An Observational Study of a Distributed Card Based Planning Environment

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Abstract. Providing support for distributed agile teams as they conduct planning meetings is tricky. In distributed settings, the use of paper index cards for planning isn't convenient, as some of the team members do not have access to the physical cards. We present the results of an observational study where a distributed card based planning tool was evaluated against planning with physical cards. The feedback we received from the participants was encouraging. Results indicated that teams were excited to use the tool in part because telepointers made knowledge of the other participants actions easier. We also found that communication was improved as the tool kept teams interested in the meeting and conversations on topic.

Keywords: Distributed Planning, Groupware, Agile Planning, Story Cards

1 Introduction

Many software development teams today are involved in projects where the ability to have all team members sit together and plan the next iteration is difficult. Dispersed & distributed teams and off-shoring development is commonplace in the software industry. The reality is that distributed software projects are here to stay and with them so are distributed planning meetings. Planning in an agile environment is something that does not fit well with distributed projects. Being able to see story cards as they are created and negotiating whether they are in or out of an iteration is something that is much easier to do when all team members can see and manipulate the story cards.

Planning processes in the agile community varies from team to team. However, most teams follow the idea of using index cards (or similar sized sheets of paper) to record stories and subsequently organize then into iterations [1, 3]. Pen and paper allow easy and quick creating of stories during a meeting and makes organizing them either on a table or board effortless. This cannot be said when planning with distributed team members. As team members are not at the same location, sharing the

current state of the iteration plan becomes substantially more difficult. Picking up a pen and writing on an index card and placing it on the table is not helpful in creating a shared understanding of the current state of the plan. Cards need to be created and manipulated on multiple sites. This replication can – and often does – lead to inconsistencies between sites resulting in misunderstandings and an overall slowdown of the planning process.

Tools that support distributed planning must allow for easy and intuitive creation and modification of stories and iterations during the planning meetings and not after the meeting. This implies that digital representations of story cards and iterations must be as easy to create, modify and destroy as their physical counterparts. DAP [9, 10] is an open-source distributed project planning tool that supports card based planning in a fashion that resembles pen and paper based planning. For reasons discussed below, we picked this tool for evaluating if tools improve the effectiveness of distributed iteration planning meetings. In this paper, we present the results of a qualitative evaluation where DAP and distributed paper based planning were compared.

The paper is structured as follows: Section 2 takes a look at existing works relating to agile project planning and groupware applications. Section 3 highlights DAP distributed planning features. Section 4 looks at the qualitative evaluation process, participants, and context. Section 5 presents the results of our evaluation. We summarize our results in Section 6.

2 Related Works

Software systems that provide support for both collocated and distributed agile project planning have been around for quite some time. Existing options such as: Scrum Works [4], XPSWiki [11], Rally [12], Version One [16], and XPlanner [17] provide basic functionality for creating and organizing stories in one way or another. Most of these systems use traditional web technologies and as a result present planning information in the form of tables supporting create, read, update and delete operations.

The collaborative aspect of these systems, though effective, leaves a lot of room for improvement. Awareness information that allows others to know who is online and working or editing information is often limited or not available at all. Research into supporting collaboration with computers has been around since the early 1960's. Many researchers focusing on Human Computer Interaction have made significant strides in improving our understanding of how to build more collaborative tools. This collaboration aware [15] or groupware research has tended to focus on generalized group activities in order to better understand the entire groupware spectrum. A large part of the literature in this area looks at tasks such as drawing and or editing text [5, 15]. The focus on general group tasks has provided significant amounts of insight for tool developers to draw upon. Recommendations, however, tend to be generalized to all groupware applications and their relevance to agile planning tasks is varied.

Early work by Tang [15] produced a number of recommendations on how to approach the design of groupware applications. Of significant importance when building groupware applications is the consideration of: hand gestures during communication, the importance of the workspace tools for mediating collaboration, and the role of spatial orientation in structuring the collaborative activity.

Specifically for planning tasks, workspace awareness is important to understand in more detail. Gutwin et.al. [8] breaks down workspace awareness into three parts: knowing what others are able to see, knowing where their mouse is located and when it is moving (telepointers), and finally seeing the movements and modifications of artifacts in the workspace as they happen (What You See Is What I See, or WYSIWIS). Research into workspace awareness puts a strong emphasis on sharing the workspace with everyone connected. With a shared workspace, one important aspect is knowing where and what others are doing. To provide this information to everyone all three aspects need to be supported.

To ensure that everyone sees the same information, an interface that supports the WYSIWIS paradigm is essential [13, 14]. This ensures that when one artifact is moved or changed that those changes are shared with everyone immediately (in real time), thus duplicating the environment on every client.

An important aspect for workspace awareness involves supporting telepointers [6, 7, 15]: the ability to point to locations in the shared workspace on *all* connected clients. Support for telepointers in the workspace provides support for gestures in the workspace as it shares all the interactions of one mouse with the other clients. Telepointers alone do not completely address gesturing in the workspace, however, they drastically increase team members abilities to refer to an artifact in the workspace.

Recently, two agile planning tools were developed that incorporate ideas from the groupware community. We used one of them, DAP, for our study and describe it in detail below. The 2nd tool, CardMeeting [2], is a web-based agile planning application that moves away from existing implementations by representing planning information as colored cards in a shared environment. The system provides users the ability to create blank index cards that look identical to their physical counterparts. The cards can be moved around the workspace with ease. When compared to existing agile planning tools, however, there are no accounting features or indicators of which card belongs to any given iteration. It simply creates digital cards in a workspace that can be managed and modified by every distributed individual.

The use of a shared environment that simulates face-to-face planning presents the requirement that updates to that environment are near real-time. When comparing DAP and CardMeeting against collocated agile planning performance levels were noticeably different. Both tools were tested with two clients located next to each other. CardMeeting experienced substantial delays, with interactions taking in excess of two seconds, interactions in DAP were substantially shorter. (See section 5.3 for more on DAP's performance)

3 Distributed AgilePlanner (DAP)

DAP provides a shared planning environment (Figure 1) that helps distributed teams to conduct a planning meeting synchronously in real time [9,10]. DAP uses visual objects to represent the various different planning artifacts. These visual artifacts allow team members to plan in a way that mimics paper based planning with the added benefit that team members do not have to be in the same room to share a planning space. Besides providing standard effort accounting functionality, DAP is

able to reconstruct previous planning sessions effortlessly. This allows teams to quickly remember the context of the last meeting and track the progress of the project.

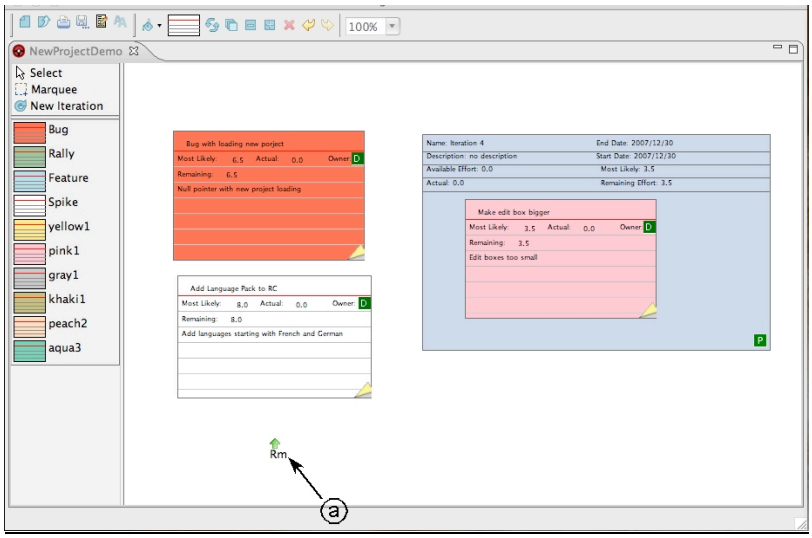

Figure 1. DAP environment

3.1 Interacting with Planning Artifacts

Story card and iteration creation is straightforward and mimics paper based planning. Clicking or selecting the story card or iteration button and then clicking or dropping the artifacts at the desired location creates the artifact. Once the artifact is dropped at the desired location it is immediately shared with all other connected clients. DAP's flexibility allows for story cards and iterations to be created anywhere in the workspace.

Editing of story or iteration information again mimics team members using paper cards. Card fields are quickly edited by clicking on the desired field and changing its contents. Editing of the text is done directly on the card so that all team members, distributed and collocated, can see the changes happening in real-time.

DAP takes great care in making card organization intuitive while leaving teams free to organize cards in a way that best suits them. A large component of card organization is moving a card from a given location to another. In DAP this is accomplished via a simple drag-and-drop action. Moving multiple cards involves selecting multiple cards and dragging the group. Iteration objects containing cards are also moved by the same means. Iterations act as containers for story cards and when moved they keep the internal organization of the stories.

3.2 Distributed Planning

Our primary reason for choosing DAP for our study is its distributed team support. Traditionally, as we saw earlier, tools to support distributed agile teams do not

provide much synchronous and immediate feedback to the others participating in the meeting at a different location. DAP attempts to provide team members with as much as possible non-verbal information as team members would get if they were all sitting in the same location. In order to provide this kind of awareness, artifacts are shown in all the shared workspaces as soon as they are created.

In order to support pointing to artifacts for distributed teams, DAP makes use of telepointers [8] (Figure 1:a). DAP's telepointers provide connected clients the ability to point out, highlight artifacts or gesture to others in real time. This feature provides team members with a natural and non-verbal means communicating, in addition to verbal communication.

4 Study Design

To understand the impact of a distributed planning tool that uses two dimensional representations of story cards as well as groupware features, a preliminary but structured qualitative study was conducted. The study looked at how teams interacted with story cards in both a paper-based environment and then using the DAP tool. The purpose of the study was to determine if tool support for distributed planning improves upon existing paper based planning approaches. In addition, the study hopes to highlight the strengths and shortcomings of such a tool.

4.1 Participants & Context

The evaluation of DAP took place over the course of six months in early 2007. During this time five teams were observed (amounting to twenty six participants) as they conducted various planning meetings. All five teams were predominantly composed of graduate students from the areas of software engineering and management studies. The teams can be categorized into two groups Case Study Teams (two teams) and User Study Teams (three teams). The case study teams were involved in existing software development projects for clients. The user study teams were participating in mock project planning meetings organized by the researchers, but no development was carried out afterwards. User study teams were used to provide a larger user base for observation, as no other development teams were available.

The Case Study teams had existing projects for delivery to a customer. User Study teams, on the other hand were given a high level project description, a vague description of a point of sale application. Teams were given a short and limited (30 second) introduction to the DAP planning tool, comprising of a short tour of the tool.

The five teams were observed in a variety of situations. The three user Study teams participated in two distributed planning meetings, one with paper index cards and one with the DAP tool. Of the two Case Study teams the first participated in three distributed planning all using the DAP tool as they were already using the tool for their development, while the second team participated in one collocated planning meeting with paper index cards, one distributed planning meeting using paper index cards and another distributed planning meeting using the DAP tool. Collocated planning was not possible for most of the teams due to the geographical limitations.

Participants were located in Canada, the United States and the United Kingdom. Developers for all the teams were located in one Canadian city with customers located in another Canadian city, a city in the United States and a city in the United Kingdom. Participants experience with story card planning varied from team to team, with more then half of the participants having little to no experience with the planning approach.

4.2 Data Collection & Evaluation Criteria

Data was collected from the meetings through observations of the planning meetings, and interviews. Observations were conducted by means of video and the researchers taking notes during the planning meetings. Researcher observations were conducted by one researcher in the United Kingdom and one in Canada. No researchers were able to be on site with the US team.

After the planning meetings, participants were asked a variety of questions relating to their experience in the study. Questions focused on: the perceived learning curve of the tool, the perceived ease of use and interaction with the tool, the impact the tool's use had on productivity compared to previous meetings and experiences.

5 Study Results

Feedback from the participants in addition to the observations from the planning meetings was affirmative. Participants were generally positive towards their experience with DAP. We did not observe any difference between participant responses based on location nor user type. Participants seemed excited and expressed a desire to use and interact with DAP. However, this does not mean that there weren't issues that manifested. Issues surrounding communication as well as tool related issues did occur.

5.1 Observations

Observations from the teams highlighted a number of positive and negative effects that DAP brings to distributed environments. The case study teams demonstrated that a tool like DAP has an impact on synchronizing the entire team while at the same time keeping everyone involved and engaged in the planning when compared against distributed paper based planning. Based on our own experiences as educators, we decided to use eye contact and fidgeting as a way to subjectively determine team member engagement.

Team members engagement was most noticeably affected with the introduction of DAP. The levels of perceived engagement in the meeting as expressed by eye contact and the amount of fidgeting from each team member increased while using the tool. When comparing the three meetings of the second Case Study team (collocated, distributed and DAP) the meetings with the most eye contact and the least amount of fidgeting were the collocated and the DAP meetings. The distributed planning meeting where no tool was used saw almost everyone on the team looking around the room, closing their eyes for long periods of time and continuous fidgeting in their

chairs. The collocated and DAP planning meetings saw all team members focusing on the customer, either physically in the room (collocated) or on their interactions on a large shared display (DAP). Only rarely did a team member shift their focus away from the planning tasks. In addition team member's body language differed: during the collocated and DAP meetings team members positioned themselves to face the customer /display and a tendency to lean towards the customer/display. This type of body positioning was not seen during the paper-only distributed planning meeting.

Tool usage across all five teams was relatively similar. Team interaction with DAP was dominated by the developers with the customers interacting on occasion. The exception to this was the third user study team. The interactions with the tool changed mid meeting when one of the customers asked if they could use the tool as well. Once they started using the tool, they dominated its control, creating new story cards adding descriptions and even adding the estimate values after discussing them with the developers. All throughout the meeting both the customers and the developers expressed excitement about using the tool. Comments like: "this is neat" or "oh cool".

A point of significant interaction and discussion for all teams were the telepointers. Team members liked the idea of being able to point to an object in the workspace and having their colleagues at the other location see their actions. The customer for one of the case studies commented during one of the planning meetings: "this is exciting. This is great!" after using the telepointers to point to a story card being discussed. Following that same meeting a project manager commented "It's the first time that I really saw that [telepointers] was useful, because when [he] said look here!" Similar sentiments regarding telepointers were expressed during the other planning meetings with everyone making positive comments regarding them.

Although participants were excited about using DAP, teams did experience some trouble interacting with the tool. Every team had trouble with editing story card content. Editing of story cards was implemented as a single click on the field once the card was selected. However, everyone used a double click to try and edit the fields. Double clicking resulted in the card collapsing instead of entering edit mode, as the participants expected. This resulted in frustrations amongst the teams and resulted in the teams asking the observer for help.

The second point of frustration came from creating story cards. One of the user study teams was trying to create a story card on top of another story card. It appeared that the team wanted to keep the story cards in the same visible workspace and not have to scroll around. This was a much smaller point of frustration and resulted in the team making a few attempts before resizing the other cards and then creating the card on top of an iteration.[1]

5.2 Feedback

Of the twenty-six participants, in the five teams, twenty provided feedback on their experiences in the study. The feedback was encouraging with similar comments being made by many of the participants. We did not see any differences between feedback from developers and customers. Generally, participants found that DAP was "... very

[1] Most of the usability issues identified by our study have now been fixed by the DAP developers.

very easy to use", with the exception of editing cards. In addition, participants commented on the visual representations of the cards indicating that "...it gave [them] an exact picture of the planning project".

During conversations with the participants telepointers again came up as an important part of DAP. Participants indicated that they liked how "...[they] could monitor whatever was happening on the screen of the other party" and "...that simple pointing [was] possible". In addition to the telepointers, participants liked the fact that the story cards had explicit areas for the story name and a description. In particular the description area was an important feature as it encouraged them to add more information to the story. One user study participant, acting as a developer, compared the virtual cards to paper cards and commented that when using the paper cards "...there was nothing that forced me to enter a description but the tool had the description [area] so I felt like, you know, I should fill this in".

Comments from participants continuously highlighted the impact that DAP had on communication during the meetings. The majority of those interviewed felt that the tool helped with keeping the discussions on track. They felt that during the distributed planning meetings where no tool was used that team members would easily and often go off topic or get caught up in an idea and they would then have a hard time getting back on track or interjecting to pose a question.

Participants perceived productivity[2] was slightly increased with the introduction of DAP. Participants felt that with the conversations being more directed and on topic in addition to being able to see, read and interact with the planning artifacts in near real-time helped increase the productivity of the meetings. Participants also believed that they had a better understanding of the stories for the current iteration and spent less time discussing individual stories. They also found that creating cards was just as simple and quick as creating paper cards.

5.3 Real-Time Performance

Response times for various actions in DAP are near-real-time. Actions in DAP were tested both in a controlled laboratory setting with limited network activity and in a cross-continent setting (Canada - United Kingdom). For both time trials the DAP server was located in Canada. Table 1 summarizes the times for the various different actions in DAP. Times were calculated by hand with a stopwatch, researchers communicated verbally (via VIOP system in the cross-continent case). Action starts were verbalized by one individual and when the other individual had seen the change they would verbally indicate to stop the clock.

Table 1: DAP Performance

	Create Story Card	Create Iteration	Move Story Card	Move Iteration (Empty)	Move Iteration (12 Story Cards)	Move Mouse	Edit Text (<12 Chars)	Edit Text (>12 Chars)	Delete Story Card	
Canada - UK	0.75s	1.5s	1.2s	1.5s	2.0s	1.5s	1.5s	1.5s	1.5s	
Laboratory	0.5s	0.5s	0.5s	0.25s	1.75s	0.25s	0.25s	0.25s	1.0s	

[2] When interviewing study participants, we did not define "planning productivity" but let them use their own understanding of the term.

As we can see, the majority of actions in DAP takes two seconds or less regardless of the network settings. Results from the laboratory setting were considerably faster resulting in near instantaneous changes to the workspace. We can see that there is a delay introduced when collaborating over greater distances, however, the delay is still relatively short and did not have an impact on the user study teams ability to collaborate.

5.4 Limitations

The research into the effectiveness of DAP has provided insight into supporting distributed agile planning. The results of our initial study – although encouraging – suffer from a number of limitations. Specifically, the participants for the user study are graduate students and it is unclear how well they represent agile teams working in an industrial setting. The participants are also volunteers – creating a potential positive bias in the results.

Secondly, biases are introduced due to the fact that half of the volunteers that participated in the user studies were colleagues of the primary researcher. The bias introduced by the volunteers knowing the researcher, are partially kept in check by having the remaining half of the participants in the user study teams being from other universities where there was no prior contact with the researcher or knowledge of the tool.

Finally, industrial evaluation is extremely minimal (one individual on one case study team) and DAP was only compared against paper based planning. No comparative evaluation was conducted between DAP and other distributed agile planning tools and no comparison where the order in which the planning methods were examined were conducted. The lack of comparison against other industrial tools and the limited involvement of industrial participants introduce a bias into the results presented here and demand further investigation. The reason for focusing on DAP instead of alternative tools was our desire to primarily compare paper-based distributed planning with tool-based distributed planning. We picked what we consider the best-of-breed tool as the basis for our study. After our study indicates the benefits of tool support, a next step would now be to compare different agile planning tools and evaluate if there are any differences in planning effectiveness.

6 Conclusions

Tools to support distributed agile planning have made significant strides in bringing the benefits of collocated planning to distributed teams. Research from the groupware community like a shared workspace and telepointers provide teams with additional non-verbal information that is missing from paper based distributed planning meetings.

The results from our observational study are encouraging in that teams found the additional awareness information beneficial. Participants were very receptive of the tool and felt that communication and productivity were positively affected when compared to the paper based distributed planning they experienced. In addition,

participants' feedback regarding the use of telepointers is important and suggests that future agile planning tools consider their inclusion.

Further investigation into the effects of distributed planning tools that use physical representations of planning artifacts is warranted. In addition, a comparative evaluation that examines the impacts of the various different agile planning tools is needed.

Distributed AgilePlanner provides card-based planning to agile teams – but it uses a shared vertical surface to display iterations and story cards. Our ongoing work looks into using digital tables for distributed planning and promises to be even closer to collocated agile planning meetings.

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