Towards Collaborative Modeling of Business Processes on Large Interactive Touch Display Walls

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Abstract
Analyzing and redesigning business processes is a complex task, which requires the collaboration of multiple actors. Current approaches focus on workshops where process stakeholders together with modeling experts create a graphical visualization of a process in a model. Within these workshops, stakeholders are mostly limited to verbal contributions, which are integrated into a process model by a modeling expert using traditional input devices. This limitation negatively affects the collaboration outcome and also the perception of the collaboration itself. In order to overcome this problem we created *CubeBPM* – a system that allows groups of actors to interact with process models through a touch based interface on a large interactive touch display wall. Using this system for collaborative modeling, we expect to provide a more effective collaboration environment thus improving modeling performance and collaboration.

Author Keywords
Large interactive touch display wall; touch interface; process modeling; collaborative modeling

ACM Classification Keywords
H.5.2. User Interfaces: Interaction Styles

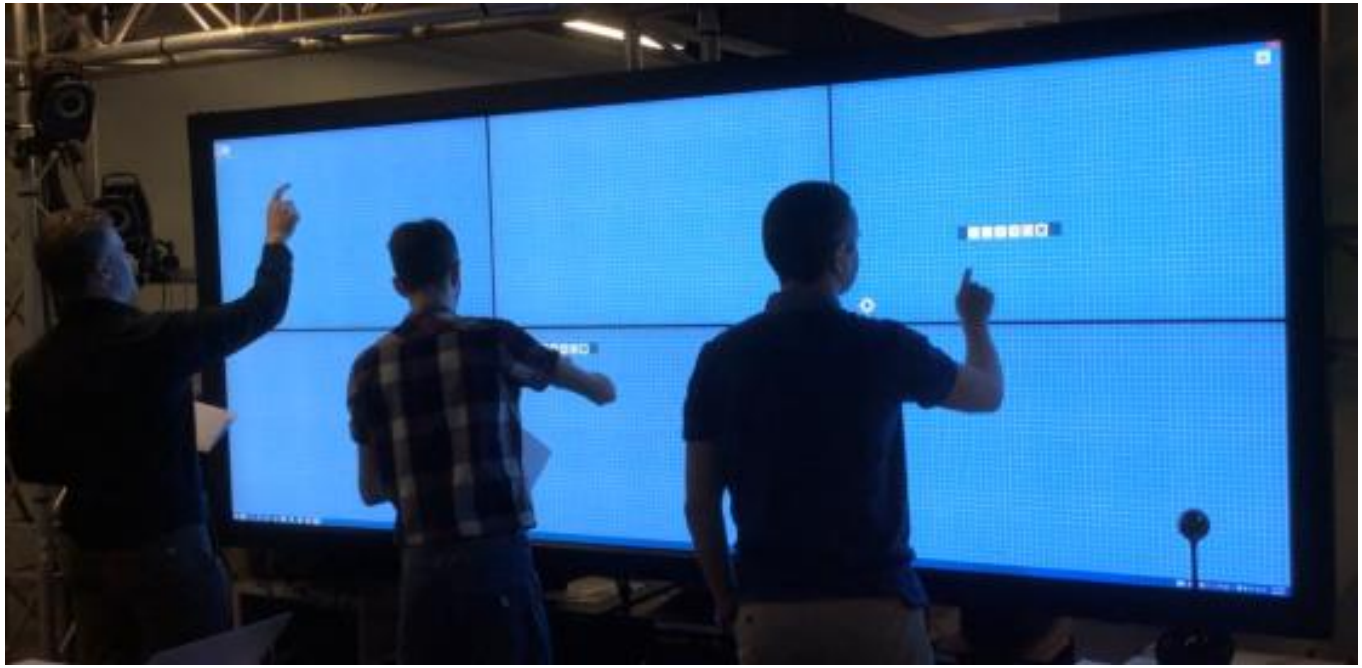

Figure 1. CubeBPM - Example of three actors simultaneously creating business process models.

Introduction

Business process models serve a variety of purposes within organizations. They are used to document processes, analyze them, identify means for improvement or serve as training material for new employees [5]. Analyzing processes in order to visualize them using graphical modeling notations is a complex task especially if the task allocation between several roles has to be represented as well as the usage of technical resources. It is thus reasonable to draft models collaboratively involving process stakeholders and domain experts alike [14,18]. Collaboration between them usually takes place within facilitated workshops in which actors verbally contribute their perspective on a process [7]. Contributions are discussed among the group, translated into a modeling notation and integrated into a process model by a scribe [18] with the discussion being led by a facilitator.

While workshop based approaches are reasonable to allow for actors to exchange perspectives, their effectiveness is often questioned [3]. Approaches like the one described before are time consuming and include long idle times for many actors as only one person may contribute at the same time while the others have to wait for their turn [8]. Furthermore

researchers found that limiting actors to verbal contributions results in reduced identification with the outcome of a modeling workshop and also in reduced buy-in when processes are later brought into practice [6,20]. Recent research also revealed the necessity for different modes of collaboration such as break out groups especially when processes have to be redesigned or newly designed [8].

We developed the *CubeBPM* system to allow for actors to directly manipulate process models thus providing direct access to process models and process modeling. CubeBPM allows multiple actors to draft models collaboratively using a large interactive touch display wall (c.f. Figure 1). However while there is a lot of research on interaction techniques on touch surfaces such as smartphones, tablets, or tabletops there is a gap when it comes to analyzing and supporting collaboration on large interactive touch display walls. We attempt to explore how collaborative process modeling can be supported by using CubeBPM on a large interactive touch display wall which provides actors with a gesture based interface that can be used by multiple actors in parallel. We used a set of gestures in order to allow for actors to learn how to use CubeBPM as quickly as possible. These gestures are based upon suggestions by Kolb et al. [10]. By allowing actors to directly interact with process models using a touch based interface we expect to increase the effectiveness of modeling workshops. We also expect the possibility to directly interact with models to influence the way actors collaborate.

The main contribution of this poster thus is to propose a system, which allows multiple actors to collaborate on process models through a touch based interface on a large interactive touch display wall. This means taking established interaction touch techniques to a new real world scenario (collaborative process modeling) as well as expanding on knowledge about how actors collaborate on large interactive touch display walls.

Related work

Modeling (business) processes is a complex activity. The complexity can partly be attributed to the complexity of the process that has to be depicted in a model [5]. Part of the complexity of modeling however also stems from the requirement to use a graphical modeling notation such as BPMN [13]. Modeling notations consist of a number of graphical symbols that represent aspects of a process such as activities that are conducted, actors that carry out those activities and resources that are used. A syntax describes rules on how these graphical symbols or elements can be combined together in order to form a syntactically correct model. Learning how to use a modeling notation to represent a real world process can be considered a challenging task [15].

In collaborative modeling workshops the translation of real world phenomena into constructs of a modeling notation is typically done by modeling experts. Collaboration thus only happens verbally with no direct influence of actors on displayed materials. CubeBPM aims at allowing for stakeholders to take a more active role by enabling them to directly manipulate models with only minimal interference by modeling experts. Recent research provides indications that stakeholders indeed are capable of collaborating on simple process models in a self-directed way [12,19]. CubeBPM builds on this research.

Figure 2. Example image of a menu instantiated at the location of the actor.

Figure 3. Example of a simulated virtual keyboard interface.

Figure 4. Item connection gesture example (arrow added for emphasis).

Adding to the complexity of model creating, modeling tools are mainly built with the requirements of modeling experts in mind. They are thus hardly usable for lay modelers [14]. Interactive tabletops and walls can provide lay modelers with an easy to use possibility to manipulate process models as they provide a direct means of interacting with the displayed material [4].

Collaboration with tabletops has been explored extensively including territoriality [21], coupling and arrangement strategies [22], and papers that stem from these studies. There has been limited work, however, exploring collaboration with large interactive touch display walls. Rittenbruch [16] explored collaboration on the QUT Cube but did not focus on a specific domain. Some researchers have focused on software development on interactive surfaces including Calico [11] for informal sketches on interactive whiteboards, AugIR [9] for business processes on interactive whiteboards, TouchRam [1] for aspect models on vertical touch displays, and SourceVis [2] for visualizing software artifacts on tabletops. None of these tools, however, have focused on large high-resolution touch walls or business process modeling.

CubeBPM

CubeBPM is a business process modeling tool that supports collaborative modeling on large interactive touch display walls. CubeBPM implements the majority of the control perspective BPMN[1] grammar including: swim lanes to represent actors in processes, gateways to represent decision points, activities, and event types [13]. CubeBPM was developed using C# and OpenGL. To demonstrate CubeBPM we use a large single integrated screen[2]. The tool however is able to run on large segmented displays via the use of synchronized and networked hardware accelerated OpenGL rendering contexts, to produce a highly scalable solution to cover large wall display systems such as those found at the QUT Cube [17].

Utilizing touch event interfaces offered in Windows, gesture recognition and concurrent multi-user interactions were devised and derived from previous research into the use of gestures on tablets for process modeling [10]. As an outcome, we created a system that allows multiple actors to work on the same model at the same time, facilitating group collaboration (c.f. Figure 1). Modifications to single-user tabletop interfaces such as the ones proposed by Kolb [10] were devised in order to support large-scale collaborative modeling. For brevity's sake only key interactions and gestures are listed subsequently. CubeBPM offers location-based flexible menus that provide actors with basic modeling functions at disparate locations. These menus are accessible via double tapping (c.f. Figure 2). In order to create an element actors have to select the elements they want to create and drag the element out of the menu to the screen. After such a drag interaction, the menu remains on screen for a prescribed time interval, within which the menu can be used again, otherwise the menu disappears and has to be reopened again by double tapping. In order to enter element labels, it is possible to use a simulated virtual keyboard on the screen. This keyboard can be accessed by double tapping on an element description (c.f. Figure 3). Like the aforementioned menu it is also possible to open multiple keyboards in parallel thus

[1] http://www.bpmn.org/

[2] See CubeBPM demo video: https://youtu.be/OuEHsL9vCR8

Figure 5. Example of an item delete crossing gesture (arrows added for emphasis).

Figure 6. Example of diagram five finger scaling gesture. Fingers are moving outward, enlarging the scale of whole diagram (arrows added for emphasis).

Figure 7. Example of undo/redo circular gesture, showing circular feedback path of gesture.

allowing for multiple actors to alter element labels at the same time. Diagram elements (events, activities and gateways) can be connected with a two-finger drag gesture between two items. In order to create a connection actors have to place one finger on an element and drag another finger to the element that they want to connect the first element with (c.f. Figure 4). Elements can be deleted via a single finger cross over the item to be deleted (c.f. Figure 5). The crossing point of the touch gesture serves as a reference for the element that is to be deleted. We also included a touch gesture that allows actors to scale the diagram via a two finger expanding stretch gesture (c.f. Figure 6). Finally, we included an undo gesture to facilitate reversal of modeling operations. Touching and winding in an anti-clockwise direction performs an undo, a clockwise direction executes a redo (c.f. Figure 7). It should however be noted that undo and redo work on a global rather than an individual level. It could thus be possible to undo actions by others using this gesture. Furthermore it is necessary to state that both zooming and undo potentially interfere with actions of other actors. Implementing control mechanisms that prevent these global interactions from interfering with interactions of others is one of our priorities when it comes to future development.

Summary

We created the CubeBPM system that allows multiple actors to directly interact with a process model on large interactive touch display walls. The goal of this system is to create an environment in which actors can collaborate on process models thus improving modeling performance and collaboration. Currently we are in the process of conducting a study during which groups of four actors collaboratively develop a model of a process they are familiar with. By video recording the subsequent modeling sessions we hope to gain insights into how large interactive touch display walls affect collaboration outcomes (process models) as well as the collaboration itself.

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References

[1] Abed, W. Al, Bonnet, V., Schöttle, M., Yildirim, E., Alam, O., and Kienzle, J. TouchRAM: A multitouch-enabled tool for aspect-oriented software design. In *Software Language Engineering*. Springer, 2013, 275–285.

[2] Anslow, C., Marshall, S., Noble, J., and Biddle, R. Sourcevis: Collaborative software visualization for co-located environments. *Proceedings of VISSOFT*, IEEE (2013), 1–10.

[3] Bostrom, R.P., Anson, R., and Clawson, V.K. Group facilitation and group support systems. In *Group support systems: New perspectives*. Macmillan, 1993, 146–168.

[4] Döweling, S., Tahiri, T., Schmidt, B., Nolte, A., and Khalilbeigi, M. Collaborative Business Process Modeling on Interactive Tabletops. *Proceedings of ECIS*, (2013), 1–7.

[5] Dumas, M., La Rosa, M., Mendling, J., and Reijers, H.A. *Fundamentals of Business Process Management.* Springer, 2013.

[6] Hengst, M. den. Collaborative Modeling of Processes: What Facilitation Support Does a

Group Need? *Proceedings of AMCIS 2005*, (2005), 73–80.

[7] Herrmann, T. Systems Design with the Socio-Technical Walkthrough. In *Handbook of Research on Socio-Technical Design and Social Networking Systems*. Hershey, 2009, 336–351.

[8] Herrmann, T. and Nolte, A. Combining Collaborative Modeling with Collaborative Creativity for Process Design. *In Proceedings of COOP*, Springer International Publishing (2014), 377–392.

[9] Kleffmann, M., Hesenius, M., and Gruhn, V. Connecting UI and business processes in a collaborative sketching environment. *Proceedings of EICS*, ACM (2015), 200–205.

[10] Kolb, J., Rudner, B., and Reichert, M. Gesture-Based Process Modeling Using Multi-Touch Devices. In *International Journal of Information System Modeling and Design 4*, 4 (2013), 48–69.

[11] Mangano, N., LaToza, T.D., Petre, M., and van der Hoek, A. Supporting informal design with interactive whiteboards. *Proceedings of CHI*, ACM (2014), 331–340.

[12] Nolte, A. and Prilla, M. Normal users cooperating on process models: Is it possible at all? *Proceedings of CRIWG 2012,* Springer (2012), 57–72.

[13] OMG. *Business Process Modeling Notation (BPMN) Specification.* Object Management Group, 2006.

[14] Prilla, M., Nolte, A., Herrmann, T., Kolfschoten, G., and Lukosch, S. Collaborative Usage and Development of Models: State of the Art, Challenges and Opportunities. In *International Journal of e-Collaboration. Special issue on "Collaborative usage and development of models" 9*, 4 (2013), 1–16.

[15] Recker, J. Continued use of process modeling grammars: the impact of individual difference factors. In *European Journal of Information Systems 19*, 1 (2010), 76–92.

[16] Rittenbruch, M. Supporting Collaboration on Very Large-Scale Interactive Wall Surfaces. *Computer Supported Cooperative Work (CSCW) 24*, 2-3 (2015), 121–147.

[17] Rittenbruch, M., Sorensen, A., Donovan, J., Polson, D., Docherty, M., and Jones, J. The Cube: A Very Large-scale Interactive Engagement Space. *Proceedings of ITS*, ACM (2013), 1–10.

[18] Rittgen, P. Collaborative Modeling: Roles, Activities and Team Organization. In *International Journal of Information System Modeling and Design (IJISMD) 1*, 3 (2010), 1–19.

[19] Rittgen, P. End-User Involvement and Team Factors in Business Process Modeling. *Proceedings of HICSS*, (2012), 180–189.

[20] Rouwette, E.A.J.A., Vennix, J.A.M., and Mullekom, T. Group model building effectiveness: a review of assessment studies. In *System Dynamics Review 18*, 1 (2002), 5–45.

[21] Scott, S.D., Carpendale, M.S.T., and Inkpen, K.M. Territoriality in collaborative tabletop workspaces. *In Proceedings of CSCW*, ACM (2004), 294–303.

[22] Tang, A., Tory, M., Po, B., Neumann, P., and Carpendale, S. Collaborative coupling over tabletop displays. *Proceedings of CHI*, ACM (2006), 1181–1190.