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IF ALL YOU HAVE IS A HAMMER, EVERYTHING LOOKS LIKE A NAIL
A CASE STUDY ABOUT TINKERING WITH MIRO

Master's thesis

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Abstract

This thesis investigates how a project team used the digital collaboration tool Miro to enable the development of a Historical Fencing coursebook. The research addresses the underexplored intersection of tinkering with Miro in the broader context of the global shift towards remote work and digital collaboration. It aims to describe how aspects of tinkering manifested in the team's concretisation of the tool. It uses a qualitative, descriptive, instrumental case study design, providing a holistic analysis of three examples through five thematic lenses derived from literature. The results show a rich pool of tinkering examples and aspects of how the project team used Miro to manage their coworking process, project time plan, and results. It contributes to the body of empirical research on tinkering with Miro and highlights how tinkering processes can support digital collaboration efforts in remote work contexts.

Keywords: Educational Technology, Adapting Miro, Tinkering, Tools, Historical Fencing, Empowerment, Remote Work, Innovation, Case Study, Hybrid Work,

Table of Contents

Introduction

The global rise of remote work (Özgüzel *et al.*, 2023) initiated a paradigm shift in how we collaborate digitally. This profoundly impacts teaching and learning (Ibrahim *et al.*, 2023) and how we collaborate (Ghar, 2024), turning the option to collaborate remotely into the new norm (Hatzius *et al.*, 2023).

The advantages of this emancipation from local dependence are evident. Companies can access a global rather than a limited local talent pool, which can increase innovation, productivity, and equity (Kho *et al.*, 2024), and it offers opportunities for innovation and empowerment in education (Diaconescu, 2024).

However, the trend is reversing. Schools have returned to business as usual, and companies have started mandating people back into the office (Flex Index, 2024), which potentially threatens productivity, innovation and competitiveness (Van Dijcke *et al.*, 2024). The motives of decision makers range from being debatable – failing to control output thus wanting to control input instead (Chamorro-Premuzic, 2025), to outright disingenuous – "blaming employees as scapegoats for bad firm performance" (Ma & Yuye, 2023, p. 17), while they struggle with employees resisting coming back into the office (Bloom, 2022).

Yet, this does not seem to be a matter of ill intent but rather reflects a lack of capacity. The wellbeing of middle managers decreased while their perceived stress increased in remote work contexts (Sandoval-Reyes *et al.*, 2023) and implementing solutions is challenging for management (Kumar Singh, 2024), indicating that decision makers might simply not be equipped to meet the demands of this shift. Digital collaboration is not a plug-and-play process. Traditional face-to-face approaches are no longer sufficient, and a successful transfer into digital collaboration is influenced by a wide range of factors (Haryadi *et al.*, 2025).

Emergent research "explores the transformative impact of digital technology on collaborative practices" (Rachmad, 2022, p. 11), but until systemic solutions catch up, the gap is bridged by nifty tinkerers, who develop and adapt methods and systems for remote collaboration, whether on a technical level (Druta et al., 2021) or managerial level (Carter, 2023).

The community of the Austrian Association for Historical Fencing – Österreichischer Fachverband für Historisches Fechten [ÖFHF] – is a prime example of one such group of tinkerers, who embraced the shift towards digital collaboration. They developed a train-the-trainer coursebook for Historical Fencing (ÖFHF, 2025), which was achieved entirely through

remote collaboration, enabling them to pool and leverage the scarce, scattered skillset required for this niche project effectively and efficiently.

Instead of relying on traditional project management systems they opted for Miro – a digital whiteboard platform – as their single central collaboration and coordination tool (Miro, n.d.-a). It turned Miro into their proverbial *hammer*, the multitude of the complex project's demands and needs into *nails*, and the team into tinkerers, adapting, experimenting, and improvising to make the tool fit their unique context.

This thesis explores the project team's tinkering process with Miro, how it manifested, and what aspects of tinkering characterized their concretisation of the tool (Bardone *et al.*, 2023), for solving their digital collaboration needs.

Chapter 1 will establish the theoretical framework of the study, discussing key aspects which characterize tinkering, demarcating it from related concepts (Chapter 1.1), the tool that is being tinkering with, Miro (Chapter 1.2), and the research problem, aim, and question of this thesis are presented (Chapter 1.3).

Chapter 2 describes the methodology of the study. It explains its context and the underlying project in which Miro was used and justifies its educational purpose and the relevance to Educational Technology (Chapter 2.1). Further, the parameters and bounds of the case study (Chapter 2.2), the sample, its size, choice, and sampling strategy are justified (Chapter 2.3). Data collection and handling procedures, the used instruments and principles behind their choice, the employed validation strategies and reliability procedures (Chapter 2.4) and the principles and activities related to data processing and analysis are explained, highlighting how the replicability and quality of the study was ensured (Chapter 2.5).

Chapter 3 presents the results of the study, exploring three examples of tinkering with Miro in depth through five thematic lenses (Chapter 3.1–3.3).

Chapter 4 discusses the results in detail, provides the answer to the research question, and critically assesses the validity and conclusions, as well as its strengths, limitations and recommendations for future research (Chapter 4.1).

1. Theoretical Overview

Due to its multifaceted and ambiguous nature defining tinkering is no trivial task. It presents significant conceptual overlap with related concepts like engineering (Levi-Strauss, 1962), designing (Bardone, 2011, 2017, 2018), making (Vossoughi & Bevan, 2014) or learning (Willett, 2018). Yet, clarifying the concept is crucial for the purpose of this study, examining a project team's tinkering behaviour with Miro.

1.1. Aspects of tinkering

Dictionaries offer an initial perspective to approach a cursory demarcation. They tend to refer to a person fixing, repairing or mending things, in a skilled or unskilled manner, or describe a sometimes playful, creative or experimental creation process, inherently implying an agent, the tinkerer, engaging in the associated process or activity – tinkering – lacking the aspect of a tinkerer being an object or a thing (Cambridge University Press & Assessment, 2025; Merriam-Webster, 2025; Oxford University Press, 2025; Vocabulary.com, 2025).

However, this view remains limited. Academic literature offers further perspectives discussing the concept in a multitude of contexts, offering a more nuanced understanding and importantly ridding itself of the historically derogatory connotation. It presents a rich catalogue of qualities or aspects that are associated with tinkering, which help distinguish it from adjacent concepts. The subsequent chapters will examine these aspects in detail. They are neither intended as clear cut, rigid categories nor as an exhaustive definition of tinkering, but rather as a heuristic device to break down tinkering's complexity into workable parts and help navigate its ambiguity. Overlap between these chapters remains, reflecting the multifaceted nature of tinkering.

1.1.1. Emergence of Goals

Bardone *et al*. (2023) distinguish tinkering from engineering and designing, pointing out that "tinkering is adaptive and, unlike planning or designing, is open-ended or, to put it another way, goals cannot be fully specified beforehand" (2023, p.4).

They boil down Jacob (1977) and Turner (2007), who argue from the perspective of evolutionary biology. At their core argument, there is no entity designing or engineering evolution, it much rather "works like a tinkerer, who uses everything at his disposal to produce some kind of workable object" (Jacob, 1977, p. 1163). In their view, adaptation is not a product of a grand plan or design, but a "function of chance environmental circumstances"

(Jacob, 1977, p. 1163). Turner (2007) contrasts this to the arguments of intelligent design, but the theological discussion put aside, a worthwhile distinction of designing and engineering from tinkering remains. In tinkering, "the targets of our actions - what we are aiming at - are not fixed but moving as they are defined and redefined as one goes, not before" (Bardone *et al.*, 2023, p. 4).

One could therefore describe tinkering in terms of a function of the emergence of goals, rather exhibiting an adaptive, open-ended approach as opposed to not deviating from pursuing a fixed vision or plan.

1.1.2. Improvised Plans

Designing or engineering typically are associated with a more structured approach to problem solving than tinkering. Levi-Strauss (1962) differentiates the engineer from the tinkerer, or what he called the *bricoleur*. Where the engineer's work requires planning of resources and acquiring necessary means for a project first, the tinkerer can "make do with whatever is at hand" (Levi Strauss, 1962, p. 11). Their toolkit is limited, whereas the potential use of a specific tool is not. The engineer endeavours to find the right tools for the right job beforehand, the tinkerer will engage that job with the tools at hand and find – possibly inventive or new – ways to use these tools. Turner (2007) built on Levi-Strauss' perspectives and defined tinkering as "cobbling together slapdash solutions to adaptive problems as they arise, (…) with no foresight, planning, or attention to goals" (2007, p. 6).

In a nutshell, where design is characterized by an "anticipatory work characteristic (…) when we look ahead and plan consequently" (Bardone *et al.*, 2023, p. 4), and engineering starts with deliberate planning, "tinkering lacks foresight and deliberate planning" (2023, p. 4), and instead is responsive (2023, p. 4).

One could therefore describe tinkering in terms of a function of improvisation, characterizing tinkering as rather responsive, lacking foresight and deliberation, as opposed to following predetermined or planned actions and resources.

1.1.3. Creative Engagement

Tinkering is often connected to improvisation, problem-solving, and working within limitations. The tinkerer is bound in their choices by the available tools, "using whatever materials happen to be at hand" (Turner, 2007, p. 6) where "decisions are made in relation to the resources available at the specific moment" (Bardone *et al*., 2023, p. 4). Rather than framing these constraints as barriers, they entail the potential for the creative streak of

tinkering, also outlined by the dictionary definitions in (Chapter 1.1). The tinkerer might respond to these constraints with inspiration to think outside the box, generating makeshift solutions by creatively appropriating a tool.

Salovaara (2009) defines this as “repurposing a tool for a purpose other than the one designer’s intended” (2009, p. 3141), which reflects how “technologies are adopted, adapted and incorporated into working practice” (Dourish, 2003, p. 2) in the context of customisation in human-computer interaction.

There tools are considered polysemous, i.e. open to multiple interpretations and uses. “Tinkering describes what users do in response to the polysemous nature of tools” (Krippendorf, 2009, as cited in Bardone *et al.*, 2023, p. 4). This openness is what enables creative re-use. As Bardone and Shmorgun (2013) point out, creative re-use of tools is context dependent. It does not stem from the tool alone, but from how it interacts with the context and the user’s goals in a specific situation (2013, p. 125).

In a way, bringing a tool’s purpose to fruition is informed by the user’s creative capital and their ability to explore latent functionalities of tools (Bardone *et al.*, 2023, p. 11). This aligns with Vossoughi and Bevan’s (2014) understanding of tinkering in the context of making and learning, where it is “characterized by improvisation or creative problem solving” (2014, p. 9).

One could therefore describe tinkering in terms of a function of creativity, where repurposing and embracing the polysemous nature of tools are opposed to conventional or intended applications.

1.1.4. Iterative Conduct

Tying together the emergence of goals discussed in (Chapter 1.1.1), the responsive nature and lack of foresight discussed in (Chapter 1.1.2), and the context-dependent re-use of tools (Chapter 1.1.3), tinkering can exhibit experimental or explorative aspects, akin to “trial-and-error, where failures inform a new course of action” (Bardone *et al.*, 2023, p. 4). In this framing, mistakes are not a sign of misalignment with a plan or failure to achieve a goal, but moments of insight. It is a chance for the tinkerer to reshape their understanding of a problem and iteratively tweak their actions in response to an evolving situation. In this sense, tinkering could be described as what Schön (1992) calls “a reflective conversation with the situation” (1992, p. 4).

Tinkering is “related to experimenting and having a playful mindset in the process of creating” (Willett, 2018, as cited in Bardone *et al.*, 2023, p. 5). Vossoughi and Bevan (2014)

discuss this mindset in the context of learning and making, describing tinkering as playful and exploratory, emphasising "direct experience, experimentation, and discovery" (Martinez & Stager, 2013, as cited in Vossoughi and Bevan, 2014, p. 8). Yet they stress that tinkering is "a kind of making activity, not just a mindset" (Petrich *et al.*, 2013; Resnick & Rosenbaum, 2013, as cited in Vossoughi and Bevan 2014, p. 9). Tinkering invites revisiting, refining, and reworking, which, when taken up, can turn into an inherently iterative process that thrives on a mindset open to failure, ambiguity, and discovery.

One could therefore describe tinkering in terms of a function of its iterative nature, where a process open to adaptation through experimentation and trial-and-error stands opposed to routine assembly, and lack of a learning curve or feedback loops.

1.1.5. Serendipitous Adaptation

Tinkering does not necessarily involve creativity, repurposing (Chapter 1.1.3) or iteration (Chapter 1.1.4). Sometimes, solutions emerge by chance, or coincidence – not through deliberation, tying back to (Chapter 1.1.1). These outcomes may appear during creative or iterative processes, but they can also arise independently of them.

Here, the tinkerer does not direct the outcome – it emerges, suggesting a lack of agency by the tinkerer. This aligns with Jacob's (1977) and Turner's (2007) views outlined in (Chapter 1.1.2): adaptation is not planned – it is the result of chance. This element of uncertainty is central to tinkering. It is not only tolerated, but embraced, as Bardone *et al.* (2023) put it, "tinkering is a way to work with contingency and make decisions under conditions of uncertainty" (2023, p. 4).

By indicating that tinkering may be either skilled or unskilled, the dictionary definitions (Chapter 1.1) highlight another interesting nuance: a solution might result regardless of skill, simply from interacting with the situation until something happens to work. For the tinkerer, it is acceptable not to know beforehand and cede success to serendipity. In this way, tinkering not only allows for chance – "(it) is relying on chance events, amplifying their potential positive significance" (Bardone *et al*., 2023, p. 4)

One could therefore describe tinkering in terms of a function of serendipity, where embracing chance and contingency stands in contrast to actively steering the process and avoiding unpredictability.

1.2. The tool that is being tinkered with: Miro

Standalone, tinkering is meaningless. It inherently involves interacting with *something* – like a resource, material, or tool – strictly speaking even a thought, to be explored, adapted or used in some manner to solve a problem. The tool used in this case was Miro – the proverbial *hammer* introduced in the thesis title, which was concretised by the project team in their specific context.

The company RealtimeBoard Inc. dba Miro offers an online tool – Miro (Miro, n.d.-a) – either in the form of a native application for various mobile terminals or as a web application. It describes their tool as follows: "The visual workspace for innovation. Miro provides a visual workspace for innovation that enables distributed teams of any size to dream, design, and build the future together" (Miro, n.d.-a).

Chat GPT describes Miro as "an online collaborative whiteboard platform that enables teams to brainstorm, plan, and work together in real time using visual tools like sticky notes, diagrams, and templates" (OpenAI, 2025).

The company started out in 2011 servicing more than 90 million users in 250,000 organizations in 2025 (Miro, n.d.-a), including a substantial and growing library of solutions and resources on how Miro could be used, such as their very own Miro Academy (Miro, n.d.-b) and Help Center (Miro, n.d.-d). Basjuka and Bertzen (2022) feature a typical use-case of the tool as brainstorming aid in the ideation phase of a project.

Miro offers a high degree of freedom on how to concretise their online canvas. Much like what von Hippel and Katz (2002) describe as toolkits approach in product development, instead of developing solutions for the user's needs themselves, Miro shifts the burden of finding and fulfilling needs onto the user. The design of the tool expressly invites users to concretise the available toolkit; the practically infinite space of the canvas, forms and shapes, a substantial library of elements like emojis or flowchart graphics, Post-its and textboxes, or the ability to import and export various types of data and media – for their specific context in an innovative and personalized way. Miro's design is inherently polysemous and invites a tinkering approach and digital collaboration.

1.3. Research Question

Tinkering has been explored conceptually across multidisciplinary contexts (Chapter 1). Contributions include the work of Bardone (2011, 2017, 2018), Bardone *et al.*, (2023),

Bardone and Shmorgun (2013), Jacob (1977), Krippendorff (2009), Levi-Strauss (1962), Mol (2008), Salovaara (2009), and Turner (2007).

Furthermore, Miro has become a widely used platform for digital collaboration (Miro, n.d.-a) gaining in significance in the context of the paradigm shift towards remote work opportunities (Ghar, 2024). Its role has been studied primarily in the context of online teaching and learning, e.g. as examined by Khair Allah (2023) and Bremner (2021).

However, empirical research that connects tinkering and Miro remains scarce. Only one empirical study explicitly exploring tinkering with Miro has been identified during this research – Bardone *et al*. (2023), presenting a significant gap in the body of research. This thesis fills this gap, by presenting an empirical case study of a geographically dispersed project team leveraging Miro as their primary tool to enable the online co-creation of a Historical Fencing train-the-trainer coursebook (ÖFHF, 2025), a striking example of applied Educational Technology.

The aim of this study is to explore the project team's interactions with Miro through the lens of tinkering. It intends to add to the body of empirical research offering insight into how Miro's functionality was progressively integrated for a specific, concrete use – what Simondon (2017) and Bardone *et al.* (2023) described as concretisation. Furthermore, understanding this tinkering process offers insights for any team navigating the complexities of digital collaboration (Haryadi *et al.*, 2025). It describes examples of tinkering with Miro in the context of an educational project and explores which aspects of tinkering characterized the team's concretisation of the tool. This is achieved by applying a set of themes, analytically derived from the literature as interpretative lenses.

The guiding research question is: How did the project team's tinkering with Miro manifest, and what aspects of tinkering characterized their concretisation of the tool? The study thus contributes to the broader understanding of how distributed teams can successfully adapt and thrive in digital collaboration environments.

2. Method

2.1. Context of the underlying project

The ÖFHF is the focal point of the Austrian Historical Fencing community (ÖFHF, n.d.-b). As part of their services, they develop and facilitate train-the-trainer programmes, which is coordinated by their educational division, the "Fachbereich Ausbildung" (ÖFHF,

n.d.-a). In 2023 the educational division launched the implementation of the second level of the state recognized trainer qualification, the “Instruktor:innen Ausbildung” (ÖFHF, n.d.-a), with the aim of conducting the first iteration by the end of 2025.

One requirement of this programme was the production of a Historical Fencing coursebook for trainers, to serve as guideline and foundation for the programme’s content. The creation of this Historical Fencing coursebook is the underlying project in which this case study is grounded.

In October 2023 the managing project team, consisting of three members of the ÖFHF education division was formed, by January 2024 a comprehensive project plan was in place, and by April 2024 41 trainers from all quarters of the Austrian, German and Swiss fencing communities were involved in an extensive, voluntary, collaborative effort, co-creating the first Historical Fencing coursebook, which was published in February 2025 (ÖFHF, 2025) and is already in use in the first iteration of the train-the-trainer programme from March to October 2025. The entire collaboration in this project, from start to finish took place online with the creation of this educational material representing a concrete example of applied Educational Technology.

The project had to make do with virtually zero budget, limiting the team to free and open-source tools. While many such tools were used, such as Discord or email for communication and Google Drive to store and collaborate on text files, Miro evolved into the organisational centrepiece and linchpin of the operation. The project team’s concretization of the tool for this purpose forms the contextual basis of the observed phenomenon of the case study (Maxwell, 2013, p. 30 as cited in Cresswell & Poth 2018, p. 82).

2.2. Case Study Parameters

The parameters of this case study follow the principles described by Cresswell and Poth (2018, pp. 152–162), as a qualitative, descriptive, instrumental case study intended to gain an in-depth understanding of selected instances of tinkering interactions with Miro. The specific case in question is based on the underlying project described in Chapter 2.1, meeting the requirement of a real-life, contemporary context of the study.

The case is bounded by the project team (Chapter 2.3), their online concretisation of Miro – the Educational Technology in question (Chapter 1.2), specifically their tinkering with the tool as outlined in the theoretical background (Chapter 1) in the period from October 2023

to April 2024, i.e. the period from the launch of the project until the start of the work of the sub-teams.

2.3. Sample of the Study

The study includes three primary participants, namely the managing project team of the educational division, who consented to participating in this study. They will be referred to either as “project team” or by their initials: BB, IPK, KS. The researcher, BB, was one of the three project team members, assuming an insider role, the implications of which will be reflected extensively in Chapter 4.1. The 41 contributing trainers who were engaged in the project from April 2024 are mentioned and featured where relevant to the understanding of the subject at hand, but they are not the focus of this case study.

The participants were chosen based on the purposeful sampling strategy as described by Cresswell and Poth (2018, pp. 223–226). The pivotal selection criterion is their direct and continuous engagement in the underlying project, offering an in-depth picture and the most information possible on the case, thus “purposefully inform(ing) an understanding in the research problem and central phenomenon in the study” (2018, p. 224).

The second main reason for the choice was convenience and access, facilitated by the dual role of the researcher and emergent design of the case study. As a member of the project team the researcher spent prolonged time embedded and engaged in the project, thus establishing rapport with gatekeepers and participants and allowing comprehensive and immediate access for data collection.

This critically included the team’s access to Miro’s education plan (Miro, n.d.-c) provided by the researcher’s university license, offering extended functionalities of the tool and thus richer opportunities and potential for tinkering use cases compared to the free version.

All three participants volunteer for the ÖFHF’s educational division in official capacities. In brief, their roles and responsibilities in the pertaining project were: IKP – Project Lead, Communications, KS – Project Management, Administrative Support, BB – Digital Infrastructure, Process Coordination, Strategic Planning.

The researcher was appointed to the project team specifically for their involvement in Educational Technology, making them a valuable resource from the perspective of the project to be responsible for managing the digital infrastructure and online collaboration process. Vice-versa the opportunity to conduct this case study and the early commitment of the project

team to it, was a driving reason for the researcher to commit to their role and responsibilities in the project. This put them at the centre of the operation and implementation of Miro in the project, which was a decisive factor in creating the conditions under which the phenomenon under investigation and the case study's design could emerge.

2.4. Data collection and Instruments

Data collection followed the methodology described by Cresswell and Poth (2018, pp. 81-88, 211–241).

Between October 2023 and April 2024, the project team held 36 online meetings each lasting between one and three hours, with a balanced attendance of either a mix of two or all three members. Miro was used in parallel in all meetings.

The researcher actively participated in all but three of these meetings, focusing on his function as active project team member during his attendance. At these opportunities, data were collected with screen recording using OBS Studio, recording either the full desktop or directly the Miro interface. Simultaneously the audio track of the meeting, which was conducted with Discord was recorded. These recordings were made whenever technically or operationally feasible without disrupting (1) the project workflow (data sensitive content was not recorded, or not all sessions offered the necessary conditions for high quality recordings) and (2) the researcher's role as a project member (enhancing validity of the collected data by reducing interference of their researcher role during the meetings). Thus, 52 video sessions with roughly 41.5 hours of raw dynamic video material were produced for subsequent analysis (Appendix 1). Furthermore, roughly every three to four weeks a backup copy of the Miro board was generated and archived, preserving a static copy of the stage of development of the board during that time (Appendix 1).

Screenshots were used to extract data from (1) the video recordings, showcasing real time interaction of the team with Miro and (2) the backup copies, offering insight into the long-term development and evolution of the Miro board throughout the observed period. These screenshots were used to illustrate the examples of tinkering in the results section (Chapter 3), visually supporting the analytical interpretation.

The team's verbal interactions to an overwhelming extent focus on the content and proceedings of the project itself, only occasionally, and most often indirectly rather than directly informing about the observed phenomenon. The audio recordings therefore were selectively transcribed (Appendix 1) when necessary to understand the selected examples,

prioritizing relevance and focus over comprehensive coverage. It is acknowledged that selective transcription entails interpretative decisions and may exclude broader contextual material not immediately relevant to the cases under examination.

Additionally, after key milestones, self-reflection videos about status of the project and Miro's implementation to date, including a summary of learnings and the team's progress with the tool were produced by the researcher (Appendix 1), and occasional observational notes were taken during the observed period. Both are acknowledged as supplementary, informal memory aides and not treated as core data.

This collection of multiple forms of data is in line with features of good qualitative studies (Cresswell & Poth, 2018). Owed to the parallel development of the project and the accompanying case study, the choice of the instruments is informed by the concept of emergent design. The chosen methods allowed for "collecting data in natural settings with a sensitivity to the people under study" (2018, pp. 103), providing a "holistic account of a complex picture" (2018, p. 83).

Validity of the study was ensured by adhering to the following validation strategies (2018, pp. 340–344). From the researcher's perspective, self-reflection and clarifying researcher bias through reflexivity helped reduce subjectivity, and triangulation of multiple data sources strengthened the credibility of interpretations. From the participants' perspective, prolonged engagement and persistent observation in the field provided a rich and accurate understanding of the case. Lastly, from the reader's or reviewer's perspective, generating a rich, thick description, particularly of the context (Chapter 2.1) and participants (Chapter 2.3) of the study, allowed for transferability of findings, and peer review of the research process by the thesis supervisor offered an external check to enhance trustworthiness.

To ensure reliability, the researcher employed "good-quality recording devices" (2018, p. 345) followed consistent data collection procedures across the project acknowledged gaps in the data (Chapter 2.4), ensured consistent application of the themes across examples as described in the data analysis (Chapter 2.5), and ensured that the raw data is systemically archived and traceable (Appendix 1).

The following principles for data storage were followed (2018, p. 240): backup copies, high quality recordings, master list of gathered information, secured access to data. Furthermore, personal information in the data and appendix to this study was redacted or handled in accordance with participants consent as outlined in (Chapter 2.3).

2.5. Data Analysis

The study followed the principles of a holistic analysis (Cresswell & Poth, 2018, p. 159), examining one specific case – the project team's tinkering with Miro – and focuses on understanding the complexity of the case, rather than aiming for generalizable results. The 5-step analytical cycle described by Cresswell and Poth (2018, pp. 254–267, 278) was followed, ensuring replicability and quality of the study:

1) The raw data were prepared, organized and archived as described in Chapter 2.4.

2) The full data were subject to a cursory systematic review, identifying potential tinkering examples and themes. In parallel, the literature regarding the observed phenomenon was reviewed, and aspects of tinkering were identified.

The researcher's reflective videos serve as an additional audit trail of this process, enhancing validation of the data whereby the complementary nature of this process is acknowledged.

3) The themes were established following the principle of categorical aggregation, whereby the aspects of tinkering drawn from the literature serve as the analytical basis. In an inductive deductive loop potential themes based on these aspects were preliminarily tested on tinkering examples which emerged in step 2. They were then narrowed down to five final themes (Appendix 1, Table 2) in alignment with the literature on the observed phenomenon (Chapters 1.1.1–1.1.5). They are explicitly not intended as quantitative measure but serve as analytical lenses, with the score of a theme indicating the extent of the manifestation of the underlying aspects of tinkering, thus aiding in the "detailed description of the […] case (2018, p. 261).

4) For the interpretation of the data, three examples were selected (Chapter 3). Their choice was informed by the analytical scope and the space limitations of the study. They were described from the perspective of the *function(s)* for which the project team concretised Miro – the proverbial *nails* introduced in the title of the thesis. Leaning into the hammer and nail analogy; the main function of a hammer is driving a nail. When exploring how tinkering with a hammer manifests, and which aspects characterize this concretisation, describing the functions a hammer is used for other than driving a nail, can be used to conceptualize and abstract meaning of the data.

Collectively, the examples provide an overview of the complete evolution of the three main sections of the Miro board: "Zeitplan" – time plan, "Arbeitsprozess" – collaboration process, and "Werkbank" - workbench.

To help navigate the multiple zoom steps of the Miro board, the description of the examples uses the following terminology: the three main ***sections*** – the largest unit on the board. They are comprised of ***areas*** – spaces on the board where coworking processes occur, often bounded by a rounded square shape. For example, one protocol of a meeting, or the space of one brainstorming session. Areas are made up of ***elements*** – the smallest unit, things like individual shapes, text boxes, colours or a single uploaded document.

5) These functions then were then directly interpreted through the lens of the themes. Screenshots of the periodic static back-up files of the Miro board were selected as core data points, facilitating Cresswell and Poth's (2018) recommendation for chronological evaluation, with the dynamic video material and the selective transcripts, as well as reflective videos of the researcher supporting the exposition (Appendix 1), allowing the illustration of a wide range of functions concretised by the team's tinkering with Miro.

3. Results

This chapter discusses three examples of the project team tinkering with Miro: managing the coworking process (Chapter 3.1), storing project results (Chapter 3.2), and the project time plan (Chapter 3.3). All transcripts and figures are referenced in Appendix 2, which is omitted in the text below for brevity.

Each example will first be described in relation to the first part of the research question, exploring how tinkering manifested in terms of the main functions the tool has been used for, and how these functions evolved during the observed period. Then the second part of the research question will be addressed, exploring the aspects of tinkering characterizing the team's concretisation of Miro in terms of the themes (Appendix 1, Table 2).

3.1. First Example – Coworking Process

During an initial online call where the scope of the project was brainstormed (Transcript 1, Line 1–2) using text boxes and shapes on a first basic Miro board (Figure 1), the need for a coordinated working process quickly became apparent (Transcript 1, Line 6–7).

This led to several iterations (Transcript 2, Line 2–3) of what became the collaboration process section of the board (Figure 2), where the team ended up using Miro for four core functions: writing and archiving minutes, i.e. meeting protocols (Figure 3, 4), as a calendar to manage meeting dates and attendance (Figure 4, 5), compiling and archiving meeting agendas (Figure 6), and managing tasks (Figure 2).

The collaboration process section consolidated in these core functions over time, with the function of managing tasks being shifted to a dedicated Kan Ban area (Figure 2) and recording outcomes and results (Chapter 3.2) eventually migrating to other sections of the board (Figure 7). Further adjustments emerged during use, especially regarding decluttering and maintaining a structured overview (Figure 8) and managing space (Figure 9), (Transcript 3, Line 1–2).

Emergence of goals (+1)

The team's goals are loosely framed and often redefined during the process. The team formulated a general goal to organize their working process early on (Transcript 1, Line 3) and then refined this general goal continuously during the process. During the second meeting, the team brainstormed board sections and functions to that end, noting the need for an area to manage ToDos, considering a dedicated Kan Ban board and an area for meeting protocols (Figure 3). There was no initial goal to manage meeting attendance and dates (Figures 3–6) or archiving results (Figures 8, 9), these emerged later during the process.

Improvised Plans (+1)

The team's actions are mostly improvised, with little pre-planned structure. The team had a rough plan of which functions might be needed to coordinate their working process and an initial plan how to structure the board (Figure 3), yet most functions were improvised solutions in response to specific emerging needs (Transcript 1, Line 12–13).

The initial function of taking notes of what had been brainstormed and discussed in the first meeting (Figure 1), evolved into meeting protocols (Figure 4) and planning upcoming agendas (Figure 6) as the project progressed and grew in scope and complexity.

Tracking attendance by colour coding became a function by the fourth meeting (Figure 5), while the colour red indicating cancelled meetings, i.e. no attendance, was added only after the first meeting was cancelled in December (Figure 10).

Archiving protocols was not planned but a result of the team not deleting obsolete elements and instead opting to shrink and restructure the existing elements in response to emergent space restrictions (Figure 9).

Other than the general plan to use Miro to coordinate the coworking process, there was no strict predetermined plan to use Miro in these specific ways – the functions emerged in response to emerging needs, and the resources to manage these needs were generated during action.

Creative Engagement (+1)

The team's tinkering displayed some creative adaptation of tools/resources beyond their intended purpose. The team used basic elements like shapes, text boxes, posits, and colours as management aides (Figure 5,6) instead of using Miro's suggested project management solutions (Miro, n.d.-f), or native Kan Ban board function (Miro, n.d.-e), which were unknown to the team at the time. They opted to cobble together a custom solution emulating core Kan Ban functions by moving short task description on Post-its through workflow buckets (Figure 2).

Iterative Conduct (+2)

The tinkering with the collaboration process section and its four core functions displays clear signs of an iterative process, driven by experimentation and discovery, as can be seen by the incremental improvements over time (Figures 1–10).

Adaptation of the Miro board is guided by the arising need for new functions. The team's feedback loop is driven by the outcomes of the team's actions during the process, experimenting with and trying out new options. Those ending up working are retained and refined (Figures 6, 7), while obsolete ones mutate (Figure 2) or are discarded (Figure 3, 4).

Serendipitous Adaptation (+1)

The team's tinkering displayed signs of somewhat accidental adaptation, accepting and adopting uncertainty.

The team used a black textbox as a header for every individual area (Figure 11). The header for the second meetings protocol happened to initially contain the date of the meeting (Figure 3). Eventually this header contained date, time and attendance (Figure 9), giving rise to the calendar and scheduling function by chance.

Similarly, the team recorded meeting protocols first (Figure 4). In December, an agenda item was noted for the first time in advance – for convenience in the already prepared textbox element designated for the protocol of that future meeting (Figure 5). During the meeting, the same textbox element was used to write the protocol as originally intended. After the meeting, the element simply was retained, thus giving rise to the workflow for agenda planning, meeting protocols and archiving, which was adopted by team for the remainder of the observed period (Figure 9).

3.2. Second Example – Storing Results

Following the decision to create a dedicated Miro board to manage the project (Transcript 1, Line 6, 7), by the third meeting the team developed a basic layout and structure of the Miro board with a smaller grey area on the left and a large empty space to the right (Figure 11). From this structure resulted an empty unused space on the left in the workbench section. This empty space initially was intended for the main function of highlighting and recording project results (Figure 12). It eventually mutated into two entirely new sections of the board affording extended functions: “Ergebnisse” (Figure 13) – a results section storing key results relevant further use and reference and “Archiv” (Figure 14) – an archive section for all other completed or obsolete areas.

The team used the open area on the right in the workbench section for synchronous and asynchronous coworking and various operative tasks. Initially, when a task was finished, the team simply left the results of that task in the area where they had worked on. There was no need to move or delete it at the time (Figure 12).

By November, the team started using the empty results area on the left, generating a keyword with a dynamic link to a finished area, resulting in a form of index, cross-referencing key results (Figures 15, 16).

By December the workbench section started to fill up with content. Attempting to declutter and to make clearly visible which areas still required further work, the team started colouring the blue backgrounds of the completed areas green (Figure 17).

The team used both methods in parallel for a while (Figure 18). Over time, the indexing version turned obsolete, whereas colouring became the default version (Figure 19).

With the workbench section gradually filling up, a new need emerged. The team had not enough space in the existing layout to continue the current method (Figure 19).

Not wanting to delete any results, in a February meeting they considered options and needs (Figure 20) and decided to restructure the entire Miro board, creating two whole new sections (Figure 7). They moved anything that was not currently being worked on into the two newly created results (Figure 13) and archive (Figure 14) sections. Thus, storing results turned into moving a finished area out of the workbench section, filtering key results to the results section and archiving the rest in the archive section.

Emergence of goals (+2)

The team's goals are fully emergent and redefined continuously during the process. There was no explicitly stated goal at the onset to create a section or area to store results (Figure 3). The goal to store results emerged from the overall structure of the board, with the empty space in the workbench section lending itself to that function (Figure 12).

Deciding on the goal to ditch the indexing function entirely and creating the two dedicated storage sections (Figures 7, 13, 14) emerged primarily from the need to regain space for coworking areas in the workbench section (Figure 19).

Improvised Plans (+2)

The team's actions are entirely improvised with no predetermined plan. There is no sign of the team having a plan on how to store results at the onset (Figure 3). Since there were no results to be stored at the start of the project, the plan and resources to do so emerged with the needs during the project. The initial indexing function (Figures 15, 16) was outclassed by the background colouring scheme (Figures 17–19), which was eventually replaced by a deliberate and dedicated storage solution (Figures 7, 13, 14).

Creative Engagement (-1)

The team used tools/resources mostly as intended with minimal adaptation. While Miro is not intended as a cloud storage application (Miro, n.d.-a), uploading files is a standard function of the tool and the team simply refrained from deleting the elements and content they had worked on over an extended period, resulting in the observed variations of makeshift storage solutions.

The cross-referencing function was used as intended, linking elements within the board (Figure 16). Background colours were used to convey information – in this case if an entire area was complete (Figures 17–19). Shrinking and moving elements, as used in the final iteration (Figures 7, 13, 14) is also a standard function of Miro.

Iterative Conduct (0)

The team's tinkering with storing results shows some signs of an iterative process, with the team displaying a neutral mindset.

Three distinct iterations can be observed: indexing (Figure 16), colour coding (Figure 17–19), and two dedicated storage areas (Figures 7, 13, 14). The main sign for a trial-and-error approach was the temporary parallel use of indexing and colour coding. Beyond that, the

team did not explicitly explore or experiment with functions but kept an open mind to adjusting their process based on the encountered needs and limitations.

Serendipitous Adaptation (+2)

The team's tinkering displays signs of fully accidental adaptation, embracing chance and contingency. Highlighting and storing results emerged purely from chance. There was an opportunity – the empty space (Figure 12), which was capitalized on and turned into an index (Figure 15). After colour coding emerged in November in other areas of the board for tracking meeting attendance (Figure 5) the team embraced that function for tracking completion status by December (Figure 17). Only the last iteration was a controlled process, based on the learnings of previous iterations.

3.3. Third Example – Project Time Plan

With the first iteration of the dedicated Miro board the time plan section was added (Figures 11, 21). What started out as a simple retrospect timeline with the sole function of visualizing the project progress before October 2023 (Figure 22), eventually mutated into a fully-fledged project time plan (Figure 23), emulating functions typically found in dedicated project management tools: visualizing the project timeline in various resolutions like phases, milestones, and activities, event and task scheduling, monitoring progress and dependencies, and managing resources and personnel.

Figure 11 shows the overall structure of the board with the time plan section at the top. The section was inspired by an early version of the retrospect (Figure 24). The team used shapes and text boxes to build a basic project timeline. They colour coded project phases, visualizing key activities and milestones and used green or red frames to indicate external "stop-or-go" dependencies, and purple frames to indicate events (Figure 25).

By November the team added new functions to the time plan in a second iteration. With more and more elements like deadlines, events, or activities filling up the timeline, the team started sorting them in parallel rows, each representing responsible teams or target groups, thus also indicating cross dependencies and the total workload per row (Figure 26). A small red dynamic marker was added indicating the current date ("we are here"), which was manually shifted along the timeline as the project progressed (Figure 26). The time plan section was used in this configuration until January, gradually filling up with elements (Figure 27).

By January the timeline evolved a third time. Inspired by the colour coding scheme indicating meeting attendance with green and red text boxes (Figure 10), and the colour coding scheme indicating completion status and results (Figure 17), the team adapted the time plan's colour coding scheme (Figure 28). The closeup in Figure 29 shows the innovations, with a coloured background indicating the status: blue – planned, yellow – work in progress, and green – complete, as well as purple or teal framed parallelograms indicating online or face-to-face events. The colour coding of activities in the project phase colours thus became obsolete. The team also started using the dynamic cross referencing that emerged in Figure 16 to cross reference the working areas related to a specific activity in the timeline.

As seen in Figures 23, 30–32, the team used this configuration for the remainder of the observed period with no further adaptations.

Emergence of goals (0)

During the second meeting, the team explicitly discussed the need for a project time plan (Figure 3), but the end state was not envisioned at the onset. What started out as a simple retrospect timeline (Figure 22), was turned into a planning tool with multiple purposes as the project progressed. The goal to establish a time plan evolved, with functions for mapping resources and personnel (Figure 26) and monitoring progress (Figure 28) emerging during use.

Improvised Plans (0)

The team's actions display a mix of upfront planning and real-time improvisation. A result of the second meeting was an explicit task to establish a time plan for the project, with a deliberate decision to create a time plan with Miro instead of other tools (Figure 3). They decided against using dedicated project management tools, partially for financial reasons (Chapter 2.1) and partially considering them potentially overpowered for their purposes and thus stuck with using Miro (Transcript 2, Line 14–21).

Creative Engagement (+2)

The team's tinkering displays a highly creative use of available tools/resources, and heavy repurposing and adaptation. Miro offers explicit project management (Miro, n.d.-f) and road mapping solutions (Miro, n.d.-g). Instead of using these native functions, the team repurposed basic Miro elements, like shapes and colours to jerry-rig a time plan (Figures 23, 25, 26) with functions fully customized to the project needs.

Iterative Conduct (0)

The team's tinkering with the project time plan shows some signs of an iterative process, with the team displaying a neutral mindset.

Three distinct iterations can be observed, starting with a basic version in October (Figure 25), a revision in early November (Figures 26, 27), and the final version being used from January onward (Figures 23, 28–32). While adaptation of the Miro board is informed by the need for new functions, the team does not display signs of active experimentation.

Serendipitous Adaptation (+1)

The team's tinkering displays signs of somewhat accidental adaptation, accepting and adopting uncertainty. They started with a basic timeline (Figure 25), based on the layout of the retrospect timeline (Figure 26) and followed a general goal and plan, without the need of having every detail and function in place at the onset.

When colour coding emerged in other areas of the board (Figures 5, 17–19), the team capitalized on that chance event and adopted these functions in the final version of the time plan (Figures 23, 28–32).

4. Discussion

The results of the case study provide a holistic, qualitative account of the project team's tinkering with Miro and the tinkering aspects characterizing their concretisation of the tool, answering the posed research question.

Three examples were observed, showing how the team used Miro to manage their coworking process (Chapter 3.1), to store project results (Chapter 3.2), and to manage the project time plan (Chapter 3.3). In these three examples, the team concretised Miro for numerous functions: (1) writing and archiving minutes, i.e. meeting protocols (Figure 3, 4), as a calendar to manage meeting dates and attendance (Figure 4, 5), compiling and archiving meeting agendas (Figure 6), and managing tasks (Figure 2), (2) highlighting and recording key results relevant for further use and reference (Figure 13) and archiving completed or obsolete areas (Figure 14) and (3) visualizing the project timeline in various resolutions like phases, milestones, and activities, event and task scheduling, monitoring progress and dependencies, and managing resources and personnel (Figure 21, 23, 25–32).

These are typical functions necessary for managing large-scale projects. Rather than using traditional, dedicated tools or other applications for these functions, the team tinkered

with Miro to implement these functions. Table 1 summarizes the observed aspects of tinkering characterizing the team's concretisation of Miro, which hereafter will be discussed in detail.

Table 1 Tinkering aspects characterizing the project team's concretisation of Miro for the three observed examples.

	Example 1	**Example 2**	**Example 3**
Emergence of Goals	+1	+2	0
Improvised Plans	+1	+2	0
Creative Engagement	+1	-1	+2
Iterative Conduct	+2	0	0
Serendipitous Adaptation	+1	+2	+1

Notes. The scores are intended not as quantitative measure, but as narrative aide describing tinkering behaviour. Range: -2 to +2

Emergence of Goals

The team had a clear vision and goal in mind for the general project: they wanted to facilitate the coproduction of a Historical Fencing coursebook, and they wanted to enable this using Miro. The goal of the project was specified beforehand, and execution towards this goal was outcome driven, going against the idea of the open-ended tinkering process (Bardone *et al.*, 2023). However, regarding how they used Miro to that end, how their interaction with the tool is characterized and how it shaped the solutions for the coworking process (Chapter 3.1) and time plan (Chapter 3.3) (Figure 3), shows clear signs of not fully specifying all details beforehand (Bardone *et al.*, 2023). This open-ended approach is particularly apparent with the fully emergent solutions for storing project results (Chapter 3.2). While the creation of the project time plan (Chapter 3.3) does display aspects of adaptive goals evidenced by the evolving functions over time (Figures 25, 26, 28), it also shows notions of a fixed vision, where the first iteration of the time plan (Figure 25) already resembles a typical project timeline which is retained throughout the evolution (Figures 26, 28).

Bias regarding the team's decisions cannot be ruled out. The data does not conclusively show, if the team might have chosen different solutions with dedicated project management tools, if the researcher with his insider role would not have had an interest in observing the team's use with Miro.

Improvised Plans

The team's planning was informed by the team's decision (Figure 3) and financial restrictions (Chapter 2.1) to use Miro as their main tool or resource, and by their evolving skill in using the tool. Corresponding with Levi Strauss' (1962) idea of the *bricoleur*, instead of starting with a structured set of dedicated project management tools and workflows, the team tended to improvise solutions as project needs emerged, relying on the tool at hand – Miro. The lack of foresight particularly regarding storing project results (Chapter 3.2) is in line with the idea of the responsive nature of the tinkerer (Bardone *et al.*, 2023). Whereas the solutions surrounding the dedicated project time plan (Chapter 3.3) approach the notion of intentionally emulating and recreating conventional project management tools.

The team's tendency to improvise solutions could be connected to the team's changing skill with Miro. While the structured tutorials from the Miro Academy (Miro, n.d.-b) and Help Center (Miro, n.d.-d) were always accessible, the team did not engage with them upfront and instead engaged with the tool from a position of partial knowledge, aligning with the dictionary definitions of the unskilled tinkerer (Chapter 1). The increasing complexity of the Miro board and expansion of functions and use cases indicates the team's increasing skill in using Miro over time. Parallel to this increasing proficiency, the team also enacted clearer and more concrete plans on how to use Miro, suggesting a parallel development of skill with the tool and the ability to plan with the tool.

Interestingly, the team opted to use a resource which is designed to offer a virtually infinite space – Miro allows to pan and zoom with very little restrictions – and then wilfully restricted the use of that infinite space with their configuration of the board. This could be interpreted as a way of coping with the vast scope and organizing the onset, yet it hints at the team's lack of foresight and deliberate planning (Bardone *et al.*, 2023), as it led to two, at root, self-inflicted necessary major adaptations down the line (Figures 9, 19).

Creative Engagement

The observed examples differ from each other in how aspects of creative engagement of tinkering manifested. The team showed the highest level of experimentation and exploring of latent functionalities of Miro (Bardone *et al.*, 2023) with how they managed their coworking process (Chapter 3.1), yet their use of the basic elements might not be characterized as appropriation of Miro (Salovaara, 2009). Writing text in textboxes (Figures 3, 4, 6), using colours to colour elements (Figure 5), and clustering Post-its (Figure 2) could be considered conventional use of these elements.

The team's solution for the time plan (Chapter 3.3) displays the opposite characteristic (Figures 25, 26, 28): heavily "repurposing a tool for a purpose other than the one designer's intended" (Salovaara, 2009, p. 3141) – which would have been to use the native project management solutions (Miro, n.d.-f) – with few signs of active experimentation or exploration of latent functionalities (Bardone *et al.*, 2023).

The solution to storing project results (Chapter 3.2) displays the least signs of creative repurposing of Miro, presumably as a factor of the team's lack of agency in the emergent process – it was not contrived, it happened, highlighting a link to serendipitous adaptation.

Notably, there is tension regarding the literature in this theme. The toolkit design of Miro shifts the burden of formulating the tools intent onto the user by design. Miro supplies supporting material (Miro, n.d.-b) and tutorials (Miro, n.d.-d) on how to implement their kits, offering vast options but not prescribing an intended use. These resources were at hand, (Bardone *et al.*, 2023; Turner, 2007) but not used by the team. They were not necessarily aware of the designer's intent, which is Salovaara's (2009) premise for appropriating a tool. At the same time, they were creating the intent through their use. Any innovative function of a tool thus conceived by the user therefore inherently is as intended by the designer.

Additionally, discussing tinkering as a function of creative engagement bears a relation to the potential "repurposeability" of a tool. Miro's high degree of polysemy and opportunity to be repurposed, might distort the perceived creative engagement of the team. Imagine the team used a tool with less potential for repurposing or creative re-use. Doing anything other than driving a nail with a hammer, might be perceived as creative re-use of that tool, while at the same time, the hammer's single intended use might afford much less potential for repurposing altogether.

Iterative Conduct

The team generally was open to a process driven feedback loop, adjusting how they used Miro depending on which functions ended up working and which not. Particularly with managing the coworking process (Chapter 3.1), the team displayed signs of actively experimenting and exploring how Miro could be used to afford their needs. With storing results (Chapter 3.2) and the project time plan (Chapter 3.3), the team ended up reusing and adapting functions which were discovered in Example 1, particularly regarding the colour coding schemes (Figures 10, 18, 29). This is in line with the exploratory and playful mindset of the tinkerer discussed by Vossoughi and Bevan (2014).

Indications of path dependency can be observed. Once a solution was in place and working, the team tended not to change it anymore, and adaptations seem conditioned by previous decision. Some striking examples are the continued reuse of the rounded rectangle shape, which was used in the first brainstorming session (Figure 1) and reemerges throughout the observed period, even informing the greater layout of the whole Miro board (Figures 9, 11, 19), or the black header (Figures 1) being the first step of the evolution of several functions (Figures 1, 2, 4, 15).

The significance of this theme in terms of the prevalence of iterations remains questionable. The project was bound by a timeframe spanning several months. Given a large enough time frame, some iteration was likely to occur. Conversely, if one were to observe the team's tinkering for a day only the chance to observe iteration would be smaller.

Serendipitous Adaptation

The team's tinkering consistently displayed signs of serendipitous adaptation. The emergence of the workflows surrounding the coworking process (Chapter 3.1) and the project time plan (Chapter 3.3) align with the view of tinkering in terms of Jacob's (1977) and Turner's (2007) evolutionary arguments, where adaptation is not planned but the result of chance, as evidenced by the emergent functions for scheduling meetings, managing attendance, and meeting agendas and protocols (Figures 4, 6, 9), the embracing of emerging functions across different areas of the board (Figures 5, 17– 19) and the time plans chance evolutions through (Figures 23, 28–32).

The process surrounding the emerging solutions for storing project results (Figures 12, 15, 17) fits particularly well with the view of tinkering "relying on chance events, amplifying their potential positive significance" (Bardone *et al.*, 2023, p. 4).

The team's increasing skill with Miro might have a bearing on serendipity. It is possible the team missed chances, either because they were unaware of (not to say overwhelmed with) opportunities, or because they were unable to identify their significance, due to the initial lack of skill. The data cannot show when a potential chance event happened but was not capitalized on by the team. Only implemented examples survive. This might distort the perception of this theme.

4.1. Strengths, Limitations and Additional Potential of the Study

The study offers a rich, qualitative description of three examples of a project team's tinkering with Miro. It makes no claims for generalizability and instead provides a holistic, in-depth account of one specific, real-world case, offering a deep insight and providing a complex understanding of the observed phenomenon owing to the prolonged embedded participation of the researcher.

This insider perspective of the researcher must be scrutinized (Cresswell & Poth, 2018). It comes with the risk of potential bias and lack of objectivity as well as the "risk of reduced credibility" (Miles & Huberman 1994, p. 28, as cited in Cresswell & Poth, 2018, p. 225), and might also "distract the researcher from recording data when they are engaged in the project" (Bogdewic, 1999, as cited in Cresswell & Poth, 2018, p. 233).

It introduces a heightened risk for bias particularly during data collection, with the researcher potentially introducing distortions during the project team's interaction with Miro, and by heavily relying on the researcher's account, potentially overrepresenting their personal perspective at the expense of reflecting multiple perspectives of the participants of the study. The researcher's reflexivity about this insider role and resulting potential biases is vital to mitigate risks to credibility and validity of the research. (Cresswell & Poth, 2018).

While the examples are discussed in detail, the overall analysis of the data is necessarily limited in scope. Due to space constraints, only a subset of the available material could be examined in depth. The case study focused on illustrating the broad range of the team's concretisation of Miro, providing an overview of the general Miro board, rather than examining more isolated or fine-grained instances of tinkering.

The observed period ended in April 2024, yet the team continued using Miro intensively throughout 2025. At the time of writing this thesis, three additional boards remain completely unexplored (Figures 33–35). This extended material offers a significant opportunity for further research regarding tinkering with Miro in general, and the team's continued concretisation with Miro specifically.

Further, the aspect of the online collaboration process of the team per se was not the focus of this study, and the sample of the study was limited to the three members of the managing project team, excluding the remaining 41 contributors to the greater project. The remaining material offers significant potential for exploring digital collaboration and the management of online processes in the context of a distributed team collaborating over a prolonged period to co-create a Historical Fencing train-the-trainer coursebook.

4.2. Conclusion

The global shift towards remote collaboration has fundamentally changed how we collaborate, bringing both new opportunities and risks. Translating traditional face-to-face solutions into remote collaboration remains a challenge, but there are examples of successful adaptation when thinking outside the box.

This thesis explored one such example of a project team tinkering with the digital collaboration tool Miro, turning it into their proverbial *hammer*, the multitude of the complex project's demands into nails, and themselves into tinkerers, adapting, experimenting, and improvising in using the tool to solve their unique problem of co-creating a Historical Fencing coursebook.

The case study focused on which aspects of tinkering manifested during their concretisation of the tool, filling a clear gap in the literature on tinkering with Miro within the broader context of digital collaboration. The analysis through five thematic lenses revealed a rich pool of tinkering examples, illustrating how the team copiously concretised the tool to meet a multitude of project demands. The findings also provide general insight into how distributed teams can successfully adapt and thrive in complex, digital collaboration environments.

The study's scope is limited by its focus on a small portion of a single case within a niche community, leaving ample room for further research, both regarding tinkering with Miro specifically, and digital collaboration in general.

In conclusion, this thesis contributes to the growing conversation around remote collaboration by demonstrating how tinkering with tools like Miro could be concretised successfully, enabling thriving digital collaboration and underscores the value of tinkering as an empowering means of bridging gaps in digital collaboration.

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6. Authors Declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Bernhard Bugelnig
31/05/2025

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8. Appendices

8.1. Appendix 1

Table 2. The themes used as analytical lenses for describing the team's tinkering behaviour.

Score	Description
Theme 1	**Emergence of Goals**
+2	Goals are fully emergent; redefined continuously during the process
+1	Goals are loosely framed and often redefined during the process
0	Balanced: general goals are initially set but allow for flexible adjustment
-1	Goals are mostly fixed and guide actions consistently with minor adjustments
-2	Goals are fully fixed from the outset and strictly pursued without deviation
Theme 2	**Improvised Plans**
+2	Actions are entirely improvised, with no predetermined plan
+1	Actions are mostly improvised, with little pre-planned structure
0	Balanced: mix of upfront planning and real-time improvisation
-1	Actions mostly follow a predetermined plan, with occasional adaptations
-2	Actions are fully predetermined and strictly follow plan; little to no improvisation
Theme 3	**Creative Engagement**
+2	Highly creative use of available tools/resources; heavy repurposing and adaptation
+1	Some creative adaptation of tools/resources beyond their intended purpose
0	Balanced: tools/resources largely used as intended but with occasional adaptations
-1	Tools/resources used mostly as intended, minimal adaptation
-2	Tools/resources used strictly according to original design and purpose, no deviation
Theme 4	**Iterative Conduct**
+2	Clearly iterative process, driven by experimentation and discovery
+1	Mostly iterative process, signs of openness to feedback and exploration
0	Balanced: some iteration, with a neutral mindset
-1	Little to no iteration, with minimal reflection or adjustment
-2	No indication of iteration, mindset closed to feedback or reworking
Theme 5	**Serendipitous Adaptation**
+2	Fully accidental adaptation, embracing chance and contingency
+1	Somewhat accidental adaptation, accepting and adopting uncertainty
0	Balanced: possibility of chance events is present and tolerated
-1	somewhat deliberate adaptation, mostly exerting control
-2	Fully deliberate adaptation, exerting full control

Notes. The scores are intended not as a quantitative measure, but as narrative aid for describing tinkering behaviour.

Table 3. Master list of all video sessions

2023-11-07 11-24-35_Session-1_BB_Rework-Timeplan_Drafting
2023-11-07 13-43-56_Session-2_BB_Rework-Timeplan_Projectlines
2023-11-14 12-54-27_Session-3_BB_Reflection-Timeplan_Aims_Brainstorming_Summary
2023-11-14 13-04-17_Session-4_BB_Reflection-Summary_Coworking_Space_Process
2023-11-14 13-07-05_Session-5_BB_Reflection-Linking_Elements_Example
2023-11-14 13-09-04_Session-6_BB_Reflection-Tinkering_Examples
2023-11-14 13-16-31_Session-7_BB_Rework-Building_the_FAQ_Panel
2023-11-14 13-45-20_Session-8_BB_Rework-Building_the_Kick_Off_Meeting_Prep_Panel
2023-11-14 13-53-44_Session-9_BB_Rework-Building_Kick_Off_Meeting_Panel
2023-11-20 10-18-38_Session-10_IPK-BB_Creating-Teammeeting_Projectplan
2023-11-27 17-29-39_Session-11_BB_Reflection-Capacity-Limit-of-Coworking-Space
2023-11-27 17-31-29_Session-12_BB_Creating-Preparing_Coworking_Session_with_KS
2023-11-27 17-34-57_Session-13_KS-BB_Creating-Finances
2023-12-04 10-16-30_Session-14_IPK-BB_Creating-Followup_Finances_Customer_Journey
2023-12-11 10-29-30_Session-15_IPK-BB_Creating-Finances_Dispensator
2023-12-11 17-44-05_Session-16_KS-BB_Creating-Finances_Customer_Journey_Dispensator
2023-12-18 10-23-58_Session-17_IPK-BB_Creating-Timeplan_TPool_Process
2023-12-20 11-35-24_Session-18_BB_Rework-Timeplan
2023-12-20 11-55-53_Session-19_BB_Reflection-Timeplan_Results_Section
2024-01-02 18-13-09_Session-20_IPK-KS-BB_Creating-Aims
2024-01-08 10-15-16_Session-21_IPK-BB_Creating-TPool_Process
2024-01-08 12-46-38_Session-22_BB_Creating-KickOffMeeting_Board
2024-01-08 13-52-04_Session-23_BB_Creating_KickOffMeeting_Board
2024-01-09 16-07-29_Session-24_BB_Creating_KickOffMeeting_Board
2024-01-09 18-04-59_Session-25_IPK-BB_Creating-Recruting_Process
2024-01-09 18-48-14_Session-26_IPK-KS-BB_Creating-KickOffMeeting_Prep
2024-01-15 10-03-43_Session-27_IPK-BB_Creating_Testrecoring
2024-01-15 10-24-11_Session-28_IPK-BB_Creating-Coursebook_Creation_Process
2024-01-15 13-07-34_Session-30_BB_Reflection-Progress_thus-far.mp4
2024-01-16 18-32-10_Session-29_BB_Reflection-Progress_thus-far
2024-01-22 10-16-06_Session-31_IPK-BB_Creating-Planning_KickOffMeetings_infrastructure
2024-01-22 10-24-50_Session-32_IPK-BB_Creating-Course_Credit-Distribution
2024-01-28 13-05-31_Session-33_IPK-BB_Creating-KickOffMeeting_Prep
2024-01-30 13-10-29_Session-34_IPK-BB_Creating-Testing_video_Protocol
2024-01-30 13-44-22_Session-36_IPK-BB_Creating_KickOff_Prep
2024-01-30 14-09-02_Session-37_IPK-BB_Creating_KickOff_Prep
2024-01-30 18-39-43_Session-38_IPK-KS-BB-Team_Creating-KickOffMeeting_Videoprotokoll
2024-01-30-13 32-56_Session-35_IPK-BB_Creating-Testing_videoprotocol
2024-02-19 10-15-05_Session-39_IPK-BB_Creating-Teammeeting_Admin
2024-02-19 10-37-22_Session-40_IPK-BB_Creating-Prep_for_reworking_the_miro_board
2024-02-19 12-43-22_Session-41_BB_Creating-Exporting_faqs
2024-02-23 11-05-20_Session-42_BB_Reflection-Progress_thus_far
2024-02-23 11-15-04_Session-43_BB_Creating_Improving-the-miro-board
2024-02-23 12-58-19_Session-44_BB_Reflection-Creating_a_safetycopy
2024-02-26 10-54-28_Session-45_IPK-BB_Creating-Forming_Subteams
2024-03-21 14-27-15_Session-46_IPK-BB_Creating-Subteams_Working_Process
2024-04-27 14-06-07_Session-47_IPK-BB-TPOOL_Creting-Miro_access_management

Table 3. Master list of all video sessions

2024-04-27 14-11-43_Session-48_IPK-KS-BB-TPOOL_Creating-Start_TPool_Videoprotocol1
2024-04-27 14-47-28_Session-49_IPK-KS-BB-TPOOL_Creating-Start_TPool_Videoprotocol2
2024-04-27 16-18-47_Session-50_IPK-KS-BB-TPOOL_Creating-Start_TPool_Videoprotocol3
2024-04-27 17-52-17_Session-51_IPK-KS-BB-TPOOL_Creating-Start_TPool_Videoprotocol4
2024-12-10 11-24-35_Session-52_BB_Reflection-Overview_Miro_Boards

Notes. Format: yyyy-mm-dd hh-mm-ss_Session-ID_PARTICIPANTS-TOKEN_Type-Titel

Table 4. Master list of all backup copies of the Miro board

2023.10.30_Backup_Project_Team_Board
2023.11.15_Backup_Project_Team_Board
2023.11.15_Backup_Project_Team_Board_Timeplan_V_0.1
2023.12.17_Backup_Project_Team_Board
2024.02.15_Backup_KickOffMeeting_Assorted_Board
2024.02.23_Backup_Project_Team_Board
2024.03.28_Backup_Project_Team_Board
2024.04.09_Backup_TPool_Board_Draft
2024.04.09_Backup_TPool_Board
2024.04.24_Backup_TPool_Board

Notes. Format: yyyy.mm.dd_Title

8.2. Appendix 2

Transcript 1.

Recording: 2023-11-14 13-04-17_Session-4_BB_Reflection-Summary_Coworking_Space_Process

Timestamp: 00:39–02:40

Participants: BB

Transcript:

1. All of this madness that you see here started out as these four little bits.
2. Like this is where we were, IPK and I, the boss and I, were sitting down considering options.
3. And like in our very first meeting we just sat down and we noticed okay this is that the things that we have are not enough.
4. Let's start splitting it up and we kind of started with this initial idea.
5. And then I realized that this is not enough.
6. And a week or two in we got to the point where we are like okay we have to—we're gonna have to make this a proper project.
7. And then out of this little thing became a first version of the co-working space which I played with a little.
8. And I think you're seeing like the third or fourth mutation already.
9. Jump into previous safety copy—this is what it looked like one and a half months ago.
10. This is what it looked like one and a half months ago—much cleaner.
11. So this is where we were a month ago.
12. We weren't sure yet how the whole working process will be.
13. We weren't sure yet how we're gonna like be working together down here.
14. And now this is where we are a month, one and a half months later.
15. We've had a couple of meetings already.
16. [collaboration process section] like turns into our protocol wall.
17. And this [workbench section] is like where we work when we do our actual working together.
18. So yeah, of that move to the site—this is where it started.
19. This is what it's mutated into.

Transcript 2.

Recording: 2024-01-15 13-07-34_Session-30_BB_Reflection-Progress_thus-far

Timestamp: 36:59–38:49

Participants: BB

Transcript:

1. This is about this working process panel in the middle.
2. So basically what you're seeing here is the emergence of a calendar and collection of agendas for upcoming meetings.
3. From what just started out as a protocol of the first meeting.
4. So what you're seeing here is basically just the protocol of the first meeting.
5. And at some point the team turned to pre-casting the next protocols.
6. So today we already know it's the 16th of January.
7. We already know in mid-February there will be a date we have with the finance guy.
8. And we've already outlined the agenda for this one.
9. So this is sort of the function of a calendar and of a list of agendas for the upcoming meetings.
10. And then reverse, it is a protocol of what we talked about.
11. So today I can go back to the meeting we had on, let's say, the 20th of November.
12. And I can have a quick look at what we worked on that day.
13. Just protocoling the process that we had.
14. So the team could have chosen to just use third-party apps.
15. There's Google Calendars, there's all sorts of apps.
16. There's project management tools of all kinds to enable these functions.
17. But it just happened.
18. It just chance-fixed itself into what you see here.
19. Because it just fit the team's needs at that time.
20. Other tools possibly dedicated to fixing these problems may have been overpowered for this purpose.
21. So they just stuck to using it that way.

Transcript 3.

Recording: 2024-02-23 12-58-19_Session-44_BB_Reflection-Creating_a_safetycopy

Timestamp: 01:31–01:39

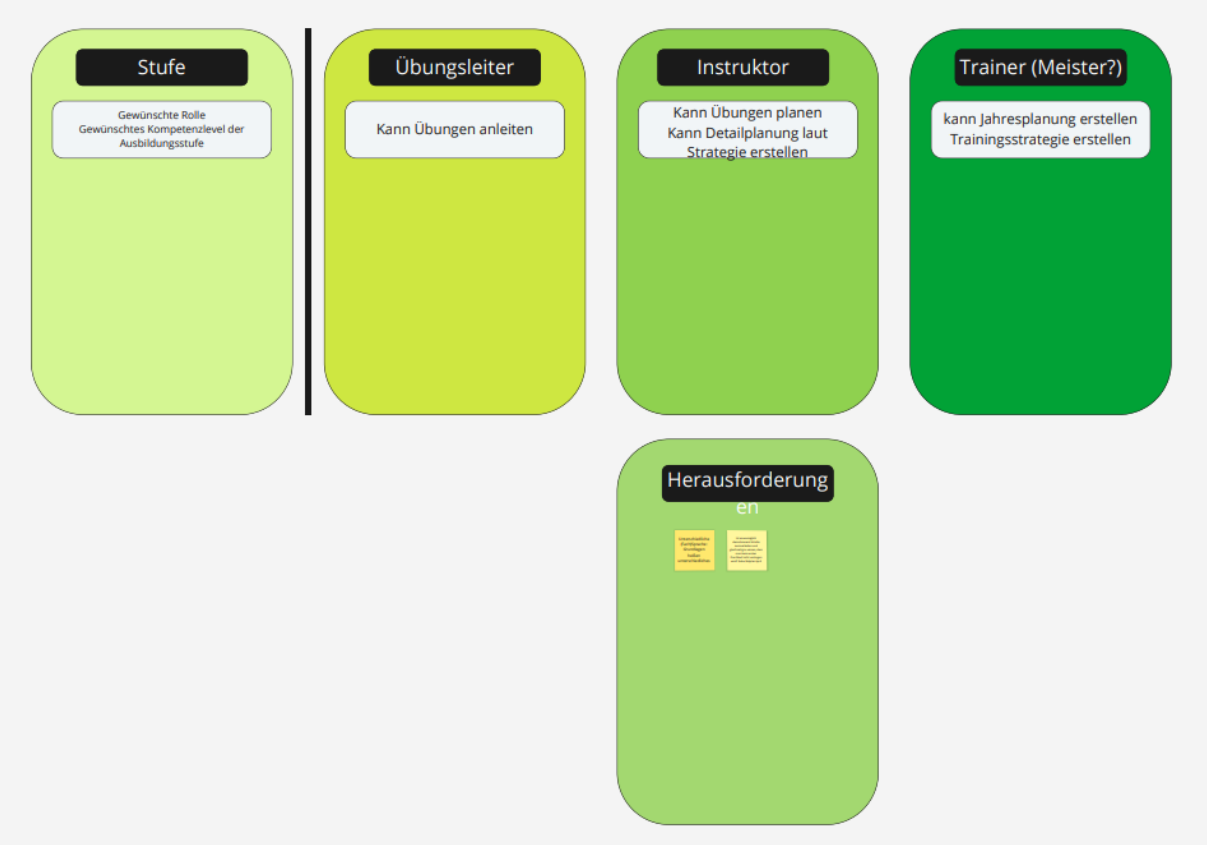
Participants: BB

Transcript:

1. And I've cleaned up this one (Coworking Section)
2. I just basically zoomed everything together.

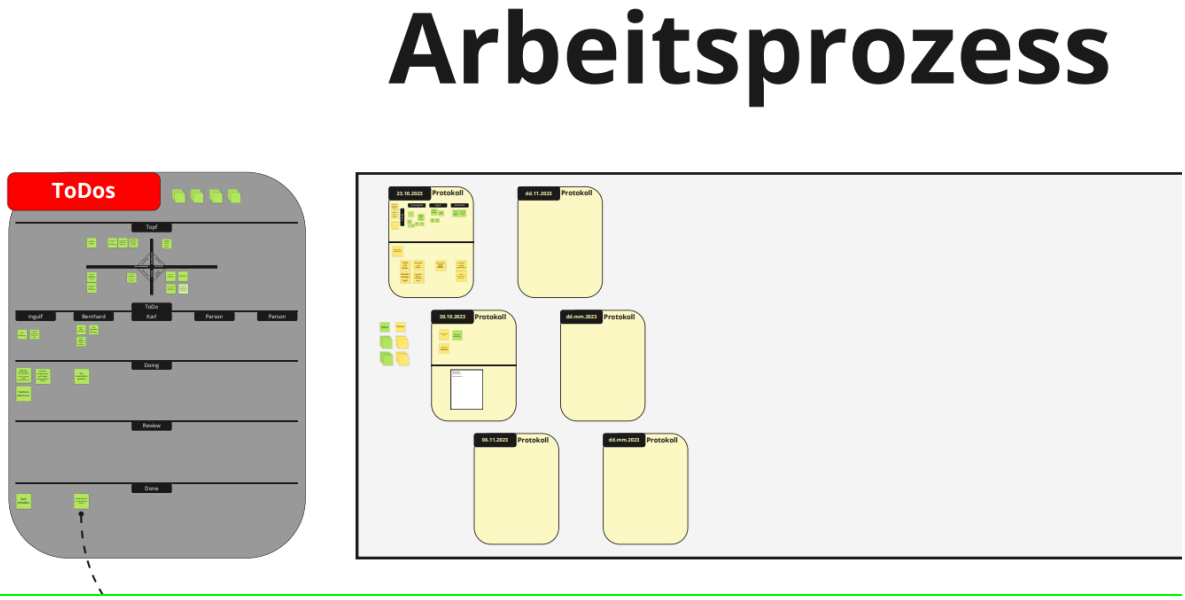
8.2.1. Example 1

Figure 1. Notes from the first meeting on 2023.10.14 (from Backup Board 2023.10.30)



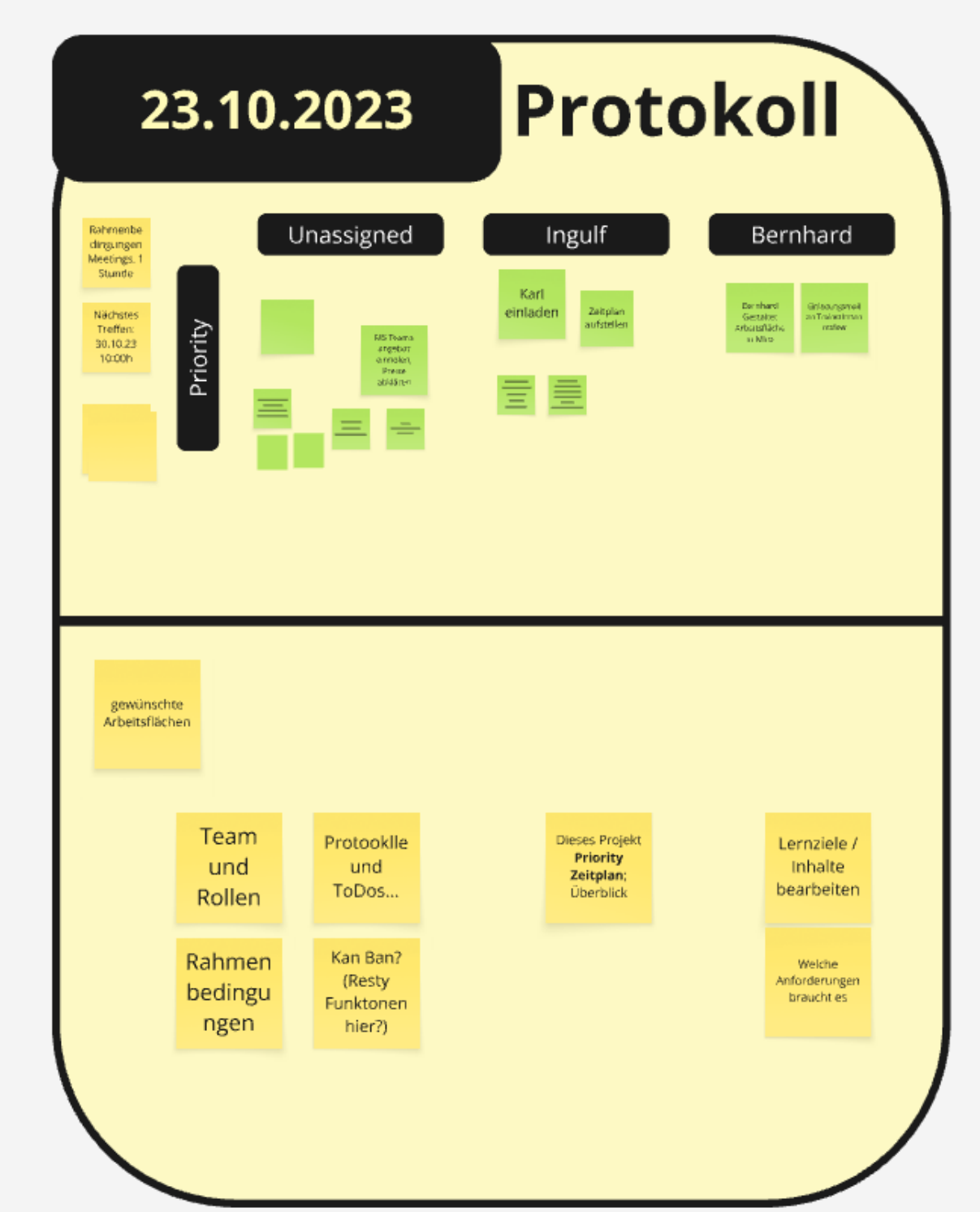
Notes. At this earliest stage, the tool was used to brainstorm the scope and challenges of the project.

Figure 2. Collaboration process section including the Kan Ban ToDos on the left (from Backup Board 2023.10.30)



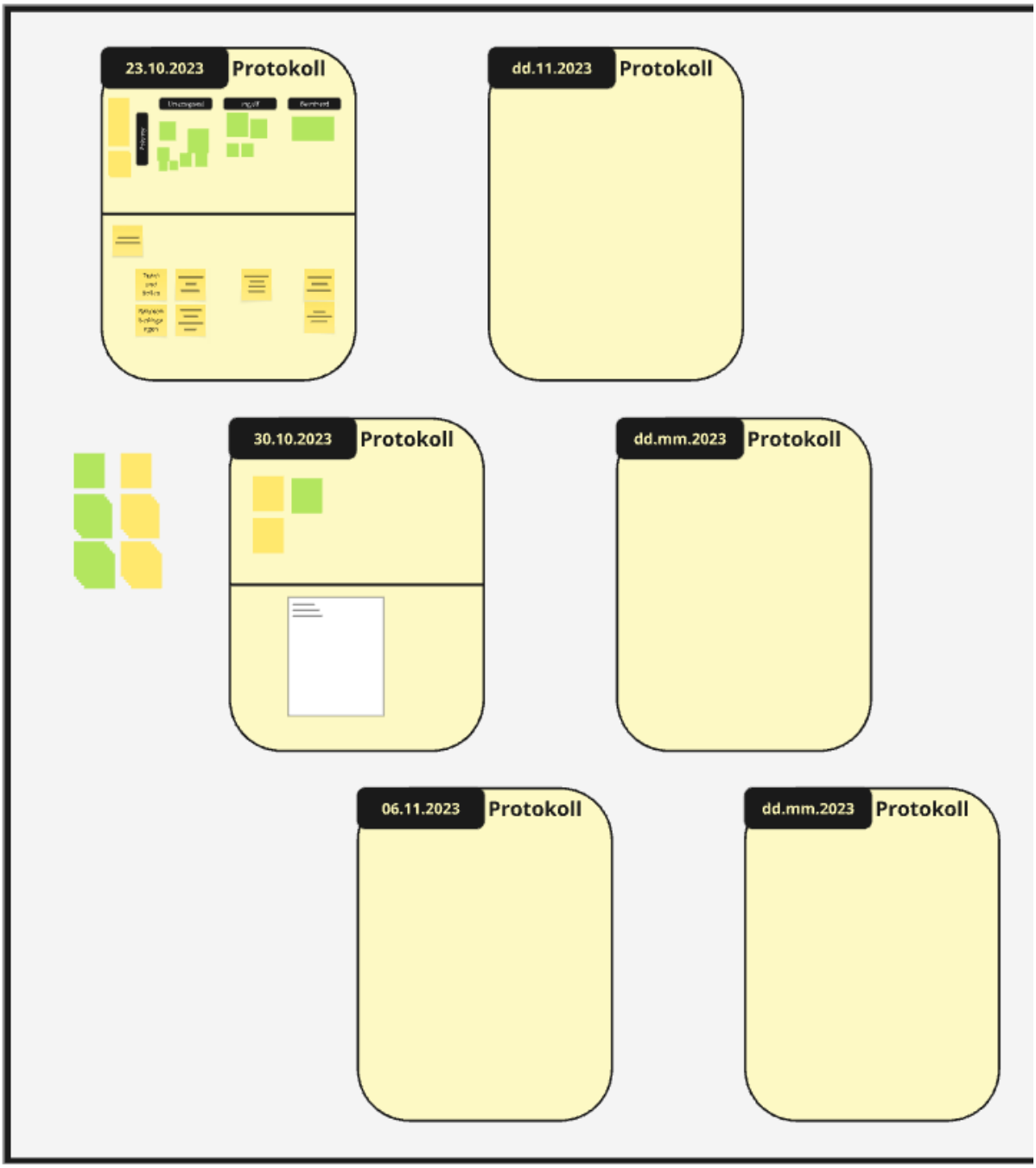
Notes. Emulation of a dedicated Kan Ban board to manage tasks to the left of the meeting protocols in the collaboration process section.

Figure 3. Notes from the second meeting on 2023.10.23 (from Backup Board 2023.10.30)



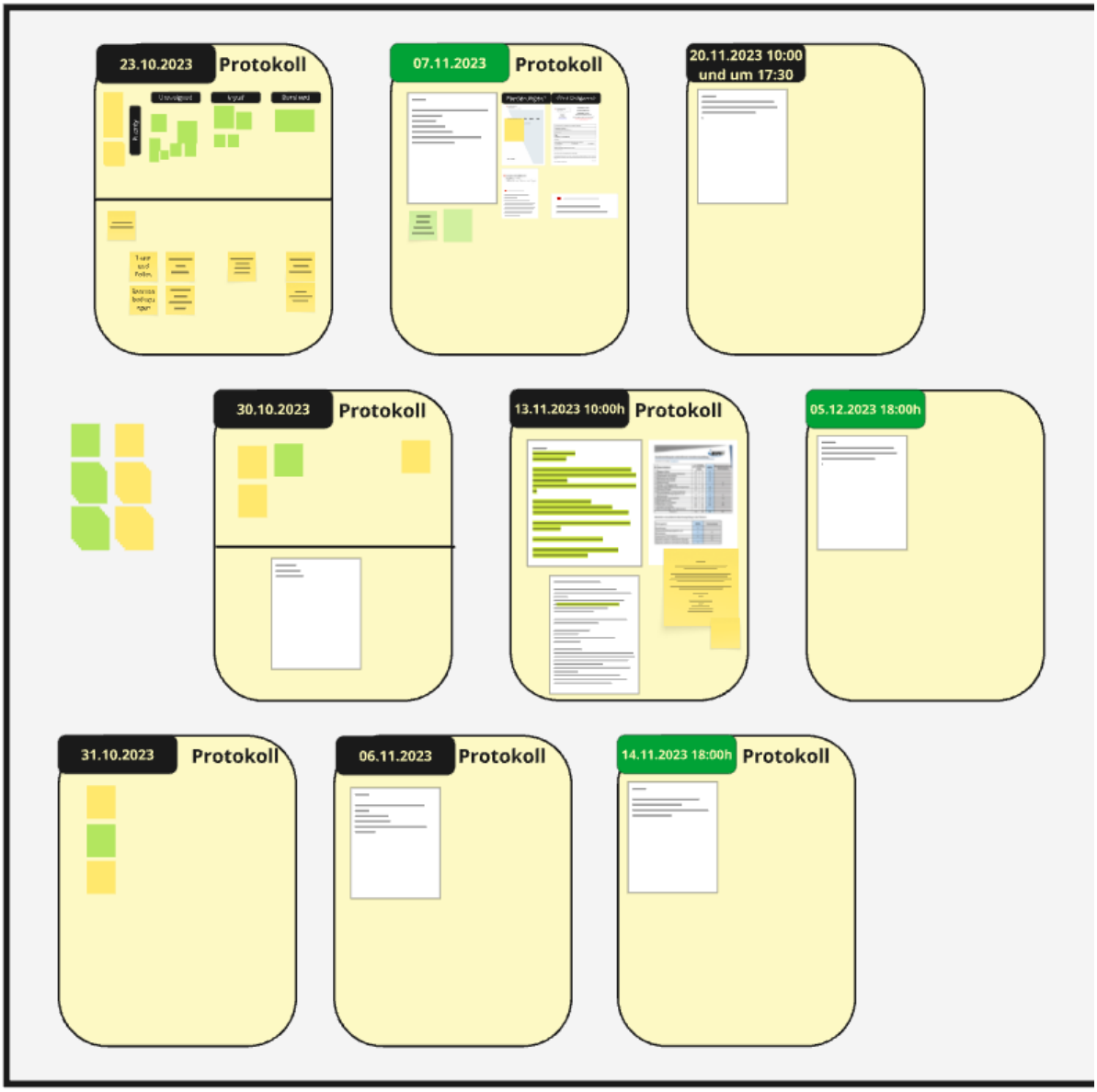
Notes. During the second meeting, the use shifted from purely brainstorming to recording meeting minutes and tasks. The bottom half shows initial considerations for the dedicated Miro board.

Figure 4. Creation of the collaboration process Section in the third meeting on 2023.10.30 (from Backup Board 2023.10.30)



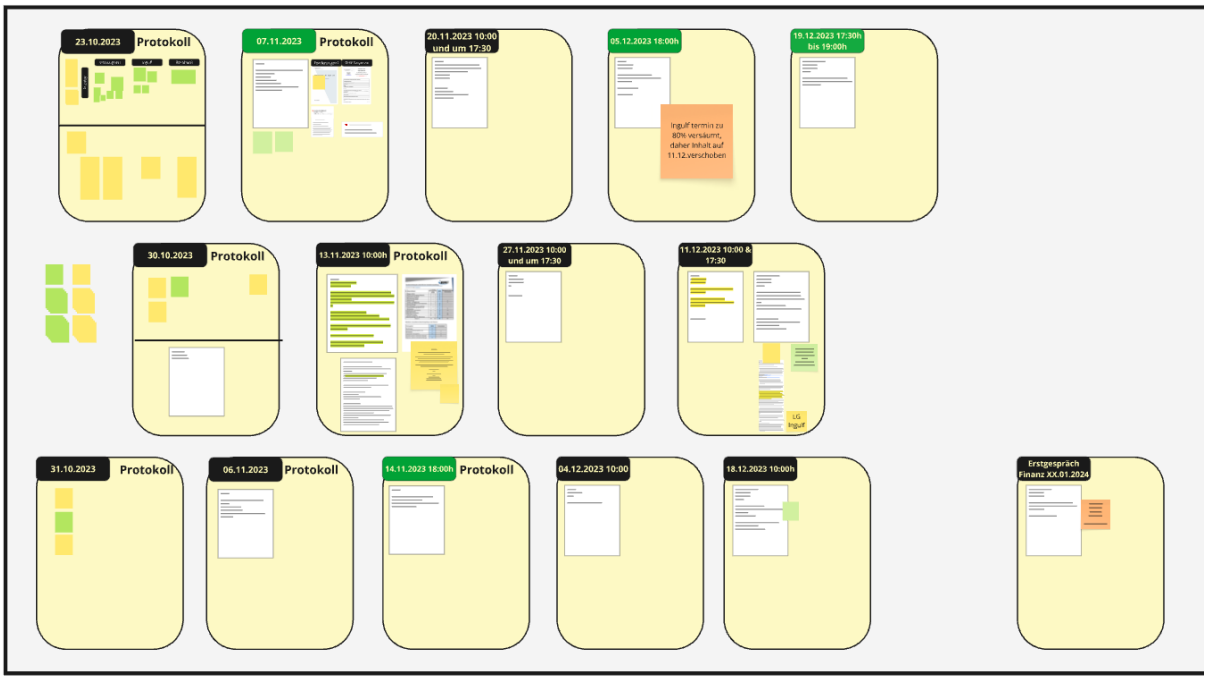
Notes. The initial use evolved, adding a basic calendar and protocol function. Managing tasks migrated to a different section on the board.

Figure 5. November evolution of the collaboration process Section (from Backup Board 2023.11.15)



Notes. By November, attendance was recorded using colour coded headers. Green means all three members were present, black means only two members were present.

Figure 6. December evolution of the collaboration process Section (from Backup Board 2023.12.17)



Notes. By December the protocol text block evolved, adding the function to plan agendas of upcoming meetings.

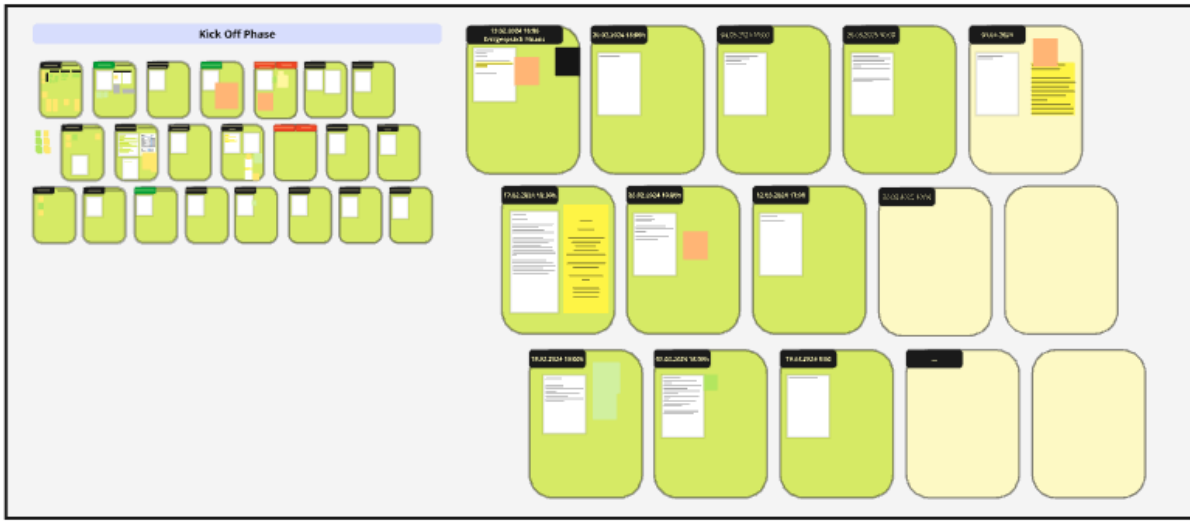
Figure 7. Redesign of the workbench section, with new “Results” and “Archive” sections (from Backup Board 2024.03.28)

Notes. The unused results area evolved into two new sections, with obsolete or completed areas moving from the workbench to their new sections.

Figure 8. February evolution of the collaboration process Section (from Backup Board 2024.02.23)

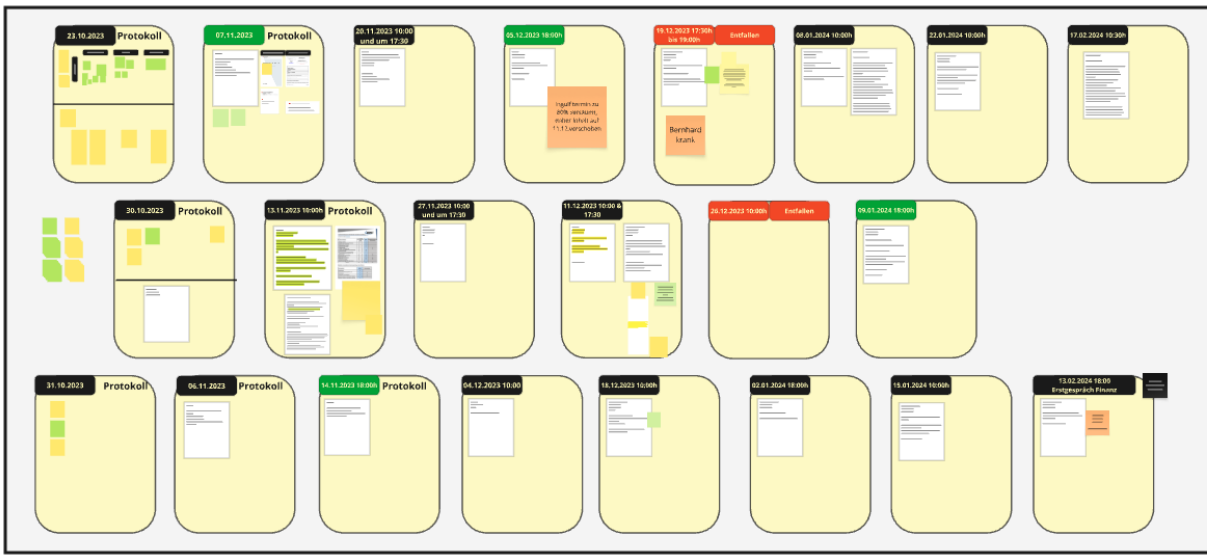
Notes. By February the colour coding scheme evolved, a green background indicating the completion of all agenda items of a meeting.

Figure 9. February evolution of the collaboration process Section (from Backup Board 2024.03.28)



Notes. With space in the collaboration process section becoming a constraint by March, the team archived obsolete meeting protocols through shrinking.

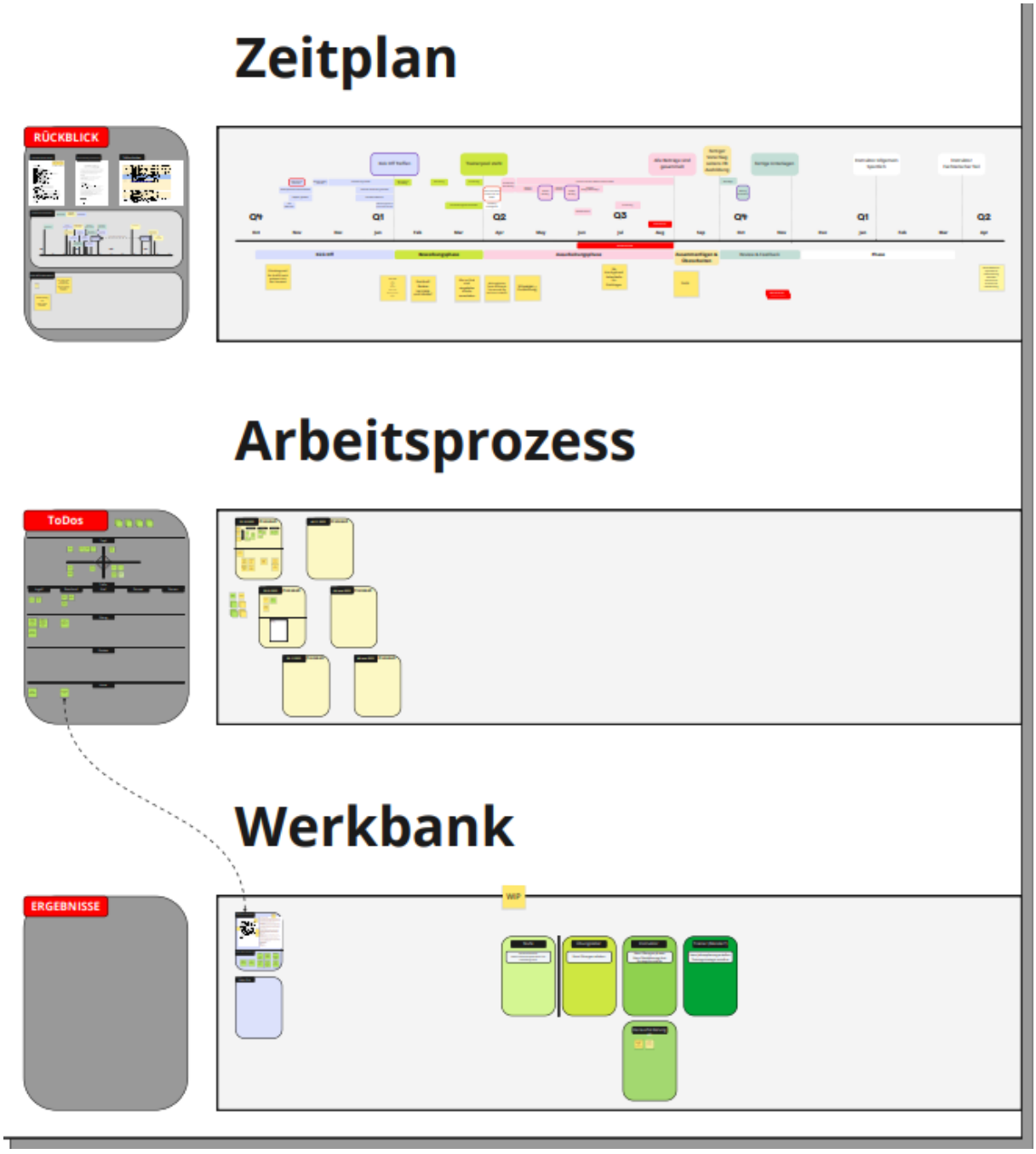
Figure 10. January evolution of the collaboration process Section (from Backup Board 2024.01.16)



Notes. By January, the colour red was added indicating cancelled meetings, and with the development of other sections of the board, elements beyond the agenda/protocol text block and dates/attendance header started migrating from the collaboration process section.

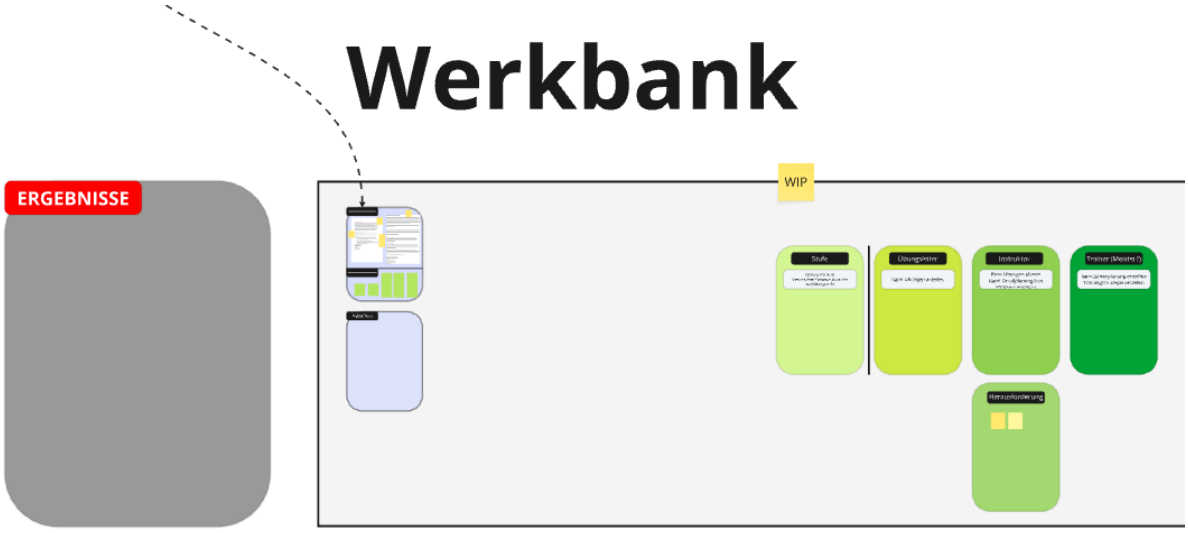
8.2.2. Example 2

Figure 11. Overview of the Miro board Structure (from Backup Board 2023.10.30)



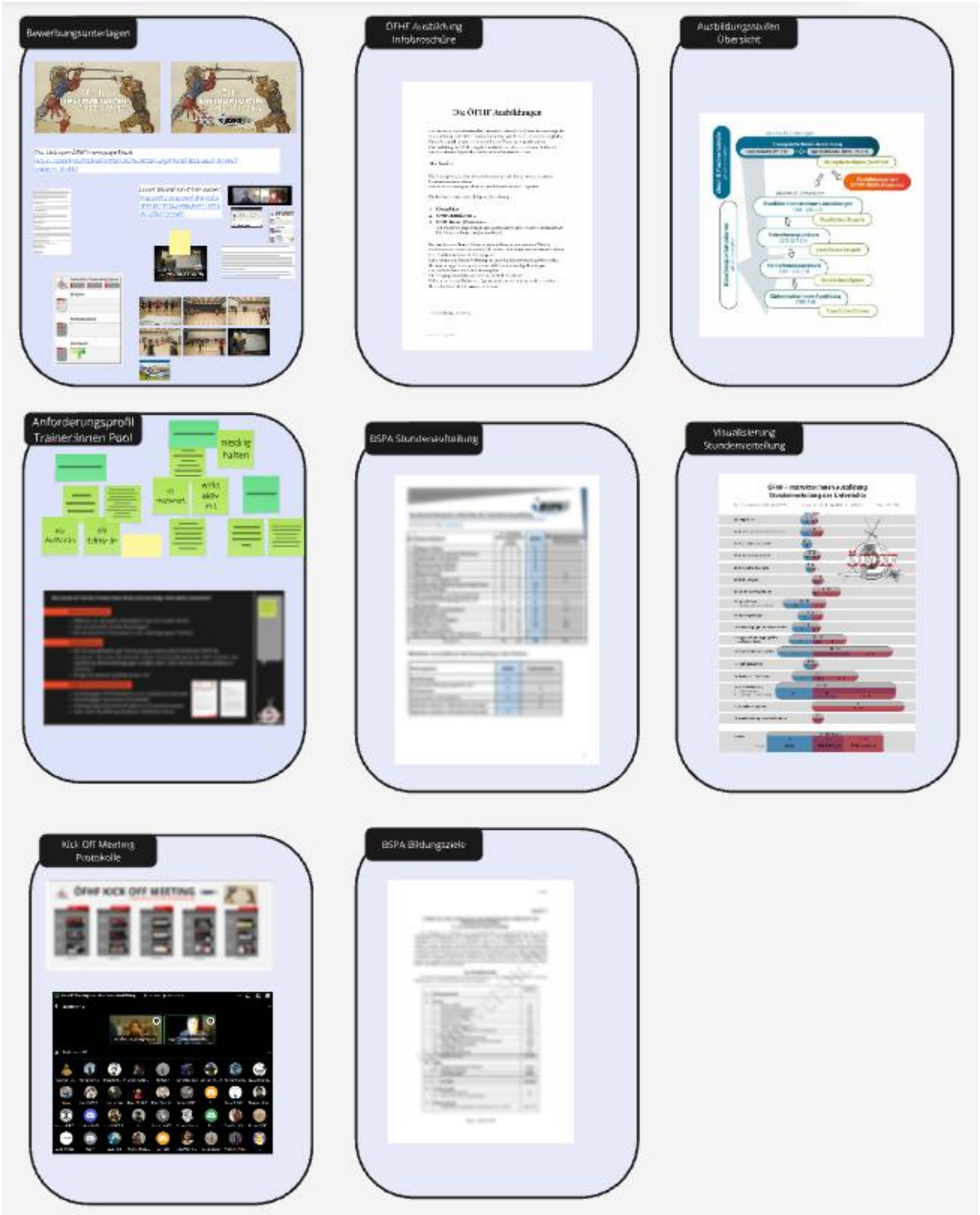
Notes. The area left of the workbench followed the layout of the Kan Ban Board above. Small black headers are used to demarcate areas.

Figure 12. Workbench section with an empty results area on the left (from Backup Board 2023.10.30)



Notes. The empty space initially had not planned function.

Figure 13. Closeup of new results section (from Backup Board 2024.03.28)

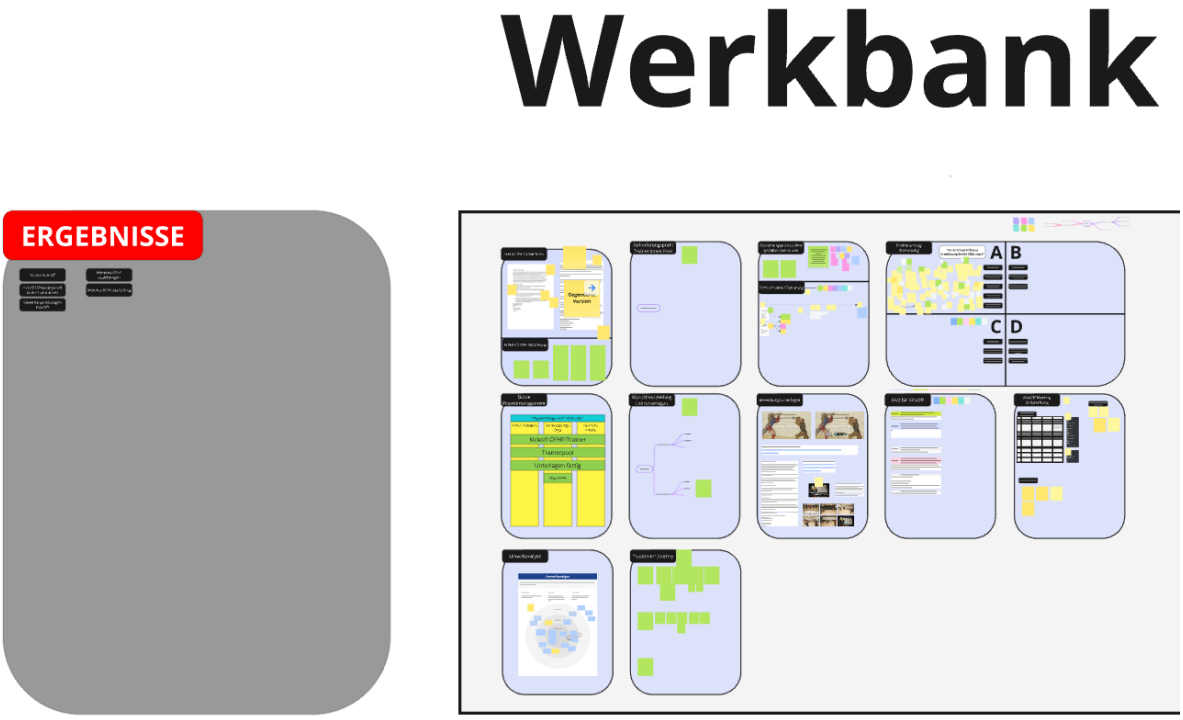


Notes. Key results are recorded and collected in the results section.

Figure 14. Closeup of new archive section (from Backup Board 2024.03.28)

Notes. Obsolete or completed areas in the workbench section shrink and migrated to the archive section.

Figure 15. November iteration of the workbench section (from Backup Board 2023.11.15)



Notes. An indexing functions emerges in the empty area on the left.

Figure 16. First iteration of recording results in the workbench Section (from Backup Board 2023.11.15)

Notes. Recording results with a collection of keywords in textboxes which dynamically link to the respective result on the Miro board (through the small blue arrow).

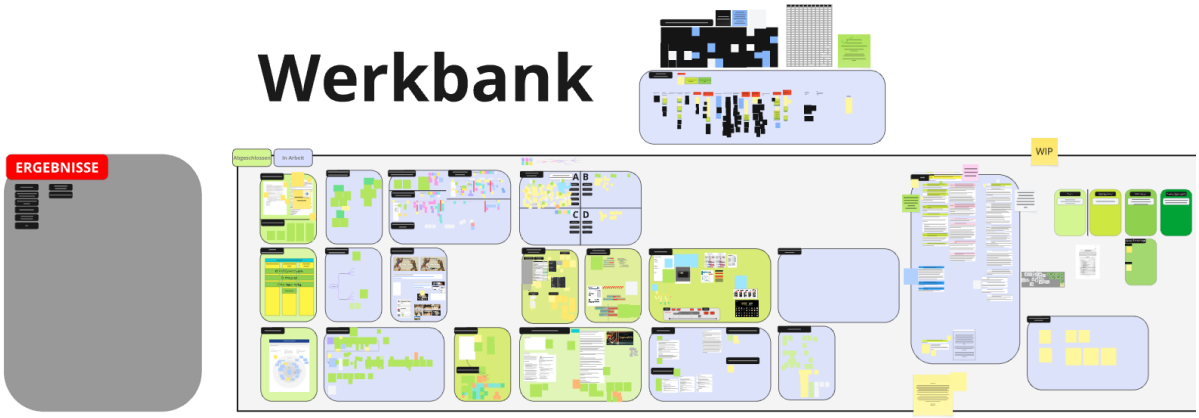
Figure 17. December iteration of the workbench section (from Backup Board 2023.12.17)

Notes. A green background of individual areas in the workbench section indicates completion of that package.

Figure 18. January iteration of the workbench section (from Backup Board 2024.01.16)

Notes. workbench section is used heavily, while the results section sees little use.

Figure 19. February iteration of the workbench section (from Backup Board 2024.02.23)



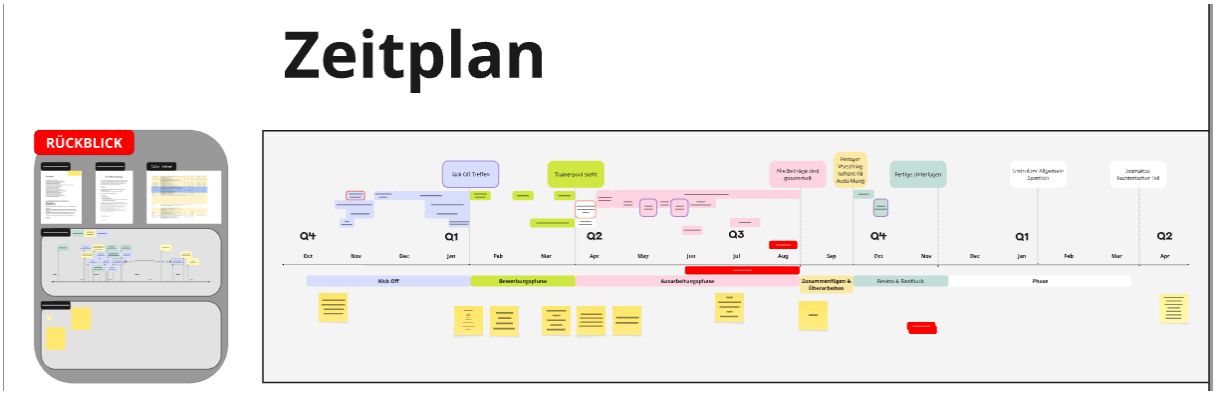
Notes. workbench section is overflowing, while the results section has not been used since January.

Figure 20. Area for brainstorming the redesign of the board's sections (from Backup Board 2024.02.23)

Notes. Needs and use cases in green Post-its, draft of new sections in yellow Post-its.

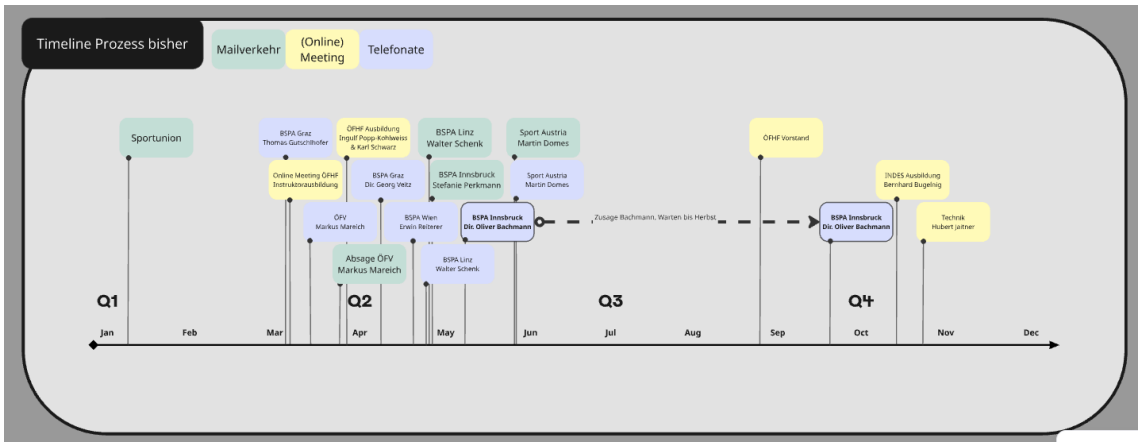
8.2.3. Example 3

Figure 21. Overview of the October iteration of the time plan section (from Backup Board 2023.10.30)



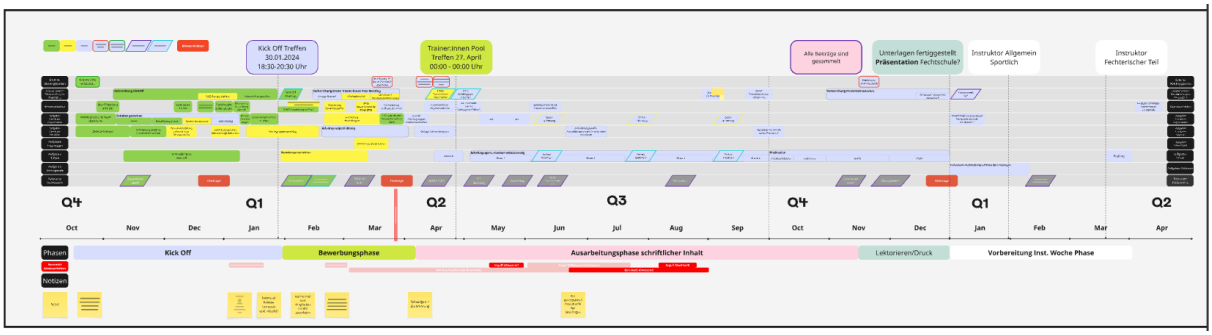
Notes. The time plan section was the structural basis for the entire Miro board layout.

Figure 22. Closeup of the retrospect timeline (from Backup Board 2023.10.30)



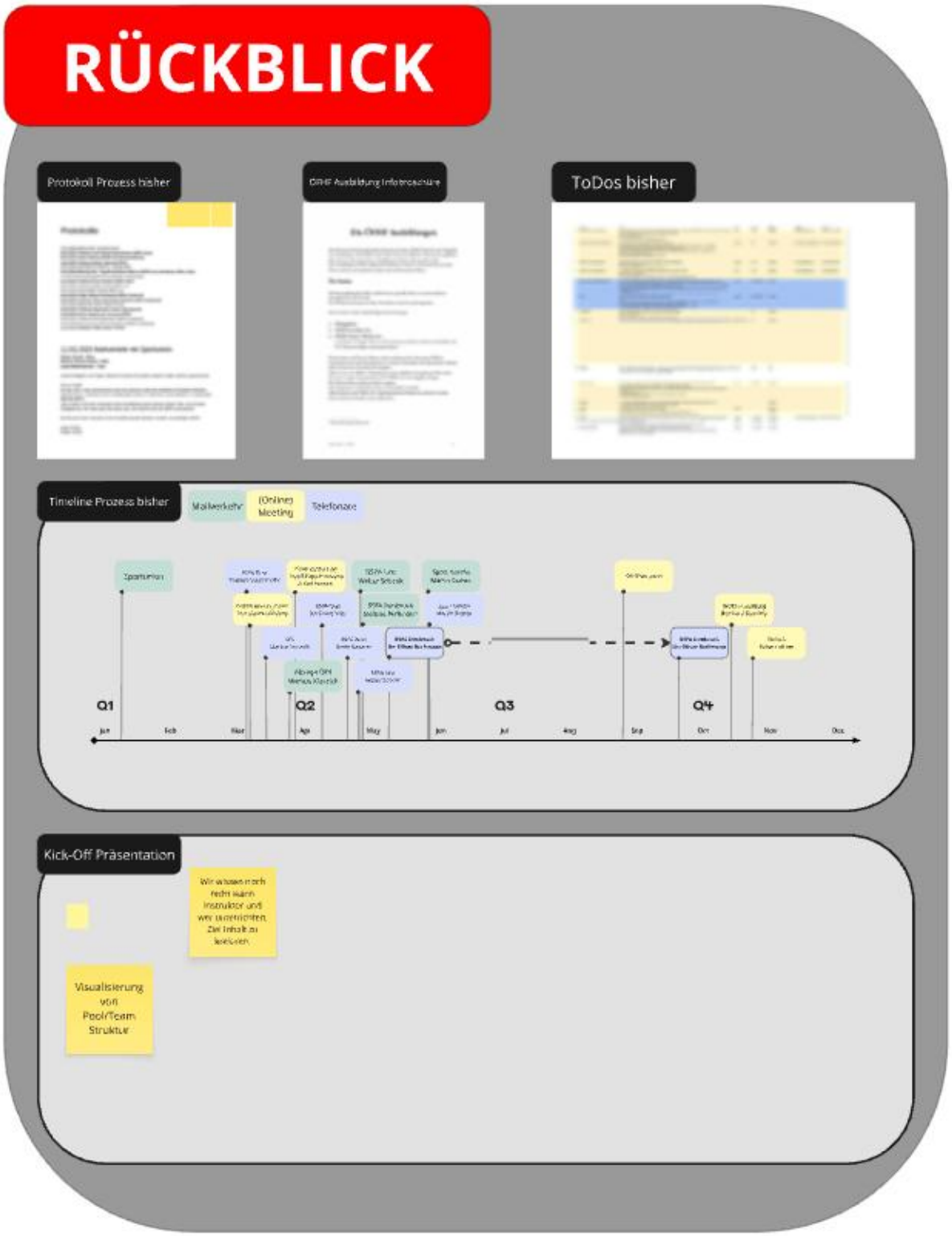
Notes. The timeline showcases the progress of acquiring the necessary official state partners before starting the project in October 2023.

Figure 23. March iteration of the time plan section (from Backup Board 2024.03.28)



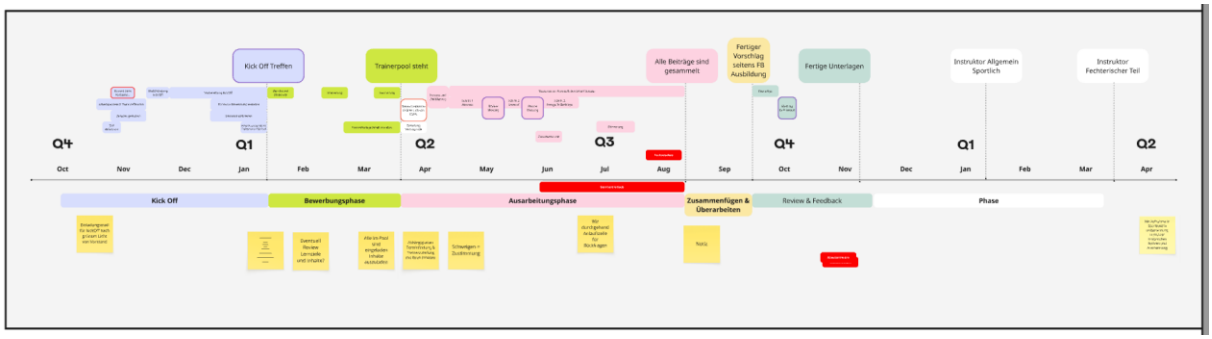
Notes. The final iteration of the time plan resembles the functions of a dedicated project time plan.

Figure 24. The left area of the time plan section, with a retrospect on progress thus far (from Backup Board 2023.10.30)



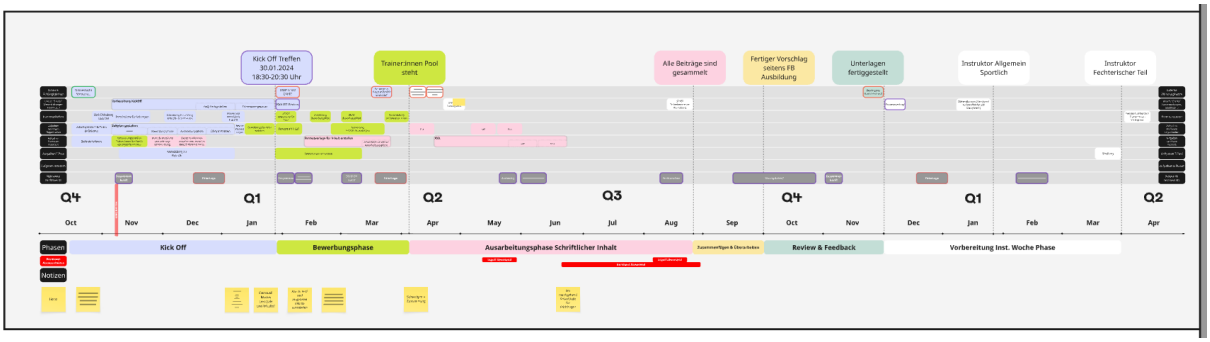
Notes. The retrospect area was used as a space to compile and show the projects progress before October 2023.

Figure 25. October iteration of the time plan section (from Backup Board 2023.10.30)



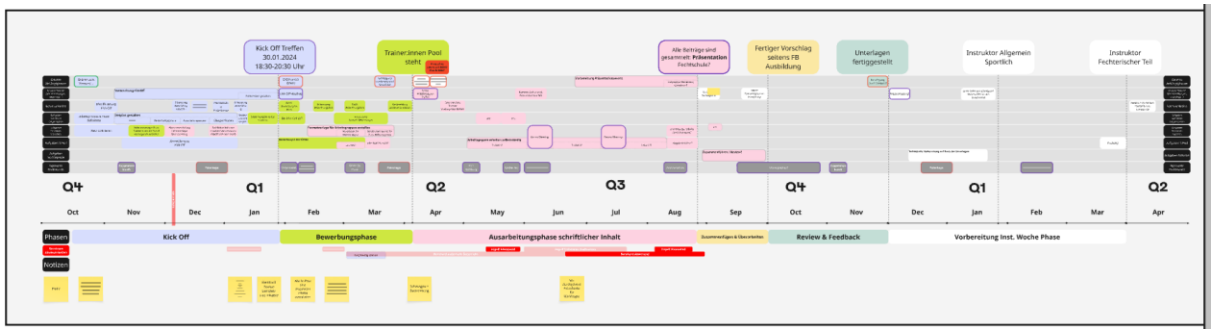
Notes. First draft of the project plan with colour coded project phases and milestones on top.

Figure 26. November iteration of the time plan section (from Backup Board 2023.11.15)



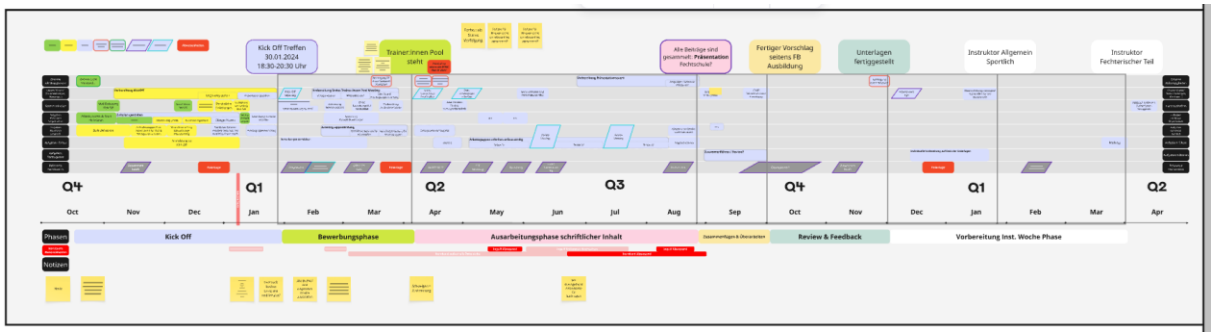
Notes. Rows were added to separate tasks into teams and themes, and a small red tracker was added (left bottom) to show progressing time.

Figure 27. December iteration of the time plan section (from Backup Board 2023.12.17)



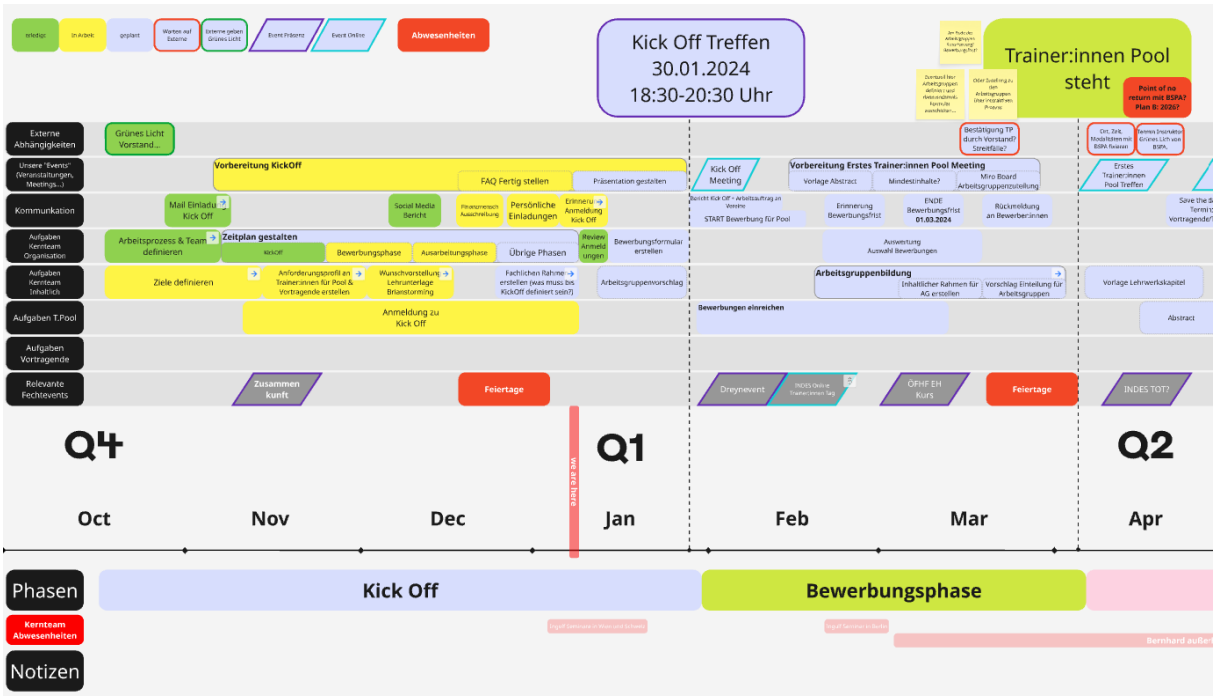
Notes. The colours of the tasks indicate the phase in which the task is due.

Figure 28. January iteration of the time plan section (from Backup Board 2024.01.16)



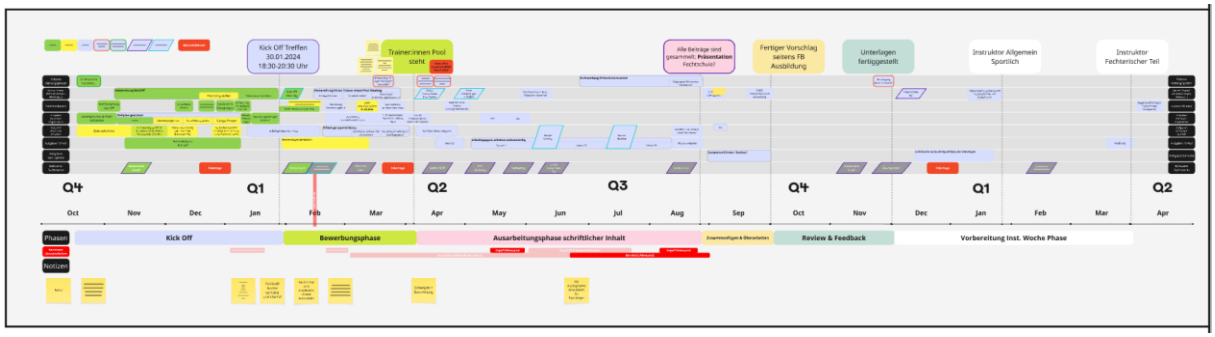
Notes. New colour coding indicating status, instead of phases, and new shapes and border colours indicating different types of events.

Figure 29. Closeup of January iteration of the time plan section (from Backup Board 2024.01.16)



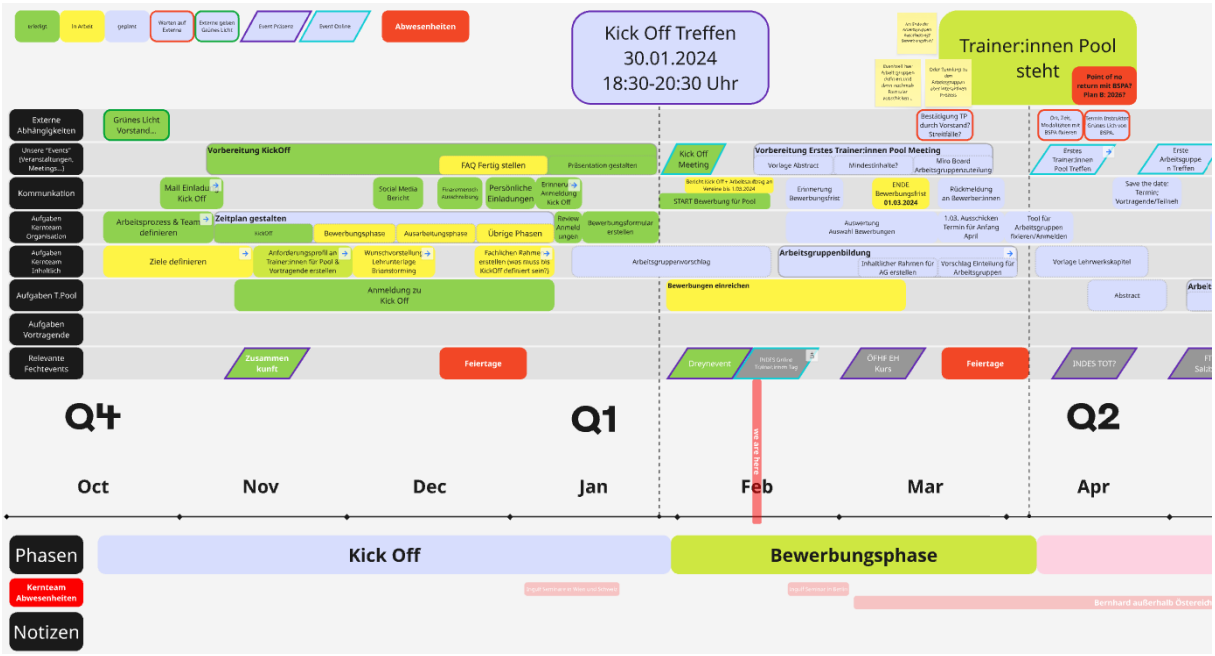
Notes. New colour coding was added, indicating the status of each task.

Figure 30. February iteration of the time plan section (from Backup Board 2024.02.23)



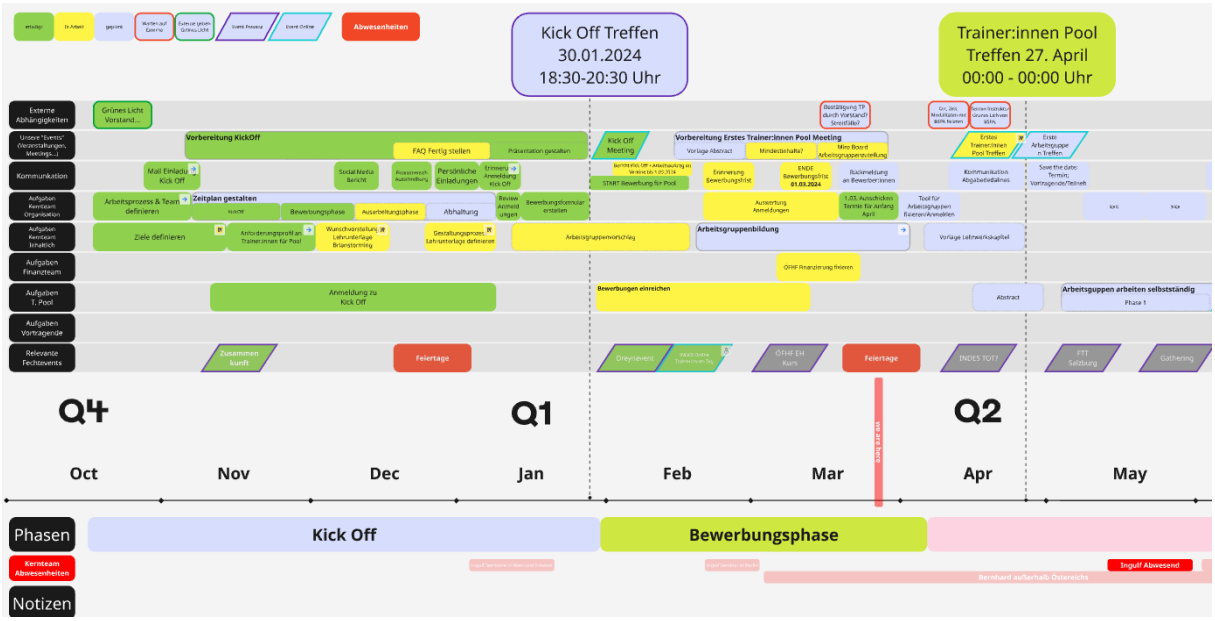
Notes. Note the remains of the colour coded phases and milestones from previous iterations.

Figure 31. Closeup of February iteration of the time plan section (from Backup Board 2024.02.23)



Notes. The colour coding scheme is adopted for the remaining period.

Figure 32. Close up of March iteration of the time plan section (from Backup Board 2024.03.28)



Notes. The colour coding scheme is adopted for the remining period.

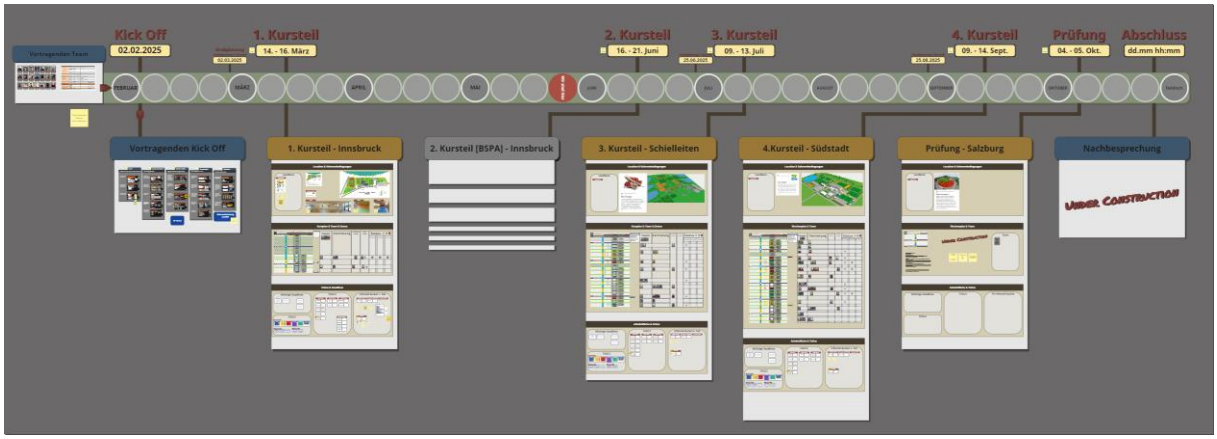
Figure 33. Kick off Meeting Board.

Notes. Miro was used like an interactive, collaborative Power Point or Prezi board.

Figure 34. The collaboration board for the 41 Trainers.

Notes. This board was used to manage the workflow and coworking process of 23 sub-teams from April 2024 to January 2025.

Figure 35. The collaboration board for the 20 trainers conducting the first iteration of the train-the-trainer programme in 2025.



Notes. This board was used to coordinate the preparation and planning of the 20-day train-the-trainer programme from February to November 2025.

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