co-evolution phase*, this conditional logic continued. Mixed users started to black-box certain parts of the system through repeated use, while leaving other parts overlooked. As Aron described: "Once it's opened, I know exactly what to do... then it's just automatic." This indicates that once a functionality of the module was actively in use and seen as affording, some actions became part of the subconscious. However it required the users to show effort and engagement, which was not always the case due to their mixed perception, it hindered the possibility of full black-boxing. This partial black-boxing made co-evolution fragile. When the system caused confusion, errors, or layout issues, users easily reached out to Excel or peers for feedback, rather than resolving issues within the module themselves. Karin recalled an instance where mixed users tried to adapt to the system, but only in cases where the users did not have to put high amounts of effort into adapting, otherwise they worked around the module: "if she doesn't know, then she calls me. So then I come over and then I sit down. And then we look at it together to still get it done" This pattern illustrates how their engagement with SAP Scheduling was easily reversed when faced with doubt or complexity.

The outcome for this group was best described as partial black-boxing. Their engagement was pragmatic and conditional. If SAP worked, they used it, if it didn't, they returned to old routines, leaving their routines partially stabilized, yet vulnerable. Unlike the negative group, mixed users showed moments of alignment and stabilization. However, full black-boxing remained out of reach due to the fluctuation between adaptation and resistance.

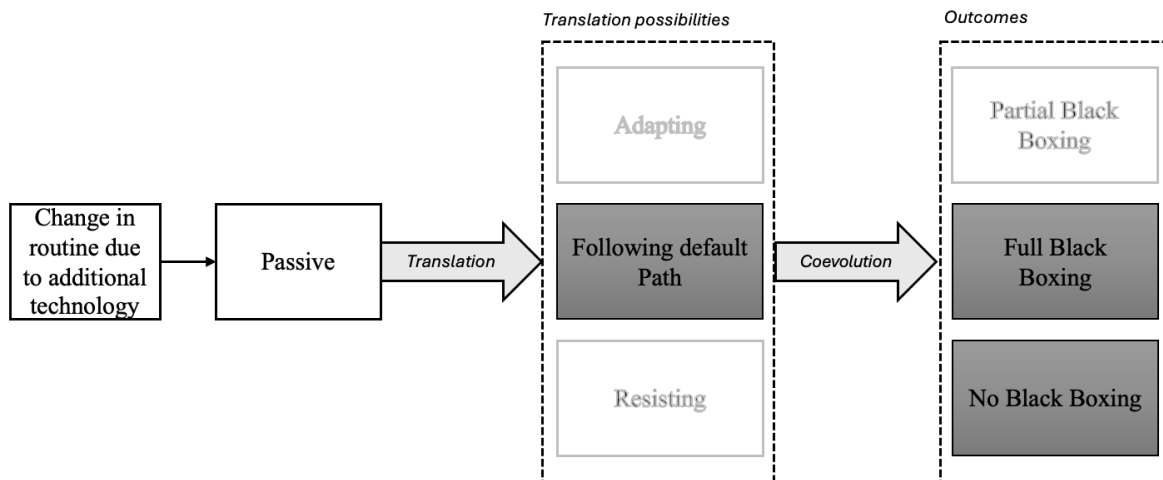
4.2.4 Passive Users' black-boxing trajectory

When analyzing passive users (see table 2), they were the most disconnected disengaged with SAP Scheduling out of all user categories. Unlike positive, negative, or even mixed users, this group explicitly identified the system as neither constraining or affording. This category used SAP as a given part of their work, with no strong perceived affordances or constraints being

expressed, it just needed to be done. As a result, their re-black-boxing trajectory, visualized in Figure 4 below, was marked by procedural compliance rather than active engagement.

Figure 4.

Passive users' black-boxing trajectory



In the *translation* phase, passive users usually followed the “default path.” following the steps shown to them often without critically reflecting on the affordances or constraints of the system. Instead, their engagement was minimal and procedural since their goals when using the system differed in comparison to users who felt strong affordances, since they did not want to actively understand the system. Their main goal was to avoid being punished by management for performing their job incorrectly. This also differed with users who perceived strong constraints, since they did not want to highlight imperfections, instead, they only wanted to resolve them in order to avoid punishment as well. As John summarized it when observing him when I asked him about how he used SAP Scheduling in practice, he told me that he only used the module when the work-instruction told him to do so, then he explicitly followed the steps in this instruction to ‘keep his manager happy’, otherwise he had no interaction with the system since he saw no personal need to engage with it. This illustrates a reliance on mandatory tasks driven by conflict avoidance, rather than active learning or system integration.

Despite this minimal engagement, some level of *coevolution* did occur. When disruptions arose such as fault codes or unexpected system behavior, passive users typically asked for help from more experienced colleagues instead of resolving issues themselves. During one observation with Karin, a colleague approached her with a problem in SAP but had not attempted to resolve the issue herself, she immediately called Karin for help. This form of outsourced co-evolution turned SAP learning into a shared, reactive process rather than one of

personal adaptation and actual embedding of the technology within user's routines resulting in No-Black-Boxing.

Still, for standard tasks that remained stable over time, passive users fully black-boxed SAP Scheduling automatically. Anne reflected: "Now that you mention it, I don't really think about it anymore. It's just something I do automatically" Through repetition, elements of the system became routinized despite the lack of a deeper understanding by these users. Since they did not question the system or seek improvement, the default-path became part of the subconscious. However, this stabilization was fragile. When routines were disrupted by updates or unfamiliar tasks, passive users could not draw on personal insight to resolve issues. Their low engagement type of coevolution broke down and required active engagement and active problem solving. In these cases, users reached for outsourcing co-evolution again, as Irene described when recalling a phone call with a passive user: "They think: oh I just have to quickly book on and off, click click click. And the next time they have problems... then they immediately call us saying 'errrrr, it doesn't work.'" Until the outsourced co-evolution transformed the default-path so it could be followed again, passive users remained stuck in no-black-boxing. Their routines therefore switched between shallow black-boxing and quick break-down, depending on whether the default path was followable.

This trajectory leads to a surprising conclusion. While passive users were the least engaged, they were also the most likely to achieve full black-boxing, at least for standard procedures since they never questioned or negotiated the module's functionalities. Their lack of engagement withheld them from critically evaluating and experimenting with the module, which in turn reduced friction and possibilities for misalignment. In contrast, the positive and more enthusiastic users who were driven by high expectations, often remained stuck in cycles of adjustment and critique.

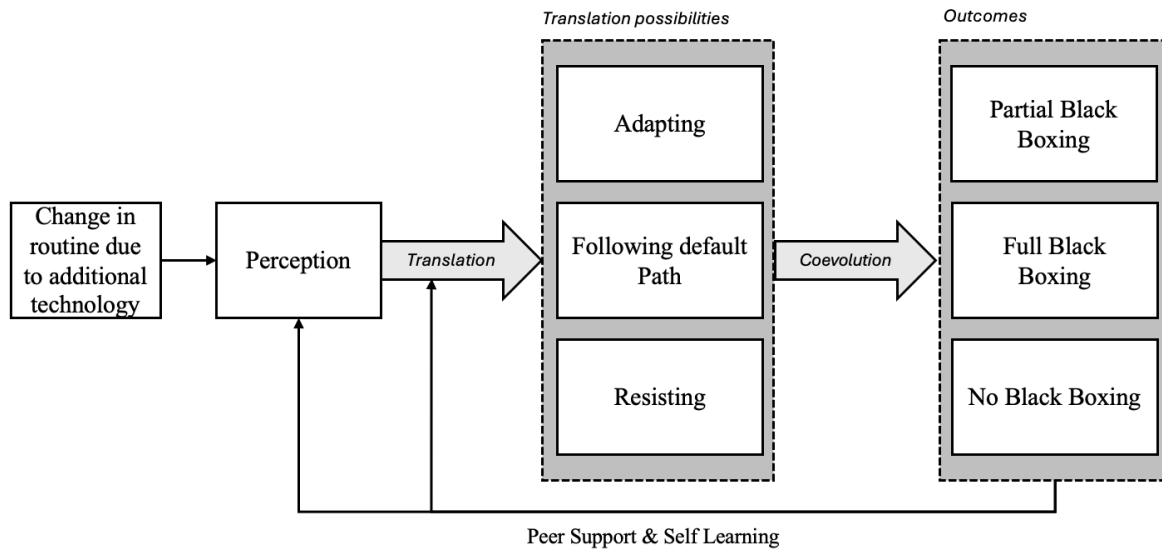
4.3 Imbrication as the Mediating Mechanism in Re-Black-Boxing

Across these four user groups clear differences were seen in how users moved through the final phases of black-boxing: translation and co-evolution. While these distinctions are analytically useful, another significant insight lies in their fluidity. Users are not static in one category, rather, their perceptions, and therefore their trajectories, can evolve over time. Based on the data, such imbrications were not isolated events, but rather ongoing interactions in which users' routines negotiated with SAP's functionalities, often resulting in subtle changes in how activities were performed, interpreted, and valued building upon each other. Crucially, these imbrications influenced both user translations and perception, shown in figure 5, the

overarching framework of this study, which shows two feedback loops surrounding black-boxing trajectories driven by peer support and self-learning.

Figure 5.

Imbrication as the mediator for black-boxing



The *first feedback loop* illustrates how a stabilization outcome can trigger a return to the translation phase. This occurred when users began to engage differently with the technology, even if their overall perception hadn't yet changed. Paige, initially a clear negative user demonstrated this loop clearly. Early in her interview, she expressed skepticism and frustration during the initial introduction of SAP Scheduling: "When we started I thought: this is never going to work." However, later in the interview she reflected that as time progressed her perception became milder and more usage scenarios were shown, which showed a subtle shift in her perception: "You have to find your own way of working of course. Because otherwise we won't get anywhere." While this shift did not result in full or partial black-boxing, it indicated a re-opening of the translation phase. Imbrication resulted in triggering these users to re-thinking their translation due to the user's interactions with the system or peer support. Users started experimenting, selectively engaging, or asking for assistance, highlighting that they changed their translation from only resistance to selective adaptation. These behavioral adjustments, often initiated by peer support or accidental self-learning, indicate a new phase of translation for these users.

The *second feedback loop from outcome to perception* demonstrates how stabilization outcomes can influence the user's perception of the system (see table 2). Perception was initially treated as a starting point in the black-boxing trajectory, but due to this loop it became

a product of prior outcomes, forming a feedback mechanism that resulted in different trajectories for the same user. Randy clearly demonstrated this change in perception. He was initially seen as negative. When observing him, he mainly talked about how the new module was constraining his work, mainly complaining about all the system's imperfections whilst overlooking the possible affordances of the system. One month later, I talked with him again and he told me that he began to revise his view of SAP Scheduling functionalities after witnessing their successful use by peers. His view changed from passive skepticism to cautious optimism. In this loop, the system's perceived affordances increased not through formal training but through peer support and self-learning, particularly when users discovered tangible benefits for themselves. Unlike the first loop, which returns users to the translation stage via subtle behavioral shifts, this second loop marks a deeper cognitive change. The user no longer saw the system as something external forced upon them but began to interpret it as a supportive tool. This change in perception repositioned Randy within a different user group: from negative to mixed, which resulted in a new trajectory of black-boxing for this user.

Together, these feedback loops reveal that re-black-boxing is not a fixed path but a recursive loop, where outcomes and perceptions influence each other through ongoing imbrications. As seen in Figure 5, these loops allow for shifts of a user from one user group to another, not because the system changes, but because their relationship to it does.

Chapter 5: Conclusion & Discussion

Conclusion

The goal of this thesis was to contribute to the current understanding of how employees stabilize additional ERP functionalities within already existing routines, taking variations in perception into account.

The findings demonstrated that perceived affordances and constraints were not sufficient to explain user behavior or the extent to which new ERP functionalities become stabilized. Rather than perceiving the system as either affording or constraining, users at NSP scored on both criteria in various ways, resulting in four distinct user groups based on these scores: positive, negative, mixed, and passive. These user groups were not predefined but inductively derived from the data. Additionally, each user group followed a different trajectory through the final two phases of black-boxing (translation and co-evolution), also called the phases of re-black-boxing. Positive users, who perceived strong affordances and weak constraints, were triggered to explore and actively engage with the new module to update their routines. However, their high level of engagement also came paired with high expectations. When the system did not meet their expectations due to complexity or lack of knowledge, users experienced friction which prevented these users from fully black-boxing the module. Negative users on the other hand mainly perceived strong constraints. They viewed SAP as externally forced upon them and inefficient, which led them to resist the system completely and comply only when it was mandatory. Their ongoing reliance on shadow systems like Excel meant that SAP never became an integrated or subconscious part of their routines resulting in no black-boxing. Mixed users moved between perceiving strong affordances and strong constraints, depending on whether a functionality aligned with their specific tasks or expectations at that point in time. This selective adaptation led to only partial black-boxing. Surprisingly, the passive users, the users who expressed neither clear affordances nor constraints, were most likely to achieve full black-boxing. Their low expectations, procedural compliance, and consistent use of the module according to the 'default path' allowed the system to embed itself into their routines with minimal resistance. Because they did not question the system or actively tried to engage with it, they experienced fewer disruptions of their routines during usage which allowed the system to fully black-box.

What ties these diverse user trajectories together is the role of imbrication (Leonardi, 2011). Rather than a one-time event, imbrication functioned as a continuous mediating process

in which users' actions and perceptions were shaped by, and in turn shaped, their interaction with the module. As routines and functionalities aligned or conflicted over time, users repeatedly negotiated the system's place within their work via peer support and self-learning, resulting in shifts in translation, user groups and black-boxing trajectories among users.

These findings highlighted that the black-boxing of a new additional technology is not only driven by system design, user training, or initial engagement alone, but also by the ongoing ways in which users perceive and interact with the technology over time which significantly differs from the original black-boxing trajectory. Perception played a crucial role in how users navigate the re-black-boxing process, going through different imbrications and shifts in perception and translation. Therefore, black-boxing can best be described as a recursive, dynamic process driven by shifting user-system imbrications, rather than a static endpoint of stabilization.

Discussion

This thesis refines the model of D'Adderio (2011) that defined black-boxing as a four-phase trajectory. In contexts where new additional technologies, like SAP Scheduling, are layered onto existing workflows, users did not begin with an empty routine but rather modified their already existing routines. While D'Adderio (2011) presented black-boxing as a sequential process of recognition, inscription, translation, and co-evolution, these findings suggested that the first two phases of this process were already pre-established through top-down implementation and prior inscriptions. In such cases, users were not required to recognize or negotiate inscriptions themselves, they directly began within translation and co-evolution. This insight refines D'Adderio's black-boxing model by illustrating how new additional technologies that overwrite pre-existing routines produce different trajectories to black-boxing than technologies that require routine building from scratch.

Second, the findings challenge current assumptions about affordance perception. Affordance Scholars (Hutchby, 2001; Markus and Silver, 2008; Leonardi, 2011) argue that when users perceive (technological) artifacts as affording, they are more likely to engage with the system in a meaningful way to reach their goals, increasing the likelihood of integration into routines. However, this study showed that high perceived affordance also created high expectations. When these expectations were not met due to system complexity or a lack of knowledge, positive users remained stuck in adaptation loops of ongoing negotiation, which prevented full-black-boxing. In contrast, passive users, who neither perceived strong affordances nor constraints, followed the default path with minimal engagement. Their low

expectations and procedural compliance made them more likely to reach full black-boxing. This finding nuances the literature by suggesting that someone who perceived strong affordances does not always have the most efficient embedding of a technology. In fact, it exposed users to more friction and critical reflection, which hindered the embedding of new additional technologies into existing routines. This adds an important layer to imbrication theory (Leonardi, 2011) and affordance literature (Hutchby, 2001; Markus and Silver, 2008; Leonardi, 2011), which often linked active engagement to successful integration. Additionally, this finding challenges the assumption that users intentionally initiate new imbrications (Leonardi, 2011). Instead, due to the forced nature of SAP Scheduling use, imbrications also emerge from compliance rather than intention, suggesting that theory account more for the role of obligation in initiating imbrications.

Third, this study showed that black-boxing is not a permanent outcome, but part of a recursive cycle. Drawing on imbrication theory (Leonardi, 2011), the findings showed how users did not make a binary distinction for themselves but scored themselves on both affordances and constraints, creating four user groups (positive, negative, mixed and passive), which provided more nuance to affordance theory (Gibson, 1979; Leonardi, 2011). Additionally, these perceived affordances and constraints were fluid due to imbrications, as they were influenced by shifts in translation, peer support and self-learning. These patterns highlight that routine embedding is not solely driven by human and material agency, but also by how users reinterpret technological artifacts as they continued to engage with the system. This extends Feldman and Pentland's (2003) assumption of performative variation, by showing that variation is not only embedded in action, but also in the recursive negotiation of perception.

Limitations

The first limitation of this thesis is the temporal scope of the research, which limits the ability to observe changes in user perception over time. A key finding of this study is that black-boxing outcomes change how users perceive SAP, influencing which trajectories users follow in the future. This framework was built using interviews and field observations done within a specific time frame. Although early signs of perceptual change were seen, like Randy's transition from a negative to a more mixed stance, these developments were not tracked over time. A longitudinal research design might be more appropriate for showing how routines and perceptions grow together during many rounds of imbrication and re-black-boxing.

Second, the theoretical framework of the study evolved throughout the research process. While the primary goal was to investigate how ERP functionalities stabilize within

routines, the inductive analysis showed that user perception, not only imbrication, played a significant impact in influencing routine results. As a result, the concept of re-black-boxing and its relationship with perception developed as a key analytical contribution. However, because this concept emerged during the research, certain theoretical features, such as the emotional or identity-related drivers of perception (Orlikowski & Gash, 1994), were unable to be taken into account during the interviews and observation. Future study could build on this basis by using theories from cognitive or interpretive organizational studies to improve the understanding of perception formation and how this can be linked to imbrication theory as a combined moderator for the re-black-boxing trajectories.

Third, while categorizing users into four groups gave clarity and structure to the research, it also resulted in a loss of depth within each category. While each trajectory was supported by empirical evidence, the study's scope did not allow for further differentiation within the categories, such as between subtypes of mixed users or their relation to task demands. A larger sample or multi-site research design could have resulted in more nuanced categories and increased the generalizability of group-specific findings.

Suggestion for future research

First, future research could use a longitudinal or ethnographic research design to better understand how views change over time and how these shifts reshape re-black-boxing trajectories. In this study, the feedback loop from partial or no black-boxing outcomes to perception is an essential dynamic. However, due to the research's short time span, only the beginnings of these perceptual changes were captured. A longer-term study would allow researchers to better explore how users switch between perception groups, for example from negative to mixed or passive to positive, and how these changes affect the stabilization of technological artifacts. Such work could be used to validate the model's recursive nature and provide more insight into how imbrications unfold over time.

Second, more research is needed to embed user perception as an essential part of routine dynamics literature. While this study used perception inductively to explain variation in black-boxing outcomes, perception itself is not seen as a crucial aspect of routine dynamics yet. Future research could use theories of sensemaking (Weick, 1995) or interpretive process theory (Langley et al., 2013) as a starting point to better understand how users interpret technological artifacts on the spectrum of affordances and constraints. This would not only add more depth to routine dynamics but also offer a more nuanced understanding of how the interaction between the user and technology vary across user groups.

Third, future research could extend the conceptual model of Konlechner et al. (2016) by looking into whether user perception functions as a mediator not only in the context of strategic tensions, as mentioned in the article, but also in relation to technological artifacts. While these authors investigated how individuals balance competing demands through routine enactment, their model was designed to capture this dynamic in relation to traditional artifacts such as checklists. This thesis suggests that the same dynamics can occur in situations with more complex artifacts like ERP systems, where there is also conflict surrounding functionalities. Future research could investigate if user perception mediates routine change in similar ways across different types of artifacts, and whether variations in perception, stemming from affordances and constraints, align with the interpretive patterns shown in the model in relation to strategic complexity. Such research would help to implement perception into routine dynamics, providing a more comprehensive understanding of how interpretive processes influence routine stability, both analogue and digital.

Practical implications and recommendations

First, training efforts should be differentiated and tailored according to user perception groups. Rather than treating the users as universally the same, it is important to identify user groups and develop support strategies that respond to their particular needs. For instance, mixed users may benefit most from targeted support on functionalities they perceive as constraining, while passive users could need mechanisms to stimulate reflective engagement. Re-black-boxing therefore becomes a process that can be actively supported through perception-informed interventions and can help these users navigate their re-black-boxing process in a helpful way.

Second, the role of informal learning and social interaction should not be underestimated. This study shows that moments where resistance turned into adaptation happened during peer support or informal sharing of tips or frustrations, highlighting bottom-up change initiatives. Organizations should actively support the creation of these initiatives, where users can openly share how they use or overcome system functionalities. Encouraging peer mentoring, reflective sessions, or open feedback platforms may help people transform their constraints into affordance while also identifying risks or possible flaws in the system.

Third, management should put more effort into translating the intended purpose of an additional SAP Module effectively. The study highlighted the reliance of users on peer knowledge, previous habits or surface-level understanding, sometimes leading to misaligned expectations or frustration among users. Management should actively communicate how the new module improves efficiency and individual workflows, instead of assuming this is self-

evident. This can help users who experience strong constraints, the negative and mixed users, reframe or re-translate functionalities as more affording, leading to a possible shift in perception and black-boxing trajectory.

Reflexivity

Because the research is interpretive, the researcher's position within this study must be recognized on how it may influence the study and its findings. As a student researcher who was only present for a small time frame in the organization, I had little prior contact with the company or its employees, only 2 employees knew who I was beforehand. Therefore, this offered both advantages and disadvantages. On the one hand, my external status made it more probable that respondents would respond truthfully, as I was not sent there by management, but only for my personal research objectives. Unfortunately, my short time in the field may have hindered the level of trust I was able to build with certain users, particularly those who were skeptical about the research or the SAP system in general as this is seen as something hard to talk about, due to the possibility of there being consequences when talking negative about ideas from management.

Throughout data collection, I maintained a consistent but adaptable research presence by attending scheduled team meetings, conducting interviews, and taking observational notes through shadowing activities. My prior academic experience with ERP literature and routine theories could have influenced my initial focus and thoughts on the data. However, I purposely tried to enter the field with an open, inductive mindset. For example, I did not seek out to establish four separate groups of users; rather, they formed organically when conducting and analyzing interviews and observations about this system use.

Finally, I acknowledge that my interpretation of users' perceptions and actions is shaped by my own lens as someone who does research on specific routine theories. Despite my best efforts to be aware of these biases, the perspectives of the participants and interpretation of the data has always affected this, since I actively participate in the dialogue and shape conversations around this topic, willingly and unwillingly. To reduce bias, I wrote reflection after each interview, observation, and internal document analysis.

Acknowledgements

First, I would like to thank my supervisor Stijn Bruls and second reader dr. Mirjam Goudsmit for their constructive feedback, guidance, and helpful insights throughout this thesis process. Their support helped me stay focused whilst remaining my enthusiasm for this thesis. I also want to thank all employees at NSP Animal Health who participated in this research, your openness made this thesis possible. I would like to thank Daan, my internship coordinator, for giving me a pleasant time during my internship and making me feel welcomed. Next, I would like to thank my thesis partner Luuk, who went through the same process and was a helpful sparring partner during the feedback sessions. Lastly, I would like to thank my girlfriend Guusje for her support even during the most intense weeks of writing.

References

- AlMuhayfith, S., & Shaiti, H. (2020). The Impact of Enterprise Resource Planning on Business Performance: With the Discussion on Its Relationship with Open Innovation. *Journal of Open Innovation Technology Market and Complexity*, 6(3), 87. <https://doi.org/10.3390/joitmc6030087>
- Boudreau, M., & Robey, D. (2005). Enacting Integrated Information Technology: a Human Agency perspective. *Organization Science*, 16(1), 3–18. <https://doi.org/10.1287/orsc.1040.0103>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Da Costa Júnior, J. C., Da Silva Nascimento, L., Da Silva, M. V. S., & De Barros Jerônimo, T. (2024). Routine dynamics and sociomateriality: insights into technological artifacts and their roles. *International Journal of Organizational Analysis*. <https://doi.org/10.1108/ijoa-09-2023-3970>
- D’Adderio, L. (2011). Artifacts at the centre of routines: Performing the material turn in routines theory. *Journal of Institutional Economics*, 7(2), 197–230. <https://doi.org/10.1017/S174413741000024X>
- Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly*, 48(1), 94–118. <https://doi.org/10.2307/3556620>
- Feldman, M. S., Pentland, B. T., D’Adderio, L., & Lazaric, N. (2016). Beyond routines as things: Introduction to the special issue on routine dynamics. *Organization Science*, 27(3), 505–513. <https://doi.org/10.1287/orsc.2016.1070>
- Gibson, James J. (2014) *The Ecological Approach to Visual Perception: Classic Edition*. 1st ed., Psychology Press, <https://doi.org/10.4324/9781315740218>.

- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
- Gupta, M., & Kohli, A. (2004). Enterprise resource planning systems and its implications for operations function. *Technovation*, 26(5–6), 687–696. <https://doi.org/10.1016/j.technovation.2004.10.005>
- Hutchby, I. (2001). Technologies, texts and affordances. *Sociology*, 35(2), 441–456. <https://doi.org/10.1017/s0038038501000219>
- Kindness, D. (2024, July 31). *Enterprise Resource Planning (ERP): Meaning, components, and examples*. Investopedia. <https://www.investopedia.com/terms/e/erp.asp>
- Konlechner, S. W., Müller, B., Güttel, W. H., Koprax, I., & Link, K. (2016). Sheep in Wolf's Clothing: The role of Artifacts in Interpretive Schema Change. *Schmalenbach Business Review*, 17(2), 129–150. <https://doi.org/10.1007/s41464-016-0012-9>
- Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2021). Digital transformation in business and management research: An overview of the current status quo. *International Journal of Information Management*, 63, 102466. <https://doi.org/10.1016/j.ijinfomgt.2021.102466>
- Langley, A., Smallman, C., Tsoukas, H., & Van De Ven, A. H. (2013). Process Studies of Change in Organization and Management: unveiling temporality, activity, and flow. *Academy of Management Journal*, 56(1), 1–13. <https://doi.org/10.5465/amj.2013.4001>
- Leonardi, P. M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *MIS Quarterly*, 35(1), 147–167. <https://doi.org/10.2307/23043493>
- Leonardi, P. (2023). Affordances and Agency: A clarification and integration of fractured concepts. *MIS Quarterly*, 47(4), ix–xx.

- March, J. G., & Simon, H. A. (1958). *Organizations*. John Wiley & Sons.
- Markus, M. L., & Silver, M. (2008). A foundation for the study of IT Effects: A new look at DeSanctis and Poole's concepts of structural features and spirit. *Journal of the Association for Information Systems*, 9(10), 609–632.
<https://doi.org/10.17705/1jais.00176>
- Marsh, E., Vallejos, E. P., & Spence, A. (2021). The digital workplace and its dark side: An integrative review. *Computers in Human Behavior*, 128, 107118.
<https://doi.org/10.1016/j.chb.2021.107118>
- Menon, S. A., Muchnick, M., Butler, C., & Pizur, T. (2019). Critical challenges in Enterprise Resource Planning (ERP) implementation. *International Journal of Business and Management*, 14(7), 54. <https://doi.org/10.5539/ijbm.v14n7p54>
- Myers, M. D. (2020). *Qualitative research in business and management* (3rd ed.). SAGE Publications. <https://us.sagepub.com/en-us/nam/qualitative-research-in-business-and-management/book248060>
- Nieto-Rodriguez, Antonio. 108# - Do all SAP implementation projects fail? Why? 2 Feb. 2024, <https://www.linkedin.com/pulse/108-do-all-sap-implementation-projects-fail-why-nieto-rodriguez-uvmf>.
- NWO. (2018.). *Netherlands Code of Conduct for Research Integrity*.
<https://www.nwo.nl/en/netherlands-code-conduct-research-integrity>
- Opdenakker, R. R. (2006). Advantages and disadvantages of four interview techniques in qualitative research. *Forum Qualitative Sozialforschung*, 7(4), 10.
<https://doi.org/10.17169/fqs-7.4.175>
- Orlikowski, W. J., & Gash, D. C. (1994). Technological frames. *ACM Transactions On Office Information Systems*, 12(2), 174–207. <https://doi.org/10.1145/196734.196745>

- Parmigiani, A., & Howard-Grenville, J. (2011). Routines revisited: exploring the capabilities and practice perspectives. *Academy of Management Annals*, 5(1), 413–453.
<https://doi.org/10.1080/19416520.2011.589143>
- Pentland, B. T. (1999). Building process theory with narrative: From description to explanation. *Academy of Management Review*, 24(4), 711–724.
<https://doi.org/10.5465/amr.1999.2553249>
- SAP (2025) *What is ERP? The Essential Guide* <https://www.sap.com/products/erp/what-is-erp.html>
- Schwartz-Shea, P., & Yanow, D. (2013). *Interpretive research design: Concepts and processes*. Routledge. <https://doi.org/10.4324/9780203854907>
- Symon, G., & Cassell, C. (2012). *Qualitative organizational research: Core methods and current challenges*. SAGE Publications. <https://doi.org/10.4135/9781526435595>
- Teittinen, H., Pellinen, J., & Järvenpää, M. (2012). ERP in action — Challenges and benefits for management control in SME context. *International Journal of Accounting Information Systems*, 14(4), 278–296. <https://doi.org/10.1016/j.accinf.2012.03.004>
- Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research: From grounded theory to abductive analysis. *Sociological Theory*, 30(3), 167–186.
<https://doi.org/10.1177/0735275112457914>
- Thornberg, R. (2012). Informed grounded theory. *Scandinavian Journal of Educational Research*, 56(3), 243–259. <https://doi.org/10.1080/00313831.2011.581686>
- Wagner, E. L., Scott, S. V., & Galliers, R. D. (2006). The creation of ‘best practice’ software: Myth, reality and ethics. *Information And Organization*, 16(3), 251–275.
<https://doi.org/10.1016/j.infoandorg.2006.04.001>
- Yin, R. K., & Campbell, D. T. (2018). *Case study research and applications : design and methods* (Sixth edition). SAGE Publications, Inc.

Zeebaree, S. R. M., Salim, B. W., Zebari, R. R., Shukur, H. M., Abdulraheem, A. S., Abdulla, A. I., & Mohammed, S. M. (2020). *Enterprise Resource Planning Systems and Challenges*. TURKU International Journal of Research in Engineering and Technology, 62(4), 1–10.

Appendix A: Interview Format

Introductie:

Dank u wel voor uw deelname en medewerking aan dit interview. Het volgende gesprek is over uw ervaring met SAP, in het specifiek de recent toegevoegde module SAP Scheduling, binnen uw werkveld. Ik ben benieuwd naar hoe u het systeem in de praktijk toepast, waar het uw werk mogelijk vereenvoudigt en waar het u mogelijk beperkt. Alles wat u vertelt blijft anoniem en wordt alleen gebruikt ter uitwerking van mijn scriptie en onderzoeksdoeleinden. Mag ik het gesprek opnemen? U kunt op elk moment stoppen of aangeven als u een vraag liever overslaat. Voordat we beginnen, mocht u nog verdere uitleg nodig hebben over mijn onderzoek wil ik dat u graag geven, zodat het doel van dit interview volledig duidelijk is voor u.

Vragenlijst – 9 Hoofdvragen met doorvragen met focus op de 5 kernconcepten en de 4 fases binnen black-boxing²

- 1. Kunt u mij eerst iets vertellen over uw rol binnen MSD en welke dagelijkse werkzaamheden daarbij komen kijken?**
 - a. Wat doet u zoal op een werkdag? En hoe komt SAP hierin terug?
- 2. Wat is uw algemene mening over het systeem SAP?**
 - a. Wat is naar uw kennis de rol van SAP binnen uw eigen werkzaamheden?
- 3. Wat is uw algemene mening over de specifieke meest recent geïntroduceerde SAP add-ons, SAP scheduling?**
 - a. Hoe vond u dat de communicatie en hoe het veranderingsproces verliep toen deze nieuwe modules werden geïntroduceerd?
 - b. Toen SAP Scheduling werd geïntroduceerd, had u het idee dat het systeem een bepaalde manier van werken van u verwachtte? (phase 1 - inscription)
 - i. *Zo ja, wat voor verwachtingen merkte u op in het systeem zelf, zoals verplichte stappen, vaste volgordes, of bepaalde formats?*

² The Initial question were written by me, afterwards the following ChatGPT prompt was used to delete any possible confusing terminology to make the interview questions as easy to comprehend as possible: "Hey chat, where do you so any possible confusing question, and how would you minimize confusion for the participants?". Afterwards I took this as inspiration and revised all the questions where needed with careful consideration. To see the ChatGPT awnser, see Appendix D.

4. **Kunt u een situatie noemen waarin SAP Scheduling u hielp om uw werk efficiënter te maken? Zo ja, kunt u deze situatie omschrijven? (Affordance) (phase 2 - selective configuration)**
 - a. Hoe is deze manier van werken voor u ontstaan, en is dit inmiddels uw vaste werkwijze geworden?
 - b. Hoe ziet u dat terug bij collega's?
5. **Heeft u ook weleens ervaren dat SAP Scheduling u tegenwerkt of belemmerde in uw werk? (Constraint) (phase 4 - Struggles)**
 - a. Zo ja, kunt u daarover vertellen wat er toen gebeurde?
 - b. Zijn er dan ook onderdelen van SAP die u bewust vermijdt? Zo ja, waarom?
 - c. Hoe heeft u dat toen opgelost?
 - d. Is deze oplossing gedeeld met collega's, en zo ja, hoe werd daarop gereageerd?
 - e. Is dat iets wat vaker voorkomt, bij u of bij collega's?
6. **Hoe zou u zeggen dat SAP Scheduling in een ideale situatie wordt uitgevoerd voor uw werkzaamheden? (Ostensive routine)**
 - a. Heeft u een idee van hoe de organisatie verwacht dat het systeem gebruikt wordt? (phase 1 - inscription)
 - b. Hoe vindt u dat deze ideale situatie aansluit op hoe er nu gewerkt wordt?
7. **En als we kijken naar de praktijk: hoe gebruikt u SAP Scheduling in de praktijk dan precies? (Performative routine)**
 - a. Zijn er dingen die u anders doet dan deze vooraf benoemde 'ideale situatie'? Zo ja, welke?
 - b. Heeft u hier een reden voor?
 - c. Heeft u deze manier van werken gedeeld met collega's, en zo ja, wat was hun reactie?
8. **Is uw werkwijze met SAP Scheduling anders sinds u ermee begonnen bent begint?**
 - a. Waar merkt u dat aan?
 - b. Waar komt die verandering vandaan, denkt u?
9. **Zijn er delen van SAP Scheduling die ondertussen zo vanzelfsprekend zijn geworden dat je er eigenlijk niet meer aan stilstaat? (Phase 3, Translation)**
 - a. Wat zijn wat voorbeelden van functies die 'gewoon' geworden zijn?
 - b. Tot op welke hoogte hebben 'eigen aanpassingen' dit gestimuleerd?

- c. Waren deze vanaf het begin al zo, of zijn er nog andere vormen van werken geweest die weer aangepast zijn naar aanleidingen van (externe) factoren?
- d. Tot op welke hoogte bent u zich hier wel nog bewust van?

Afsluiting:

Is er nog iets dat u verder kwijt wilt over het werken met SAP Scheduling dat we nog niet besproken hebben?

Heel erg dank voor uw tijd en deelname aan dit interview. Als wilt kan ik nadien het transcript naar u sturen zodat u kunt controleren of alles juist is.

Appendix B: Observation Format

Algemene gegevens:

- Datum & tijd:
- Locatie (kantoor of productie):
- Functie geobserveerde medewerker:
- Geobserveerde activiteit / proces:

Observatiepunten (gericht op sensitizing concepts):

1. Ostensive routine (Wat is zichtbaar als 'de bedoeling' van de taak?)

- Welke stappen lijken meer voort te komen uit voorgeschreven procedures en liggen op een lijn met de documenten die ik in heb gezien?

2. Performative routine (Hoe wordt de taak daadwerkelijk uitgevoerd?)

- Zie ik verschillen met de documenten die ik in heb gelezen en hoe uit zich dit? Kan ik ook zien waarom?

3. Perceived affordances (Wat lijkt het systeem mogelijk te maken?)

- Waar kan ik zien dat iemand echt profijt heeft van SAP en het zijn/haar werk positief beïnvloedt?

4. Perceived constraints (Waar lijkt SAP Scheduling de medewerker te belemmeren?)

- Waar zie ik dat de medewerker niet tevreden is met SAP, of hoe belemmert de technologie zijn/haar werk? En hoe reageert deze persoon hier op?

5. Black-boxing (Welke SAP-functionaliteiten worden zonder na te denken gebruikt?)

- Kan ik zien dat iemand de technologie zo onbewust gebruikt dat het ingesleten lijkt?

Vrije notities / opvallende situaties:

- wat is de context, zie personen of materialen
- wat is het gevoel van de medewerker, en non verbale uitingen

Opmerking: Tot slot wordt er na elke observatie korte reflectie geschreven over mogelijke aannames en biases van mijzelf, ter bevordering van credibility en confirmability.

Appendix C: Codebook

Open Code	Selective Code	Theoretical Code	
Active stance towards the new technology	Very Positive user	Imbrication (User categories)	
Trust in SAP			
Eager to learn			
Affinity with SAP			
Lack of motivation			Very Negative User
More trust in Excel			
Overwhelmed by SAP			
Give backlash on SAP			
No clear opinion			Passive User
Not feel the need to learn the system			
Passive stance towards the change, no involvement			
Seeing clear pros and cons, and combining both within their perception	Mixed Perception user		
Not having a clear preference, only a slight preference			
People acknowledge the value of SAP	Recognition of cognitive artifacts	Black Boxing	
People acknowledge its presense	Inscription		
SAP's inflexibility	Translating routines 3 categories (first time) default path		
SAP has certain functions given to the team that are just there			
No critical reflection	struggling		
No feedback or questions asked			
Just use the standard procedure			
Asking for help as a coping mechanism, to not adapt themselves			
Postponing what needs to be done	adapting		
Backlashing SAP as a system			
People feel insecure in their own capabilities			
People try to find solutions for their own problems			
Accepting to invest time in learning			
Actively trying to learn the syst			
Help others when they are struggling			co-evolution through performative struggles
People discuss with colleagues to come to a solution together			
Feedback on errors and learning from this			
Changing behavior due to errors			
Influence of managers on what needs to be done	3 Black boxing outcomes		
Learning from internal documents			
Learning from other colleguas who found a solut			
Using Quick Reference Cards	Partial Black-Boxing		
People can sometimes do it by heart, but still regularly need to look at instructions			
People can do it without needing to think about it			
People can never work without work-instruction			
Comparing to the previous methods	Re-translating routines		Re-Black-Boxing (new additional codes due to re-blackboxing)
Re-interpretation of the work / reconfiguring routines	Adopting		
Doing double the amount of work, due to shadow systems			
Accepting to unlearn the previous and learn the new	Struggling		
Having trouble letting go/unlearning previous routine (routine inertia)			
Old and New routines conflict, resulting in discussions on the workflow	new co-evolution through performative struggles		
Learning from colleagues with more expertise			
	Outcomes		
Prevent the system due to lack of trust in the new	No black-boxing		
Do not know why, but it just happens automatically	Full Black-boxing		
some aspects are black-boxed, but the previous routine is still used as a check	Partial black-boxing		
Trying to learn functionalities that were previously avoided	Feedback Loops		
After training/learning re-evaluating the technology			

Appendix D: ChatGPT prompts

Footnote 1; My Prompt:

“Hey chat, where do you see any possible confusing sentences, and how would you minimize confusion for the reader?”: While the D’Adderio’s model (2011) provides a valuable processual view of black-boxing due to its four phases model towards this outcome, it leaves several key questions underexplored. First, it treats the path toward black-boxing as a result of interaction with the artifact itself, without taking variation across users into account. D’Adderio’s model shows how black-boxing occurs, but not why it fails for some users and not for others, even when technological inscriptions are the same for all users. Second, it is unclear how stabilization unfolds when users experience the same system as simultaneously affording and constraining. The model demonstrates a straightforward path towards black-boxing, but does not fully explain cases where routines remain un-black-boxed, or where black-boxes reopen. Lastly, the model mainly focuses on situations where routines are formed from scratch, resulting in a lack of understanding the process of when technologies are layered upon already black-boxed routines, requiring reopening and adjusting these already black-boxed routines.

Imbrication theory (Leonardi, 2011) offers a way to address these blind spots. Rather than focusing on the artifact’s stabilization, imbrication highlights the ongoing interaction and negotiation between human and material agency in shaping routines. From this perspective, stabilization is not a final phase but a historically layered process, in which new imbrications are always influenced by prior ones. Crucially, this theory brings perception to the center: how users experience a system’s affordances and constraints actively shapes whether and how they adapt their routines. This lens is particularly relevant when researching situations where users must adjust already existing routines to new technologies. In these situations the new routine is not built from scratch, but requires updating the previous routine and modifying previous imbrications. The recursive nature of this process can explain the differences in black-boxing trajectories, due to the assumption that imbrication is a layered process that differs for each user depending on perception and prior inscriptions.

Taken these two theories together they offer a complementary lens to look at the data. While black-boxing explains how technologies become embedded within routines, imbrication theory explains why stabilization may differ across users, even when material properties are the same for all users.

Answer:

Your paragraph is already very strong conceptually, but there are a few spots where the sentence structure, word choice, or logic flow could be clearer or smoother. Below is a detailed breakdown of **confusing or potentially unclear sentences, why they might confuse**, and **suggested rewrites** to minimize confusion while keeping your academic tone and argument intact.

1.

Original:

“While the D’Adderio’s model (2011) provides a valuable processual view of black-boxing due to its four phases model towards this outcome, it leaves several key questions underexplored.”

Why it’s confusing:

- “*the D’Adderio’s model*” is grammatically incorrect. You should use either *D’Adderio’s model* or *the model by D’Adderio*.
- “*four phases model towards this outcome*” is clunky and awkward. It’s a “four-phase model,” and “towards this outcome” is vague.
- “*due to its...towards this outcome*” feels like it’s explaining the wrong thing. You probably mean: *the model is processual because it has four phases*.

Suggested rewrite:

“D’Adderio’s (2011) model offers a valuable processual account of black-boxing by outlining four distinct phases, but it leaves several key questions underexplored.”

2.

Original:

“First, it treats the path toward black-boxing as a result of interaction with the artifact itself, without taking variation across users into account.”

Why it’s confusing:

- The phrase “*treats the path toward black-boxing as a result of interaction with the artifact itself*” is vague—“interaction with the artifact” could be more specific.

Suggested rewrite:

“First, it conceptualizes black-boxing primarily as the outcome of user interaction with the artifact, without accounting for variation in how different users experience or engage with the system.”

3.

Original:

“Second, it is unclear how stabilization unfolds when users experience the same system as simultaneously affording and constraining.”

Why it's confusing:

- The word “unclear” could imply a gap in knowledge generally, but you’re critiquing the model.
- “*as simultaneously affording and constraining*” is precise but could use a clarifier for readers less familiar with affordance theory.

Suggested rewrite:

“Second, the model does not address how stabilization unfolds when users perceive the same technology as both enabling and limiting their actions.”

4.

Original:

“The model demonstrates a straightforward path towards black-boxing, but does not fully explain cases where routines remain un-black-boxed, or where black-boxes reopen.”

Why it's confusing:

- The phrase “*routines remain un-black-boxed*” is jargony. “Reopen” is also metaphorical and could use explanation.

Suggested rewrite:

“Although it outlines a linear trajectory toward black-boxing, the model does not fully account for cases where routines fail to stabilize or where stabilized routines later become destabilized.”

5.

Original:

“Lastly, the model mainly focuses on situations where routines are formed from scratch, resulting in a lack of understanding the process of when technologies are layered upon already black-boxed routines, requiring reopening and adjusting these already black-boxed routines.”

Why it's confusing:

- Long, meandering sentence.
- Repeats “already black-boxed routines” twice in close proximity.
- “*Resulting in a lack of understanding the process of when...*” is grammatically off — it should be “resulting in a lack of understanding **of** the process **by which...**”

Suggested rewrite:

“Lastly, the model primarily addresses routines developed from scratch, overlooking scenarios where new technologies are layered onto already stabilized routines. In such cases, previously black-boxed elements must be reopened and adjusted, a process the model does not fully explain.”

6.

Original:

“Rather than focusing on the artifact’s stabilization, imbrication highlights the ongoing interaction and negotiation between human and material agency in shaping routines.”

Why it’s confusing:

- “*Artifact’s stabilization*” is a bit abstract. You might mean *routine stabilization through artifact use*.
- “*Interaction and negotiation between human and material agency*” is correct but dense.

Suggested rewrite

“Instead of centering on the stabilization of the artifact itself, imbrication theory emphasizes the continuous interplay between human intentions and material agency in shaping routines.”

7.

Original:

“In these situations the new routine is not built from scratch, but requires updating the previous routine and modifying previous imbrications.”

Why it’s confusing:

- “*Previous routine*” and “*previous imbrications*” are close in meaning but clunky when used back-to-back.

Suggested rewrite:

“In such contexts, routines are not created anew but evolve through the modification of earlier imbrications and the adaptation of existing practices.”

Let me know if you want the same polishing for other sections!

Footnote 2; My Prompt:

“Hey chat, where do you see any possible confusing sentences, and how would you minimize confusion for the reader?”: Appendix A: Interview Format. Dank u wel voor uw deelname en medewerking aan dit interview. Het volgende gesprek is over uw ervaring met SAP, in het specifiek de recent toegevoegde module SAP Scheduling, binnen uw werkveld. Ik ben benieuwd naar hoe u het systeem in de praktijk toepast, waar het uw werk mogelijk vereenvoudigt en waar het u mogelijk beperkt. Alles wat u vertelt blijft anoniem en wordt alleen gebruikt ter uitwerking van mijn scriptie en onderzoeksdoeleinden. Mag ik het gesprek opnemen? U kunt op elk moment stoppen of aangeven als u een vraag liever overslaat. Voordat we beginnen, mocht u nog verdere uitleg nodig hebben over mijn onderzoek wil ik dat u graag geven, zodat het doel van dit interview volledig duidelijk is voor u.

Vragenlijst – 9 Hoofdvragen met doorvragen met focus op de 5 kernconcepten en de 4 fases binnen black-boxing

1. Kunt u mij eerst iets vertellen over uw rol binnen MSD en welke dagelijkse werkzaamheden daarbij komen kijken?
 - a. Wat doet u zoal op een werkdag? En hoe komt SAP hierin terug?
2. Wat is uw algemene mening over het systeem SAP?
 - a. Wat is naar uw kennis de rol van SAP binnen uw eigen werkzaamheden?
3. Wat is uw algemene mening over de specifieke meest recent geïntroduceerde SAP add-ons, SAP scheduling?
 - a. Hoe vond u dat de communicatie en hoe het veranderingsproces verliep toen deze nieuwe modules werden geïntroduceerd?
 - b. Toen SAP Scheduling werd geïntroduceerd, had u het idee dat het systeem een bepaalde manier van werken van u verwachtte? (phase 1 - inscription)
 - i. Zo ja, wat voor verwachtingen merkte u op in het systeem zelf, zoals verplichte stappen, vaste volgordes, of bepaalde formats?
4. Kunt u een situatie noemen waarin SAP Scheduling u hielp om uw werk efficiënter te maken? Zo ja, kunt u deze situatie omschrijven? (Affordance) (phase 2 - selective configuration)
 - a. Hoe is deze manier van werken voor u ontstaan, en is dit inmiddels uw vaste werkwijze geworden?
 - b. Hoe ziet u dat terug bij collega's?
5. Heeft u ook weleens ervaren dat SAP Scheduling u tegenwerkt of belemmerde in uw werk? (Constraint) (phase 4 - Struggles)
 - a. Zo ja, kunt u daarover vertellen wat er toen gebeurde?
 - b. Zijn er dan ook onderdelen van SAP die u bewust vermijdt? Zo ja, waarom?
 - c. Hoe heeft u dat toen opgelost?
 - d. Is deze oplossing gedeeld met collega's, en zo ja, hoe werd daarop gereageerd?
 - e. Is dat iets wat vaker voorkomt, bij u of bij collega's?
6. Hoe zou u zeggen dat SAP Scheduling in een ideale situatie wordt uitgevoerd voor uw werkzaamheden? (Ostensive routine)
 - a. Heeft u een idee van hoe de organisatie verwacht dat het systeem gebruikt wordt? (phase 1 - inscription)
 - b. Hoe vindt u dat deze ideale situatie aansluit op hoe er nu gewerkt wordt?
7. En als we kijken naar de praktijk: hoe gebruikt u SAP Scheduling in de praktijk dan precies? (Performative routine)

- a. Zijn er dingen die u anders doet dan deze vooraf benoemde ‘ideale situatie’? Zo ja, welke?
 - b. Heeft u hier een reden voor?
 - c. Heeft u deze manier van werken gedeeld met collega’s, en zo ja, wat was hun reactie?
8. 8. Is uw werkwijze met SAP Scheduling anders sinds u ermee begonnen bent begin maart?
- a. Waar merkt u dat aan?
 - b. Waar komt die verandering vandaan, denkt u?
9. Zijn er delen van SAP Scheduling die ondertussen zo vanzelfsprekend zijn geworden dat je er eigenlijk niet meer aan stilstaat? (Phase 3, Translation)
10. Wat zijn wat voorbeelden van functies die ‘gewoon’ geworden zijn?
11. Tot op welke hoogte hebben ‘eigen aanpassingen’ dit gestimuleerd?
12. Waren deze vanaf het begin al zo, of zijn er nog andere vormen van werken geweest die weer aangepast zijn naar aanleidingen van (externe) factoren?
13. Tot op welke hoogte bent u zich hier wel nog bewust van?

Answer:

Je interviewformat is inhoudelijk sterk, logisch opgebouwd en goed afgestemd op je theoretisch kader (black-boxing & affordance/constraint). Toch zijn er enkele zinnen die verwarrend of omslachtig kunnen overkomen voor respondenten, vooral als ze in een gespreksituatie snel begrepen moeten worden. Hieronder geef ik een lijst van **mogelijk verwarrende zinnen, waarom ze verwarring kunnen oproepen, en heldere, toegankelijke alternatieven.**

Vraag 3a – Origineel:

“Hoe vond u dat de communicatie en hoe het veranderingsproces verliep toen deze nieuwe modules werden geïntroduceerd?”

Waarom verwarrend:

- Ingewikkelde zinsstructuur.
- Dubbele vraagconstructie (“hoe vond u dat... en hoe...”).

Alternatief:

“Hoe heeft u de communicatie en het veranderingsproces ervaren toen SAP Scheduling werd geïntroduceerd?”

Vraag 3b – Origineel:

“Toen SAP Scheduling werd geïntroduceerd, had u het idee dat het systeem een bepaalde manier van werken van u verwachtte?”

Waarom verwarrend:

- “verwachtte” is abstract en passief

Alternatief:

“Had u het gevoel dat SAP Scheduling bepaalde werkwijzen van u vereiste toen het werd ingevoerd?”

Vraag 4a – Origineel:

“Hoe is deze manier van werken voor u ontstaan, en is dit inmiddels uw vaste werkwijze geworden?”

Waarom verwarrend:

- “voor u ontstaan” is vaag.

Alternatief:

“Hoe bent u tot deze manier van werken gekomen? Gebruikt u deze aanpak nu standaard?”

Vraag 5e – Origineel:

“Is dat iets wat vaker voorkomt, bij u of bij collega’s?”

Waarom verwarrend:

- “dat” is onduidelijk (moeilijk te herleiden naar een specifieke actie).

Alternatief:

“Gebruikt u of uw collega’s deze oplossing vaker wanneer SAP u belemmert?”

Vraag 6 – Origineel:

“Hoe zou u zeggen dat SAP Scheduling in een ideale situatie wordt uitgevoerd voor uw werkzaamheden?”

Waarom verwarrend:

- Erg formeel.
- “uitgevoerd voor uw werkzaamheden” klinkt bureaucratisch

Alternatief:

“Hoe zou SAP Scheduling er idealiter uitzien in uw werk, als alles perfect zou werken?”

Vraag 7a – Origineel:

“Zijn er dingen die u anders doet dan deze vooraf benoemde ‘ideale situatie’? Zo ja, welke?”

Waarom verwarrend:

- “vooraf benoemde” klinkt formeel.
- “ideale situatie” is abstract als dat net is besproken in vorige vraag.

Alternatief

“Doet u in de praktijk bepaalde dingen anders dan in die ideale werkwijze? Zo ja, welke?”

Vraag 9d – Origineel:

“Tot op welke hoogte bent u zich hier wel nog bewust van?”

Waarom verwarrend:

- Dubbele modale constructie (“wel nog bewust van”) is wollig.

Alternatief:

“Bent u zich hier nog bewust van, of gaat het inmiddels vanzelf?”

Algemeen tip:

- Vermijd formeel ambtelijk taalgebruik (“uitgevoerd”, “bent u zich bewust van”) en kies voor spreektaalformuleringen die natuurlijker klinken in een interview.
 - Houd zinnen kort en actief. Spreek in “u”-vorm, maar wel menselijk.
-

Wil je dat ik dit hele interviewformat omzet naar een volledig gebruiksklaar, spreektaal-geoptimaliseerd format in één keer, inclusief titels en toelichtingen?