Remote Collaboration Needs for New Work: Concepts, Procedure and Evaluation

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Abstract

More freedom, more flexibility, and reduced travel time for knowledge workers are just a few advantages of new work models, which have been discussed for several years now. Moreover, the problem of rural depopulation can be addressed by this concept. In the research project "Digital Teams", we aim to develop a digital open-source platform to support and optimize the digital work environment for distributed teams in rural areas, especially in the knowledge work context. In this article, we focus on the research and design aspects of the project. We provide insights on how we have used the design thinking approach for our research and the development of the UX- and UI-design concepts. We are focusing on an ecosystem concept, which provides all relevant services for knowledge workers in their daily work life, rather than focusing on a specific remote collaboration purpose. We present initial evaluation results, which tend to be positive and give an outlook on future work.

Keywords: New Work; Design Thinking; Collaboration; Groupware; Rural Depopulation

1. Introduction

The digital transformation is currently a megatrend. It permeates several areas of our daily life and business work, such as communication, transportation, and many others. It can provide support in many respects, make processes more efficient and user-friendly, and allows fundamentally new ways of use. We currently focus especially on new work models. New work models have emerged in recent decades. For example, the possibility to shift from presence work to mobile work. Of course, this is not true for all types of work, but knowledge work, in particular, offers the potential to use such mobile work models. However, the topic per se is not new. Already in the last century, ideas have been discussed on how to make work more flexible. In this regard, technical challenges were the focus in the 1990s, as the Internet was new at that time, and exchanging huge amounts of data was not possible as it is today.

Despite digitalization and the availability of a lot of different digital collaboration tools, knowledge generation still often works the best if team members are co-located [1, 2]. On the other hand, we have observed numerous other trends in the last decade that make this traditional form of co-located working more and more inadequate. Especially in the current COVID-19 pandemic, companies are trying to find new ways of distributed and mobile work. Many tools exist already, but they often have shortcomings, such as not being integrated into a holistic landscape or providing insufficient user interfaces for the users. The research project "Digital Teams" aims at establishing a platform that allows collaborative virtual work. The goal to be achieved through the coordinated development of optimized, end-to-end integrated application support for virtual teams on the one hand, and the necessary organizational framework conditions, on the other hand, is a significant increase in the quality of collaboration and productivity of virtual teams. An open data and service platform with smart services and apps for the collaboration of digital pioneers in rural areas will be created. This will make a significant contribution to increasing the employment opportunities of knowledge workers in rural areas and to counteracting the rural exodus in the long term.

In a previous publication [3], we focused on initial ideas and first solutions of what a technical solution to support distributed, and mobile workers might look like. We presented our open software ecosystem with the Digital Teams Platform (DTP) and services running on the platform. We gave details on the technical architecture and the dashboard as a landing page for using services, such as a task board, daily planning, mood detection, and an availability indicator. Based on another recent publication where we focused on describing our procedure to develop UX and UI-design concepts and giving examples for the main concepts, we provide an extended version where we added more concepts and focus on an initial evaluation of these implemented concepts [4].

This means, in this publication, we focus on showing how we arrived at our solutions and what is necessary to develop a more holistic and integrated solution with a suitable user interface and appropriate usability and user experience. We start with insights into this topic by presenting related work in Section 2. Section 3 describes our procedure and how we arrived at concrete results, which are then presented in Section 4. Section 5 provides details on how we performed an initial evaluation. Finally, Section 6 concludes our article and presents an outlook on future work.

At this point, it is mentionable, that the project Digital Teams already started in April 2018 [5]. At this time (pre-Covid) digital

collaboration software wasn't that popular. An initial version of Microsoft Teams was released just a year earlier, and its feature set was very limited compared to today. Since there was little comparable software, this paper does not include benchmarks with other products that are widely used today. This paper focuses on solutions to improve the work of remote workers that we have developed through our research.

2. Related Work

Remote work is favored by a variety of global trends. Digitalization and the use of information and communication technologies are a central driving force in enabling and developing remote distributed teamwork [6]. Changes in social values as well as demands for flexibilization, digitalization, and networking influence the design of remote work. Digital teamwork plays a central role in the debate about the working world of the future. A digital team is a group of people who have a common goal and work together on a mobile, semi-virtual, or virtual basis. Team collaboration is characterized by a significant amount of interaction in virtual space, the use of virtual collaboration tools, and work that is asynchronous in both time and space [7]. These definitions apply both to teams within organizations and across organizations.

The competencies of the individual team members of remotely distributed teams are crucial for successful digital collaboration and include self-organization, self-care, and mastering the use of digital tools. In addition to personal, team, and leadership skills, a set of organizational and technical standards that properly support remote activities in distributed teams need to be established [6]. Collaboration between team members benefits from tools that support both collaboration and the actual execution of work tasks. Distributed teams can profit from existing collaboration tools used by traditional on-site teams. Nevertheless, the tool landscape and personal preferences can make it difficult to collaborate well in distributed teams [8]. Many existing tools only offer solutions for a specific purpose rather than a more sophisticated platform with intelligent, integrated, and data-driven services.

Schweitzer et al. present a summary of collaborative tools and their use in the context of virtual distributed work [3]: For example, communication tools such as Slack offer functionalities such as video or audio calls and chats. Others, such as Google Drive, support document sharing. Microsoft Teams has brought many innovations in the last year. They have integrated this communication tool into its cloud-based office suite, and also opened it for third-party providers to integrate their apps into the Microsoft ecosystem. Thus, the major players are also pushing their existing products toward ecosystems.

However, all these initiatives are heavily brand-oriented and aimed at the original product. In addition, none of the providers offers open-source technology, which would enable further distribution and connection of niche solutions. Current work tries to address organizational, technical, and personal challenges in digital teams and to develop solutions for these challenges. The main objective of our Digital Teams solution, on the other hand, is the development of an open ecosystem for distributed work.

3. Design Process

In this section, we will describe the concrete methods and tools used in the design process. The current project is following the design thinking approach, in which three design phases are performed as shown in Fig. 1., i.e., inspiration, ideation, and implementation [9]. This well-established approach allows us to get a deep understanding of the users' needs and to translate them into requirements and planned product features while testing their feasibility at the initial stages [9]. Fig. 1. shows the three process phases and lists the methods and tools used in each phase.

In the first phase of the process (INSPIRATION), the problem space was uncovered using a series of methods that built on each other. First, general workshops were conducted to identify the typical problems of the domain. Based on the results, interviews were conducted, which promoted a deep understanding of the problem areas. The findings of the interviews were then validated with the help of a questionnaire and concrete problem statements were derived. The second phase (IDEATION) dealt with the generation of ideas for the derived problem statements. Personas were created, and two innovation workshops were held for the generation of solution approaches. The promising solutions were, in the third phase (IMPLEMENTATION), prototypically implemented and reviewed in walkthroughs with experts. Moreover, the prototypes were discussed with relevant target groups and new ideas and impulses were collected, which further improved the developed solution. As in any Design Thinking process, this was an iterative run through the different phases. The individual activities are described in detail in the next sections.

3.1. Inspiration

In the first phase, we analyzed the stakeholders' needs using four different methods, which helped the project team to understand the current situation in the remote work domain in Germany.

Initial Workshops: As a first step towards understanding the domain of remote work, a series of interactive workshops were conducted [6]. The goal of these workshops was to capture a broad spectrum of success and influencing factors in remote collaboration to derive initial fields of action. In February 2019, four interactive workshops were held in different German cities (Leipzig, Berlin, Munich, and Kaiserslautern). A total of 56 representatives. 41 from industry, eight from research, and seven from the public sector participated in the workshops. All participants were knowledge workers [10]. Using the "World
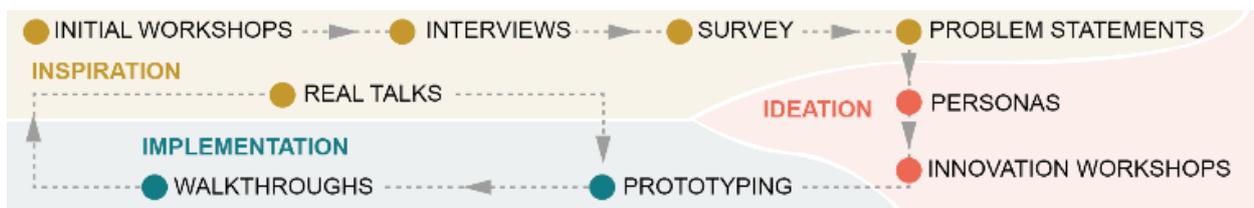

Fig. 1. Design thinking activities and process

Café" method, many aspects from the areas of social factors, technological factors, and structural conditions were identified. The social factors dimension includes aspects that, e.g., influence collaboration, relationships, and the social environment of the team members. The discussion on technological factors revealed that many of the participants already use the option of mobile work and the availability of information and data from almost everywhere. The structural conditions referred to aspects of labor law, public and private infrastructure, as well as organizational forms, leadership, and social acceptance.

Interviews: The interviews aimed to deepen the findings from the initial workshops and figure out the state of the practice regarding the organization and structure as well as constraining and supporting factors of remote work within distributed teams [6]. We performed pre-structured guided interviews with a total of 14 interviewees with at least one year of experience with remote work (two operational team members without management functions, four technical team leaders, four disciplinary team leaders, and four disciplinary leaders of multiple teams). Based on the interview results, four main challenge areas were identified. Communication, work organization, and structure represent the largest or most frequently mentioned challenges for the participants, followed by the topic areas of technology and tools as well as personal interaction. Additionally, a tool evaluation was performed with the interviewees, and several areas with improvement potential were elicited.

Online Survey: The central questions identified in the workshops and interviews were validated quantitatively with an online survey [6]. A total of 103 people took part in the survey. All participants reported a minimum experience of one year in remote work with distributed teams; over 50% reported experience of more than 2 years. The largest proportion of the survey's participants were team members of a remote distributed team, 25% were leaders of one remote distributed team, and 10% were leaders of multiple remote distributed teams. The focus of the survey was on confirming the challenges that distributed teams face in terms of remote work, but also on identifying the opportunities that arise from that. It assessed the collaboration of remotely distributed teams regarding topics such as creativity, trust, productivity, sense of belonging, and conflict culture. The survey was set up online via LimeSurvey and ran for three weeks in July 2019 [3].

Problem Statements: A good understanding of the problem is essential in design thinking. In this first phase, the team must derive clear problem statements from the various research results and thus be able to identify concrete design goals for the development of ideas. Through the broader research conducted in the project, 50 problem statements emerged. These problems were weighted and prioritized by the project team according to the learned aspects. Worth mentioning are the following aspects:

- Digital communication was often described as tedious and time-consuming;
- Traceability of work progress, responsibilities, and task distribution in the team was evaluated as much harder to see;
- Isolation, for example in the home office, requires a higher degree of self-discipline and structure;
- In the case of hybrid sets (part of the team on-site, part remote), many things are clarified almost automatically with the team on-site while involving and informing remote team members is perceived as double work;
- Discrepancies are much more difficult to identify and resolve at a distance; and
- Non-verbal communication suffers.

Realtalks: In the project, we have been hosting monthly Realtalks since June 2020. The purpose of Realtalks is an up-to-date exchange with our social media community. This consists of various stakeholders who work remotely and explore new work concepts. These Realtalks generate new stimuli, which we incorporate into the design of individual features, especially based on the lessons learned through the restrictions in the context of the COVID-9 pandemic. The Realtalks helped to determine new requirements and to validate current concepts of the solution. Although this is a typical task of the inspiration process, this task is performed since the prototypes were available. This shows the flexibility and iterative characteristics of the design thinking process.

3.2. Ideation

The learnings of the inspiration phase were synthesized into concrete personas and solution approaches were developed in an innovation workshop.

Personas: With the results of our inspiration phase, we followed the design thinking process and went into the concretization of personas and their needs. As archetypal users, personas represent the goals and needs of the target group and make it possible to make well-founded decisions in the development of user-friendly products right from the start. Personas illustrate typical representatives of the target group. In our case, five personas emerged based on the results from the requirements elicitation [6]: two personas from the team member context, two personas in the leadership position context, and one administrative persona. For the further process, we focused on the two personas from the team member context. They form the largest user group of the Digital Teams Platform (DTP). We call the two personas Paul Schmidt and Lara Fischer (Fig. 2.). The persona description includes diverse information about their
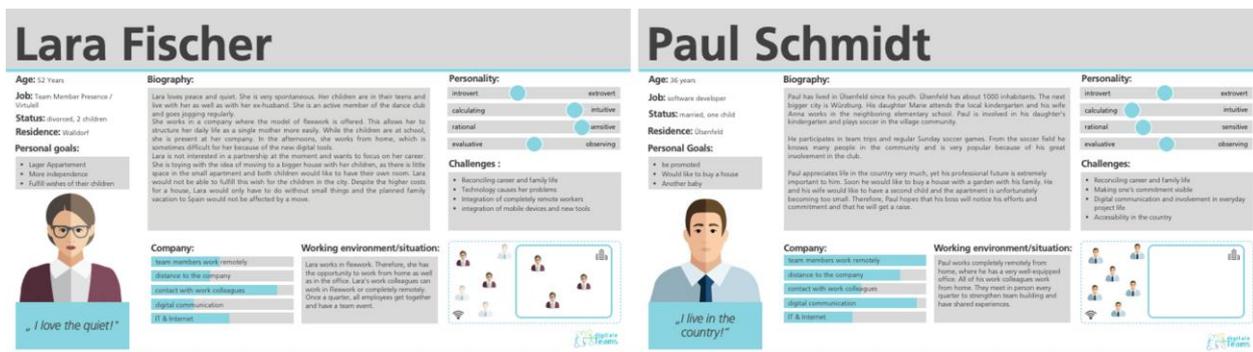

Fig. 2. Lara Fischer and Paul Schmidt are representing the largest user group of the DTP

lifeworld, making them understandable as people and enabling project participants to identify with them. Paul is 36 and a software developer. He lives very far from his employer and works completely remotely from home. He communicates with his work colleagues mainly digitally. He appreciates village life and local sports activities. Lara is 52 and lives with her two children in a rural area, close to a larger city. Lara's employer allows a flex-work model. Therefore, Lara works in the office in the morning and from home in the afternoon, which is sometimes difficult for her because of the new digital tools. Lara likes flex work because it allows her to better care for her children.

Innovation Workshops: The personas and the problem statements supported the generation of ideas and solutions in an innovation workshop performed twice in the summer of 2019, in Kaiserslautern and Berlin. The innovation workshops aimed at creating ideas for the different personas and challenges explored in the first phase of the design thinking process. In the two-day workshops, 18 participants from different backgrounds contributed to the development of over 500 ideas. One-half of the participants were project members and involved in the activities of the inspiration phase. The other half were people interested in the topic, experts or consultants, in the area of distributed teams and knowledge workers. The identified ideas were synthesized into four different future scenarios that described an ideal workflow in remotely distributed teams. Fig. 3. shows some impressions of the innovation workshop performed in Kaiserslautern.

Concept workshops: The ideas and scenarios developed in the innovation workshop were prioritized and concretized into features and system functions through user stories. Over 1500 user stories were grouped into 29 epics and prioritized for the creation of interaction concepts and to support architecture decisions. Concept workshops were conducted to develop concrete blueprints and workflows for the identified user stories. Interaction designers and developers participated in these concept workshops to ensure a balance between meeting user needs and technology requirements for implementing the features. Later in the process, the concept workshops were used to gather specific user feedback on the prototypes and improve the final concept for implementation.

3.3. Implementation

The ideas of the innovation workshop were concretized in a large implementation phase, during which prototypes were evaluated iteratively by potential users of the system during the complete conception phase. A final long-term evaluation with the final implemented product started in summer 2021.

Prototyping: We started our prototyping process with fast and easily drawn scribbles. For one need, we often had multiple solutions scribbled on paper. After an agreement was reached on a solution, the next steps were low-fidelity prototypes or mockups of our solutions to build a clear layout and see whether our concept works. The last step of building the prototype was the creation of the final high-fidelity prototype and the documentation in a style guide. The high-fidelity prototype was created in Adobe XD because of the ease of sharing the finished screens with the development team. The style guide is a simple Word document containing explanations of the basic structure of the DTP, color schemes, explanations of features in the tool, and a pixel-independent concept design of each element. Details regarding the final tool will be discussed in chapter 4.

Walkthrough: Walkthroughs were the most frequent method to evaluate the platform in our project. They were done during the bi-weekly sprint review meetings and are a bit different from the other evaluation methods: They are conducted after the development team has created the front-end UI. The team then discusses every single step to find errors, misleading interactions, or things that do not fit the prescribed UI design. Furthermore, aspects of the implementation were discussed in the walkthroughs. In development processes, it happens that features cannot be implemented exactly as they were conceived. Therefore, it is important that during such product reviews, designers and developers work together to design possible adaptations without negatively affecting the user experience of the product. Furthermore, aspects of the implementation were discussed in the walkthroughs.

4. Digital Teams Platform - Concepts

The above-mentioned design process phases and the results we gathered from them are the foundation of the concept phase. This chapter describes how we used the results to build the UX and UI concept of the DTP. The tool consists of two basic concepts, the virtual assistant Teamo, which is not discussed in this paper, and a combination of dashboards, consisting of three different types of dashboards (Personal View, Team View, Meeting View) to support workers and distributed teams during their workday [3]. Those views are placed in a container layout, which is planned to be configurable by workers regarding their own needs in upcoming releases. We plan to use a two-row layout. For each row, the user can decide how many services they want to place there, the maximum being three services per row. In the current state of the platform, we are using a fixed layout to keep the development effort low.

Because communication, organization, and scheduling are already big topics in the digital work sector, many tools are already available and in use (MS Teams Chat, MS Planner, Jira, Slack, Trello, etc.). Those can get connected to our services as a provider. There are four provider types available that will connect to our features: calendar, chat, file storage, and task(board). Once connected to the provider, all features in the

Fig. 3. Impression of the Innovation Workshop in Kaiserslautern (Summer 2019)

view can access them. The following paragraphs describe the three different types of dashboards and their key features.

4.1. Personal View

The Personal View is the private space for each worker. Our Research has shown that even if users are well-connected to their teams, they need a space where they can manage their working day and where they can connect with other people outside a specific team [6]. An example of this is a call with colleagues from Human Resources, to discuss further training opportunities. The view was designed to support this need with a freely configurable dashboard that users can fill with their preferred features.

This section focuses on one of the features of this view. Our research has shown that there is a great need for structuring and organizing a workday. Especially when a user has no personal contact with their co-workers, it is easier when they see directly if there is a timeslot in the co-worker's plan or not. Also, users need to stay focused on their tasks. Interruption is a problem, and remote work supported with the right tools can solve it. As we have learned, the boundaries between work and private life blend into each other through remote work. Because of all of this, a successful organization of work, focus time, and free time are crucial. Our feature "Your Daily Planning" will support workers in mastering this. The feature uses a 24-hour clock, which can be filled with tasks created in different teams, personal tasks, meetings, and private events (Fig. 4.).

Additionally, the feature includes a module that allows planning the day. The Information View houses the above-mentioned 24-hour clock and a list view of the user's day. The clock serves as an overview of the day; every single event is listed there. Theoretically, every worker can work from any location and time zone he wants to. A 24-hour clock is a simple, understandable tool to easily see when someone has the time or not. Because we do not want to overburden the user with all this information, the detailed list was added as a supportive element. It only provides the information needed for the next few hours, which makes it easier to stay focused throughout the day.

When starting the planning process, a module with two columns, one for the list of one's tasks and one for the known 24-hour clock, opens in an editable state. Tasks can be dragged from the left side onto the clock. The user can edit the start and end time and the status type of a task. The status has three different states (available, not available, do not disturb) to show whether the user needs focus time or whether it is okay to contact them.

A click on the clock allows a user to add personal tasks or free time, which automatically shows that the user is "not available". The marked time slot on the clock is blocked. This supports the concept of a more flexible workday: If employees need a bigger break during the day, they can show this to their colleagues using this feature.

The daily planning feature was designed in this way to counteract the blending of work and private time. Workers get a supporting tool that visualizes their whole day, with a clear separation between work and private life. This information is provided in much less detail to their colleagues in order to help them find the right time for a meeting while respecting the free time of others. The tool was also designed in this way to allow users to work in a focused manner and without interruptions, which is a valuable advantage of remote work according to our research data [6].

4.2. Team View

In the Team View, the team can configure their dashboard layout and the features displayed in it. Each team member sees the same team dashboard. In addition, the team can decide for themselves which tools they want to connect to their dashboard. The tools can be linked during the configuration of the dashboard and other providers can be connected at any time. This open system is a unique selling point compared to other providers. Thus, the individual connected tools can come from different providers. This gives the team the freedom to choose their tools independently. The Team View offers various features to choose from, such as the availability of colleagues, the daily planning in the team, a live mood barometer, team chat, or the option to show all of one's tasks scheduled for the day as well as the possibility to store the most important Team documents via SharePoint. In this section, the advantages of the two features, availability display, and mood barometer, will be elaborated in more detail.

As our studies have shown, communication is one of the biggest hurdles for digital teams [6]. Digital communication is much
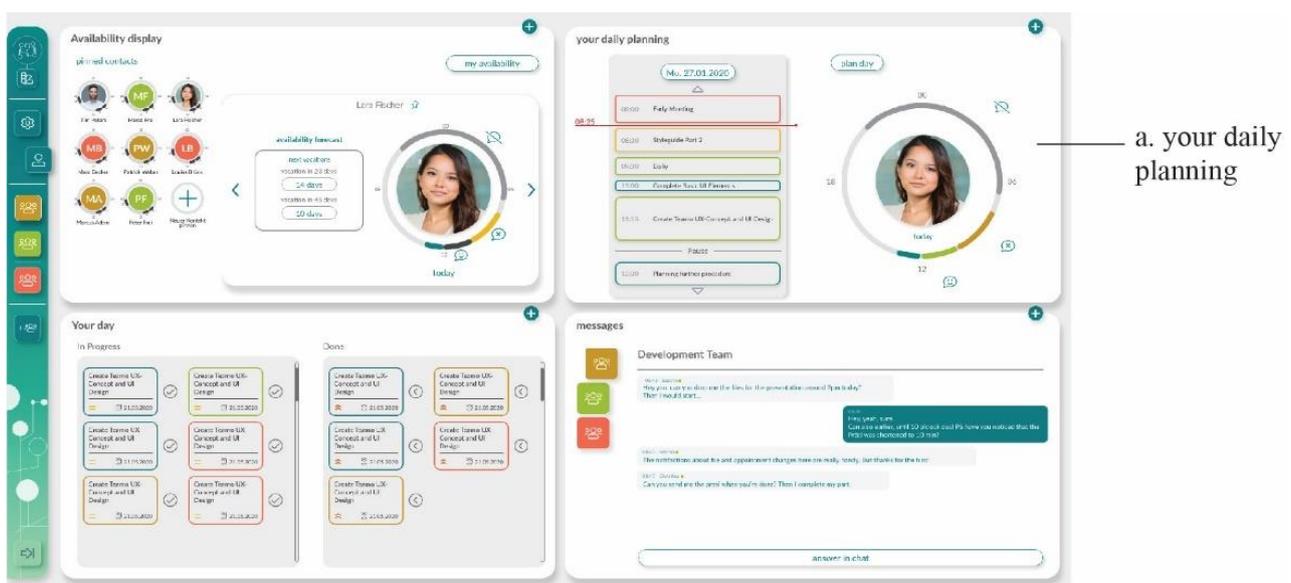

Fig. 4. The Personal View filled with four features. The top right container houses the "Your Daily Planning" feature.

more tedious. Aspects such as colleagues' vacations or availability are communicated in the office through osmotic communication. Osmotic communication describes all the information that flows into the background hearing of members of the team, e.g., in the coffee kitchen or when several people are sitting together in one room. Private conversations rarely happen in the digital space because digital communication is more factual, so we miss out on all the information in the background [6]. The hurdle to approaching colleagues is also increased by the fact that we do not know whether they are available. To increase transparency and facilitate communication at this point, we developed the concept of the availability display.

The availability display (Fig. 5.) uses the 24-hour clock (described in more detail in section 4.1) to show how busy a colleague is today and when a colleague can be contacted. In addition, the availability display tells the user when the colleague has planned their next vacation. This information facilitates the user's organization and saves communication effort. While Microsoft Teams, for example, only displays the current availability via a status indicator [6], the user can plan for the long term with the availability display of the DTP. Searching for appointments with several colleagues is also supported. The user specifies which team members are to be involved and at which time the meeting should take place. Several suggestions are made to the user, and a meeting request can be sent directly. To keep track of important contacts, these can be pinned on the display. The team members manage their availability displays. Team members add their next scheduled vacation themselves via a pop-up window. In the popup window, the user can create up to six vacations via a calendar picker. The vacations can be edited or deleted by the user at any time. In the current development phase, not all functions can be developed yet due to budget constraints. Therefore, some features are only being elaborated conceptually.

In distributed work, it is important to create communication that is close to being present. In virtual communication, body language, mood, atmosphere, and group dynamics are partially

lost [6]. This can be prevented by virtual mood indicators. For this, we have developed the concept of the team mood barometer (Fig. 5.). This barometer reflects the live mood of the team. For this purpose, all team members can show their current mood in relation to the team in their Team View. The input is divided into four dimensions: motivation, stress, satisfaction, and productivity. The team members can click on a positive, neutral, or negative emoji for each category. To avoid misunderstandings in the interpretation of the emojis, all emojis are provided with a tooltip. This tooltip indicates the meaning of the emoji and is the same for every team member. Based on the clicked emojis, the team mood is calculated and displayed in a separate window in the Team View in the form of spheres. The evaluation is anonymous and does not provide any information about what other team members voted. It is also not observable how many team members have indicated their mood to prevent pressure from superiors. Compared to other similar tools, the live team mood is a unique selling point. The DTP can collect and evaluate the team mood over a longer period. The recordings enable the project leader to recognize imbalances at an early stage and to initiate appropriate measures. It is advisable to talk to the team in the event of a prolonged imbalance in the mood to resolve any conflicts that may exist.

4.3. Meeting View

In our requirements survey results report, communication was cited as one of the most serious challenges in the digital work context. Aspects such as higher communication effort as well as higher documentation effort and loss in efficiency were mentioned frequently. Another factor is limited visual information. Through digital meetings, a lot of non-verbal communication via gestures and facial expressions is lost [7]. Due to the lack of non-verbal communication, misunderstandings can increase. The detection and evaluation of mood in meetings is an additional challenge. The moderator of the meeting, therefore, has the difficulty of assessing when he should intervene in a discussion or when a discussion should be postponed to another meeting. There is also the danger that the
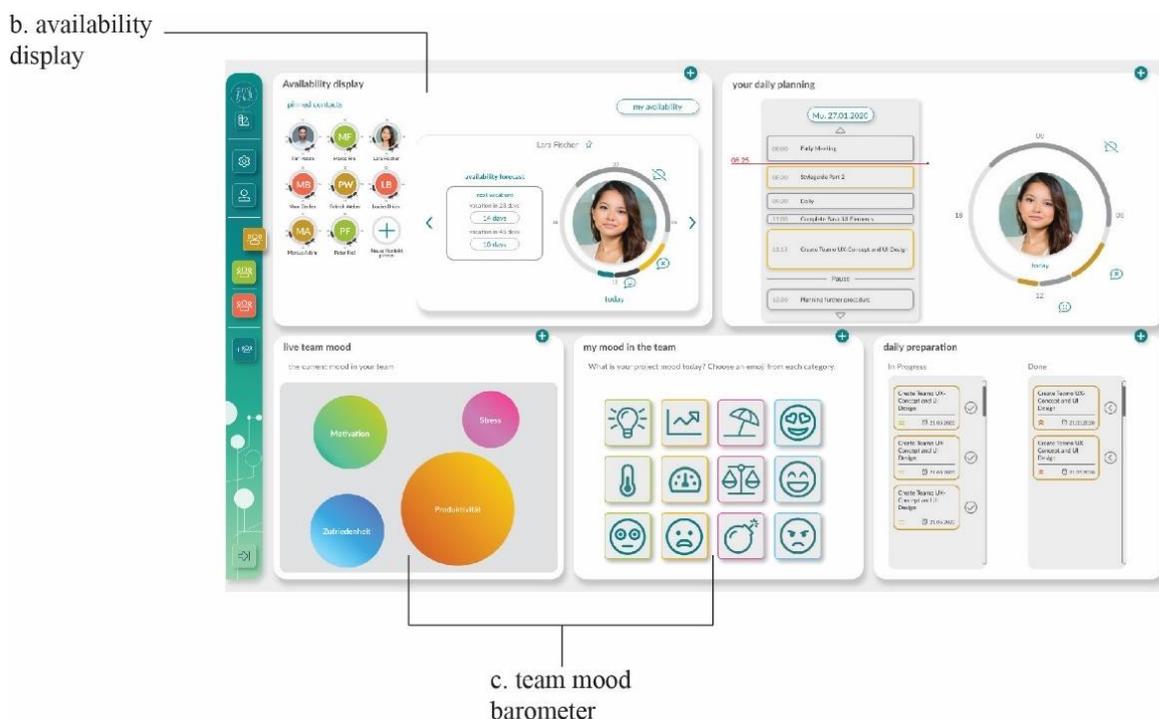

Fig. 5. The Team View with five features. The top left with the "Availability Display" and on the bottom left the "Team Mood Barometer".

meeting participants do not perceive each other. Also, respondents indicated a fear of an imbalance in the share of speech and that introverted personalities would miss out on digital meetings.

Virtual meetings are one of the most important communication channels and have their special requirements, which predominantly only occur in this context. Based on these findings, we decided to develop a separate view for meetings (Fig. 6.). This view differs in several aspects from the Personal View and the Team View, but also in comparison to similar products like MS Teams [11]. For a Teams meeting, a second window opens from within the system where the video call takes place. The DTP, on the other hand, adapts the current dashboard to the meeting situation. The user is only shown information that is important for this meeting. This avoids a change of context and enables a better focus. Furthermore, one window facilitates the handling, as it is not necessary to constantly jump between the current system and the meeting. From our studies, we found that a meeting agenda, as well as a transcript, are important requirements for a meeting. An overview of the speaking parts and a lightweight option for voting additionally support the moderator. The possibility to register speaking contributions in the agenda also makes it easier for introverts to get involved in the meeting. The virtual assistant Teamo is also used in meetings. It keeps the minutes of the meeting and can plan follow-up appointments if there is an increased need to speak. Teamo also helps if the meeting time is exceeded or, as a neutral instance, if the meeting leads to major disagreements between the participants.

If a meeting is about to start, a reminder bell appears in the navigation bar. Via this icon, the participant can go directly to the meeting view or can inform his colleagues about a delay. If a participant arrives later, he can read what has already been said in the transcript. The transcript also serves as an aid for foreign words. These are recognized by the platform and provided with an explanatory link. All important information for a meeting, such as meeting agenda, documents, and participants, can be created in advance. In addition, the minutes and collected data such as speech shares, emotions, and reactions are stored in a meeting folder in the file overview. Live transcription, meeting mood, and timer are displayed in the layout (Fig. 6.). Tedious routine tasks are taken over by the virtual assistant Teamo. The virtual assistant Teamo also helps if the meeting time is exceeded or, as a neutral instance, if the meeting leads to major disagreements between the participants.

5. Evaluation

The official evaluation phase of Digital Teams started in June 2021. The length of this phase was set to three months. Six teams were involved. Each team consists of three to seven team members. The teams were invited from different companies with different specialist fields, like work science, banking, consulting, and the software development sector. The reason for this decision is the fact, that we do not see the software as a tool only for software development teams. Alike comparable tools, we deliver a solution for every team in every specialist subject. All companies are located in the German-speaking region. Until now we cannot deliver final results but can show preliminary trends, identified during the evaluation. The project team used questionnaires and conclusion workshops with the users to analyze the usage of the DTP.

First, we have analyzed qualitative feedback. There is potential for improvement as identified by the users' feedback. Four of the six teams want more freedom regarding the configuration of the tool and its design. That means some teams would like to colorize dates and tasks in different colors, to identify them more easily. In this case, we must mention, that in the version the teams used for evaluation, the configuration of different functions and the usage of different layouts were not available, which could have affected this. The availability display was positively accepted, but also needs some improvement regarding the visibility and also interaction when multiple dates overlap each other. Also, multiple groups have already mentioned, that they have the wish to work with the DTP on mobile devices like a tablet. It is also noticeable that some
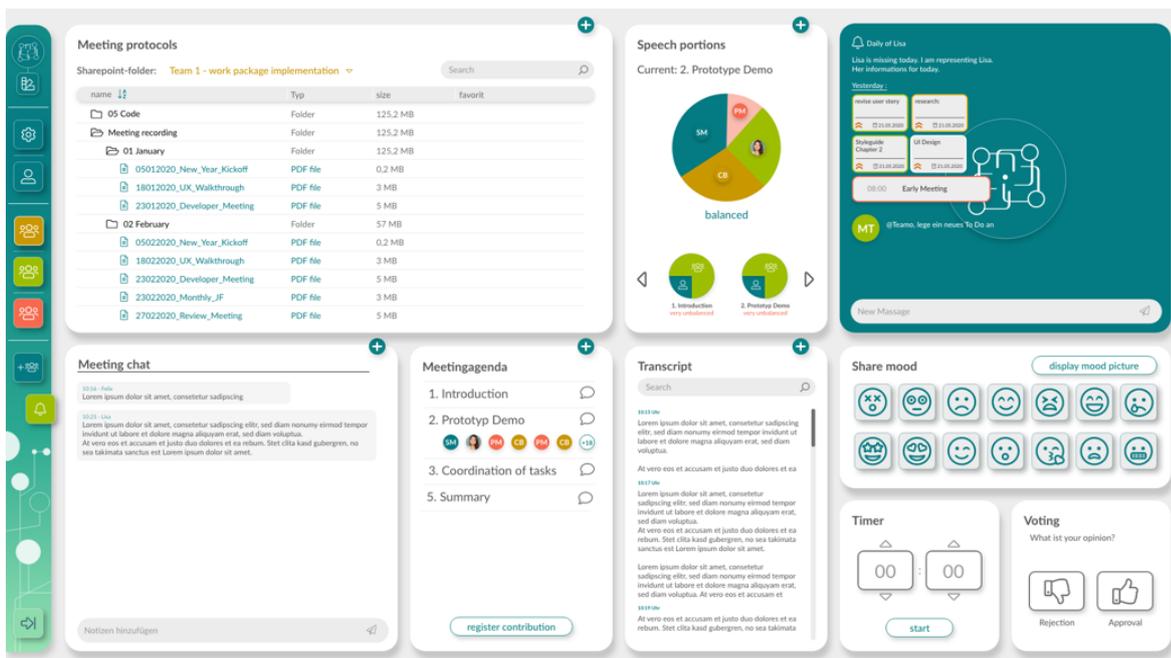

Fig. 6. The Meeting View with different features, which will support users during meetings. E.g.: The live transcript, timer or the mood indicators.

participants compared it to MS Teams. They comment that the DTP delivers a clearer designed overview.

The first random sample from the quantitative perspective is related to the design itself. Another trend shows results regarding the attractiveness of the platform design. For rating, the attractiveness, a six-step scale from "fully applies" (best) to "I cannot say" (worst) was used. The trend shows widely spread opinions regarding the design. No participant voted for the worst steps. From best to "rather not correct" (step 4), the votes are almost evenly distributed as shown in Fig. 7. This shows us, that the design was accepted by the participants, but needs some improvements. During the evaluation, we must find out what the problems are and how we can fix them.

Our second sample gives early insights into how positive the design supports the usage of the DTP. The rating follows the same principle. The results are similar, too, but not that evenly distributed. Most of the participants voted that the design of the DTP supports the usage in a rather positive way or in part. Again, there were zero votes until now in the worst two steps as you can see in Fig. 8. Because the analysis of the evaluation is not finished yet, we can only make assumptions about this outcome. One reason for the rather neutral voting, in this case, could be the lack of configuration possibilities regarding the layout and the minor selection of functions in the tool itself.
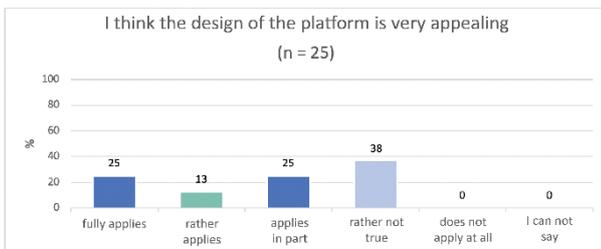

Fig. 7. **The first trend regarding the appeal of the platform design. Users could vote in 6 steps from "fully applies" to "I cannot say".**

Summarized, the spotted trends during the evaluation phase are promising. Most feedback is positive or neutral, which shows to us that the design and more important the concepts work as planned and just need some refinements.
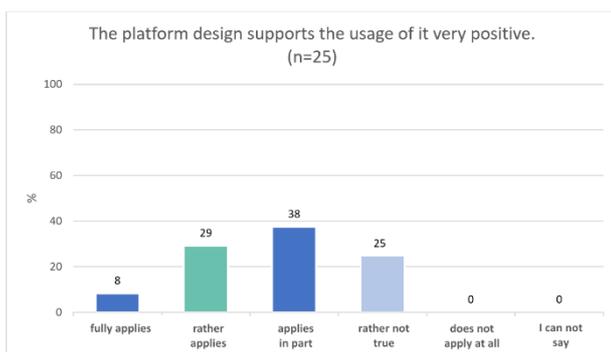

Fig. 8. **The first trend regarding the support of the platform design. Users could vote in 6 steps from "fully applies" to "I cannot say".**

6. Conclusion and Outlook

In this paper, we introduced the concepts of our Digital Teams Platform, our design process, and first evaluation insights. The DTP supports knowledge workers working in virtually distributed teams. The teams can freely configure the platform

according to their needs to create optimal working conditions for them (currently this configurability is limited, because of the still ongoing development). To make this possible for remote workers, we designed our platform, the views, and the services in a way that fits their needs best. To do so, we followed the design thinking method and derived requirements and ideas, which we then used to create the solutions.

Now, the evaluation phase with real world-users is still running. First trends show that the concept and design of the DTP show a positive start, but there is still room for improvements. The lack of configurability, which was also limited during the evaluation, because of the mentioned development progress, was a main problem for the participating teams. The concept with the different views was well accepted. A second evaluation phase, also including the planned meeting view, will deliver an even better understanding of the complete planned concept, but now it is unclear whether this implementation will fit into the project.

During the evaluation, the development of additional features, such as a virtual coffee kitchen for more social interaction, is still ongoing. In addition, we could imagine expanding other quick wins, such as the team chat, the timer, or an extended task board. At the end of the evaluation in December 2021, an analysis of the results is planned, and a corresponding adjustment of the concepts is conceivable.

As mentioned, this project started in 2018, at a time, when collaboration tools weren't that common. There were tools to (group-)chat with each other, but nothing combined with an AI that assists you in planning your day or helping with your stress level. Because of that, we do not have a benchmark with other products at this point.

After the start of Digital Teams other companies improved their collaboration software to more efficient tools for remote work, partly because of the pandemic situation in 2020 and 2021. Also, as our Digital Teams software, those are getting improved regularly. Because of these changes, it would be useful to compare our solution with products such as MS Teams [11], Slack [2], Asana [12] or similar, each with their up to date versions, to see, how those different tools deal with the remote work situation nowadays.

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