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Beyond Collaborative Model Usage and Development – A Model Lifecycle Approach for Lay User Modeling

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Abstract. Approaches of collaborative modeling and model usage aim to increase the participation of stakeholders in modeling, but either still require experts support or are bound to certain phases of the model lifecycle: This makes it hard to compose an overall concept of collaborative model usage and development. In this paper, we argue that we need concepts to engage users without modeling capabilities into self-directed, user-managed processes of using and working on models. We present a corresponding model lifecycle as well as suitable interaction and participation modes, using examples from our ongoing work on integrating lay-users into model usage and development. We analyze this work and present open issues to be discussed by the community.

Introduction: Cooperation beyond Participatory Model Usage and Development

Process models are common tools in modern organization. Most approaches of using them for analysis, specification and guidance in organizations have been developed and designed for expert users, that is, people trained in process analysis, modeling or model usage. Recent work has amended that this does not involve stakeholders in a way that encourages them to become active model users themselves (e.g., Hoppenbrouwers et al. 2010; Prilla and Nolte 2012; Rittgen

2010). This in turn also potentially leads to diminished commitment, motivation and agreement to processes. Furthermore expert support is costly and delays model development (Nolte & Prilla, 2013; Rittgen, 2010). Approaches for collaborative model usage and development consequently have emerged as research fields in recent years. While some of these approaches are at supporting collaborative modeling by experts, others explicitly integrate process stakeholders.

The (ongoing) work we present here aims at taking these approaches one step further, towards the support of self-directed, user-managed collaborative usage and development, which can be performed by users without expertise in modeling as most collaborative modeling solutions still rely on expert support (Rittgen, 2010) and some also limit participants to verbal contributions (Herrmann, 2009). This reduces stakeholder involvement as e.g. when a model has reached a stage where it serves as a source for software development, stakeholders are usually cut from the possibility to give feedback if changes occur or to suggest changes if they make experiences in practice that afford them. We argue that **stakeholders need to be integrated into model development and usage throughout the entire model lifecycle** (see Nolte and Prilla 2013 for a detailed discussion). They also have to integrated more tightly thus requiring a concepts and corresponding tool design to enable them to be active in corresponding tasks, even if (or especially in a case when) they are not modeling experts. In this paper, we present a formalization of these tasks and results of ongoing work in supporting them.

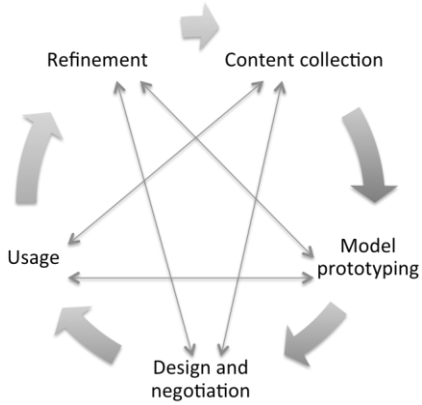

Figure 1: A model lifecycle for collaborative usage and development of models.

The Model Lifecycle

There are a lot of approaches and tools for collaborative modeling and model usage that include participants other than modeling experts. They vary from approaches requiring (expert) facilitation to self-directed modeling and model usage (Nolte & Prilla, 2013). Despite this work, in practice models are often only used by experts. We argue that one of the reasons for this is that existing support is not well aligned to a model lifecycle that integrates stakeholders into model usage and development – only if self-directed modeling throughout all its phases is support-

ed, it has a chance to become an established practice in organizations. Based on and inspired by existing literature (e.g., van der Aalst et al. 2003; Dumas et al. 2013; Prilla et al. 2013; Rittgen 2010) as well as work done in our group (Herrmann, Nolte, & Prilla, 2013; Herrmann, 2009; Nolte & Prilla, 2013; Prilla & Nolte, 2012), we have derived a prototypical model lifecycle that is tailored to collaborative model usage and development, describing relevant phases in which participants can be actively integrated. Figure 1 shows this lifecycle and Table 1 gives a brief description of its phases. The sequence is not mandatory – phases might have to be conducted multiple times before arriving at a usable model.

Table 1: Phases in the participatory model lifecycle and existing approaches.

Phase	Description	Approaches
Content collection	As a preparation, experts, stakeholders and others loosely gather necessary information and content.	*Experts:* Interviews, document analysis (Dumas et al., 2013), Ethnography (Herrmann, 2009) *Participatory:* Ideation (Herrmann et al., 2013), Collection (Andersen & Richardson, 1997)
Model prototyping	The material available for modeling is examined, necessary material is chosen and an initial model prototype is created to work with.	*Experts:* Creation of initial model from material, process mining *Participatory:* Clustering (Wiechers, Nolte, Ksoll, Herrmann, & Kienle, 2013), structured conversation (Hoppenbrouwers et al., 2010)
Design and negotiation	Together with stakeholders, the model is designed and negotiated to represent a process that all participants agree on for implementation.	*Experts:* Face to face meetings, workshops, verbal / written feedback (van der Aalst et al., 2003) *Participatory:* Voting, facilitation (Herrmann, 2009), collaborative modeling (Rittgen, 2010)
Usage	The model is used by various stakeholders, e.g. developers implementing support or workers using models as guides	*Experts:* Model presentation, workflow engines *Participatory:* Models in wikis (Rospocher, Ghidini, Pammer, Serafini, & Lindstaedt, 2009), models as means of knowledge exchange (Cherubini, Venolia, DeLine, & Ko, 2007)
Refinement	According to experiences from using the model or process, the model is refined.	*Experts:* Measurements, e.g. KPI (Weske, 2007), feedback *Participatory:* Critiquing (Herrmann et al., 2013), Walkthrough, Commenting

While the lifecycle shown in Figure 1 is not only applicable to self-directed modeling, but also to modeling procedures guided or solely conducted by experts (as Table 1 shows), its structure enables us to assess the state of the art in support for

collaborative model development and usage and also to describe challenges in enabling stakeholders to actively develop and use models in a self-directed way:

Content collection: An important part of model development is gathering information about the process. This includes process steps (activities) as well as roles carrying them out and resources used by them. Table 1 shows a variety of expert-driven approaches methods and tools supporting this phase, while there is a lack of self-directed, user-managed approaches. Non-expert users need to be supported to gather model content – some expert-driven modeling approaches even skip this phase, merging it with the following one.

Model prototyping: Building on the content collected before, this phase is intended to create a process shape and to allocate the content (activity steps, actors etc.) to it, thus aiming at creating a first representation of the process. This proves to be challenging for people without modeling expertise, as it requires a translation from mental models to model language. While most approaches supporting this phase rely on expert support, some allow for self-directed alignment of process content through e.g. clustering. This cannot be expected to result in a full-fledged process model it is a first step in model prototyping. The challenge thus is how interaction with models and modeling tools can be designed to allow users without deep modeling knowledge to create a useful model prototype.

Design and negotiation: This phase aims at creating a process model out of the previously developed prototype that all participants can agree on and that includes the necessary details for implementation (either within the organization or by support of tools). This process might be difficult, as differing views about certain process steps may be present that have to be negotiated and represented in the model. Therefore, most approaches supporting this phase use some kind of expert facilitation. There are however approaches such as voting that may serve as a support for negotiation and allow for participants to become actively involved.

Usage: After completing the model different stakeholders (e.g., workers, management, developers) can use it to guide work, transfer knowledge or use it as a reference for tool implementation. This usage may raise questions about the content or details of the model and it might impose high cognitive and time efforts because of the complexity that models may have. As there is not always a facilitator present to describe the model in an adequate abstraction or to answer questions on details, in self-directed modeling The challenge is to enable people to work with models without this support.

Refinement: Similar to BPM lifecycles, the refinement phase of model usage and development aims at integrating experiences from practice and measurements taken on the performance of the process into a process model thus revising and improving it. While there are approaches that relate lacking performance to steps in models and thus allow focused improvement of these parts, for more informal feedback of stakeholders or self-directed reflection of processes currently hardly any approaches are available. If modeling is to be done by users in a self-sustained

manner, this phase needs to be supported, as otherwise models will soon either become outdated or will show an idealized view instead of real work processes.

Regarding these challenges, the questions arise (1) whether we can support these phases of model development and usage in a way that enables self-directed model interaction for stakeholders others than experts and (2) how support for these phases can be created and smoothly connected to the respective other phases in order to support the whole lifecycle. In what follows, we relate our work to the lifecycle and identify open issues and questions to be tackled by future research.

Support for Lay User Modeling

Based upon the previously described model lifecycle we will now describe our approaches to integrate lay users into them. Besides these proposals, future research needs to clarify the role of expert facilitation in the phases.

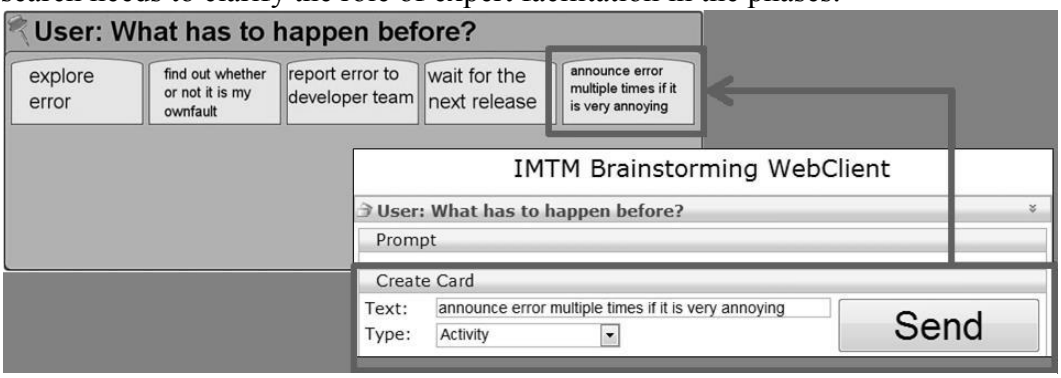

Figure 2: Written text in a web interface (bottom) resulting in an element with the respective label within a model (top).

Content collection: Figure 2 shows a system that transfers written text into elements of a modeling notation with the respective text as their label. It allows for non-modeling experts to contribute content to a model by either adding content on to an initially empty model or using pre-defined model parts as target areas for contributions as shown in Figure 2. This enables the collection of content into an existing model and it also allows for pre-structuring the collection by providing areas covering different aspects of a process such as activities conducted or resources required. While the latter approach has proven to be feasible in a workshop setting, it requires preparation by experts defining the aforementioned areas. In order to improve this we came up with the idea to guide participants through content collection by sequentially asking them predefined questions such as "What happens next?" or "Who does that and which resources are required?" thus mimicking a walkthrough approach (Nolte & Prilla, 2013). This system however is still in a prototypical state and has not been tested yet.

Model prototyping: Creating a process model based upon loose contributions requires in-depth knowledge of a modeling notation. Non-modeling experts can however certainly prepare this step as they are capable of aligning activities with

respect to their position within a process sequence and also assign roles to the respective activities that are involved in conducting these activities (Prilla & Nolte, 2012). In order to support this we developed a mechanism that allows users to align elements within clusters (c.f. Figure 3 right) by simply touching them and dropping it at the designated position (Wiechers et al., 2013). This is an initial step to support model prototyping, but important process characteristics such as conditions and flows are still missing.

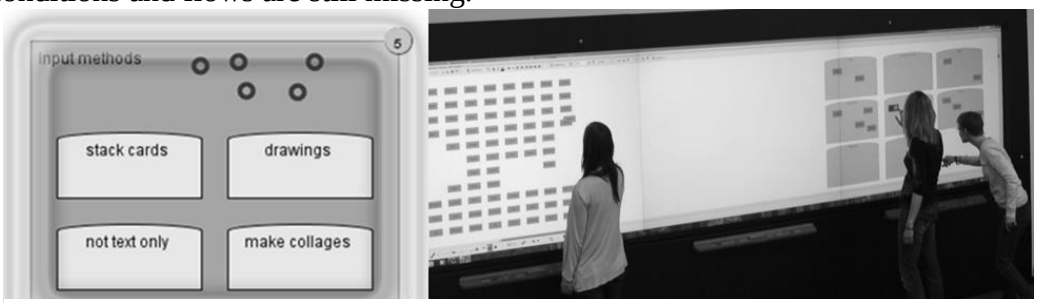

Figure 3: Screened model elements that have been marked (left) and are put into clusters collaboratively afterwards (right).

Design and negotiation: This phase is about forming model that depicts the process in an accurate manner and that all participants agree on. In an expert-driven approach, we would typically support this by inviting all relevant process stakeholders to a workshop where a facilitator sequentially walks them through the process the model depicts. In order to involve participants even more actively we developed a mechanism that allows users to mark elements (see the circles in Figure 3 left) by touching them. While this mechanism allows non-modeling experts to directly interact with the model, this phase is still dependent on the facilitator and also requires all stakeholders to be present at the same time. This led us to the idea of building a system that prompts users for modeling actions by asking questions similar to the ones described before in the content collection phase (Nolte & Prilla, 2013).

Usage: In order to use models for work that is e.g. to gather information about a process, people have to have access to it. While this sounds trivial at first sight it is far from being a common practice in organizations: usually only process owners or corporate process management have access to them. Also the software that is used to view a process is often complex to use for people not trained in using it (because it is built for the need of modeling experts). Furthermore, for a model to be useable it has to be presented in a way that non-modeling experts can make sense of it on their own. While we support access through an easy to use web based system that does not require any additional software to be installed (Figure 4), presenting it in a suitable manner still remains an issue. While the system allows for steps of a process to be hidden and later be shown again to the user (thus supporting exploration), it is still very static.

Refinement: As this phase is tightly connected to the previous one due to the necessity of using models in order to being able to refine them, our means of supporting this are very similar. The aforementioned web based system not only al-

lows for displaying and exploring models but also provides the opportunity to attach textual comments to any element of the model (c.f. Figure 4). Combining a familiar means of articulation (textual input) with access to the models (see above) allows process stakeholders to reflect on their processes during every day work – the comments they leave comments are later included in the model. While this is a rather simple solution, it keeps the usage barrier low and allows people that usually are cut from further model development to become pro-active model users. Furthermore the content and number of comments can provide process management departments with useful information about whether processes are up to date or need further refinement. Feeding back the comments into the model then usually happens within modeling workshops.

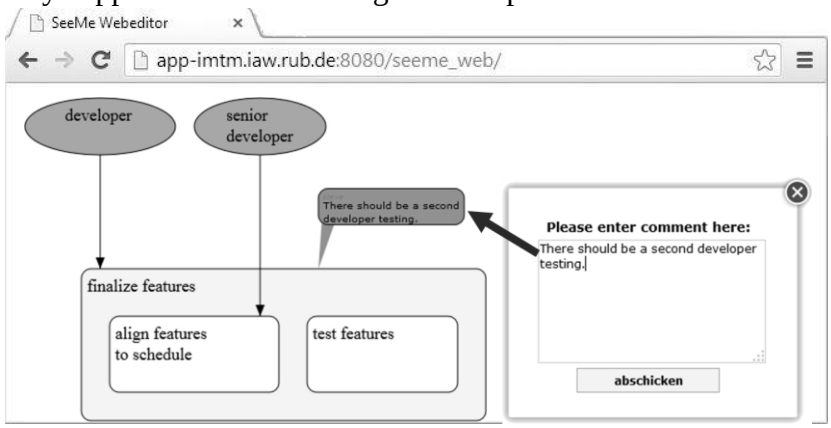

Figure 4: A textual comment that is attached to a model element.

Solutions and open issues

We presented a participatory model lifecycle and its respective phases. We also showed current support and issues for self-directed non-modeling expert participation within these phases. While it became apparent that phases like *content collection* and *model prototyping* are supported in a promising way, others still lack proper support for process stakeholders to become active in model development and usage. Especially phases like *design and negotiation* and *usage* still rely on experts. For *design and negotiation* we are currently planning to makes use of milestones as scaffolds thus supporting process rather than content related clustering. Using approaches such as Kanban and Gantt diagrams for project planning that are known to process participants might also be beneficial. Our future work will focus on discussing current issues thus aiming at enhancing existing support for non-modeling experts developing and using models throughout the model lifecycle. Furthermore we are aiming at seamlessly intertwining these phases thus creating an approach that ties them closer together.

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