Class Notes: BPM Research and Education

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The BPMVE Wunderkammer

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Time flies. It seems like yesterday but it is actually well over two years ago that I was asked to write Columns for BPTrends, on the various elements and trends that I encounter in BPM research and education. This was a task I thoroughly enjoyed and so it fills me with sadness to report that this will be the last Column of mine before I hand over this enjoyable and exciting role to my dear colleague Jan vom Brocke (another Jan!) from The University of Liechtenstein. But more about this role change towards the end of this Column.

In this Column, I have decided to give you an insight into a both outward and forward looking area of BPM research; in fact, we want to discuss one of the streams of research and development that are yet to find a way of translation into practice. To that end, I have teamed up with colleagues and students here at Queensland University of Technology with whom I have shared some thinking and research around BPM in Virtual Environments (hence, BPMVE).

In a previous BPTrends issue [1] we detailed some of our initial work involving the use of 3D virtual worlds to visualise business processes being executed. Now, we want to look back as well as forward to describe how the research has progressed over the past five years, and also what can be expected in the future.

In structuring this Column, we look at two key and recurring issues in BPM, namely, collaborative process modelling and process model communication, both of which continue to be a struggle for practitioners as well as researchers and which we consider to be viable candidates for the application of virtual worlds. This is due, in the large part, to the affordance of virtual worlds to applications requiring remote collaboration and visualisation.

How Virtual Environments Enable Remote Collaboration in BPM

To create process models, modelling experts have to extract and consolidate the domain knowledge that is distributed among all the people involved in the business process. The quality of tool support for process modelling influences how stakeholders view the practice [2], and can also increase the participation in process improvement projects. This is especially so when domain experts are scattered across multiple locations in a large multinational company or in global projects, as the technology facilitates communication.

Present remote process modelling collaboration technology, however, does not support a number of visual cues, including non-verbal communication, often used for efficient collaboration on artefacts. Based on our previous research on collaborative virtual worlds[3, 4], we suggest that the use of avatars in a virtual environment will assist remote collaborative process model creation and validation, by providing visual cues that are critical for efficient collaboration. Figure 1 shows how this is accomplished via the integration of communication and task spaces, incorporating human avatars that enable the juxtaposition of the process model with a representation of the remote modeller and the editing tasks they are performing.

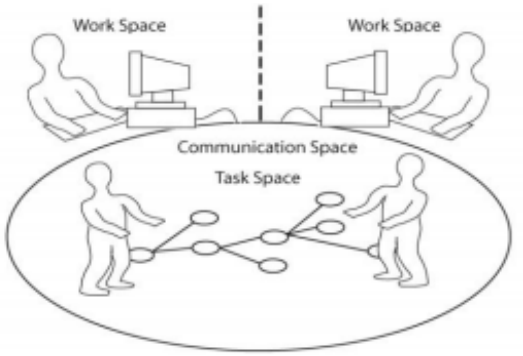


Figure 1: Representation of integrated communication and task spaces in virtual world remote collaboration scenarios

How Virtual Environments can Assist Remote Process Modeling

We have developed a prototype virtual world-based BPMN editor [5], incorporating most process model elements from the BPMN standard, including swim lanes, all activities, events, gateways and three types of sequence flow (see Figure 2).

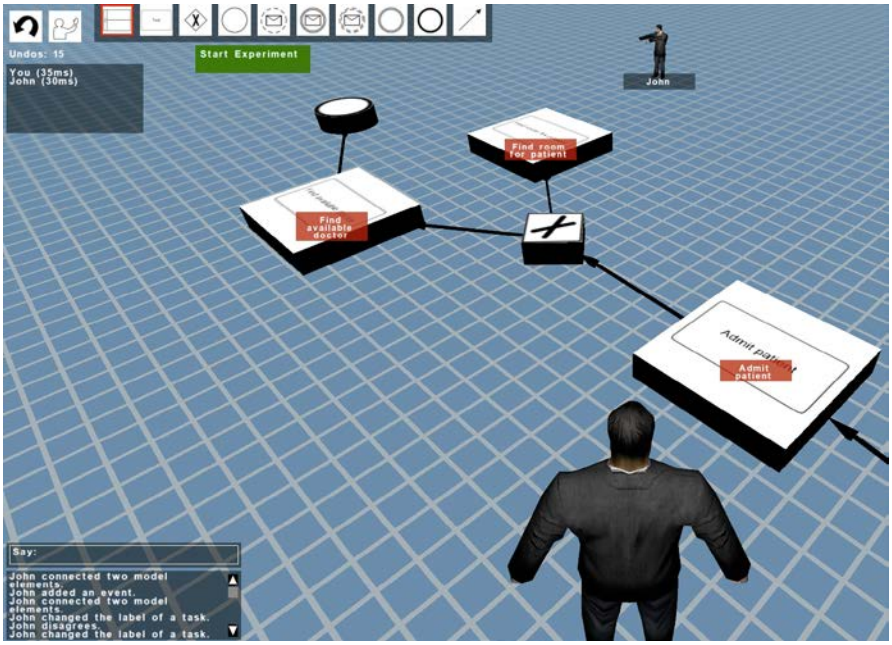
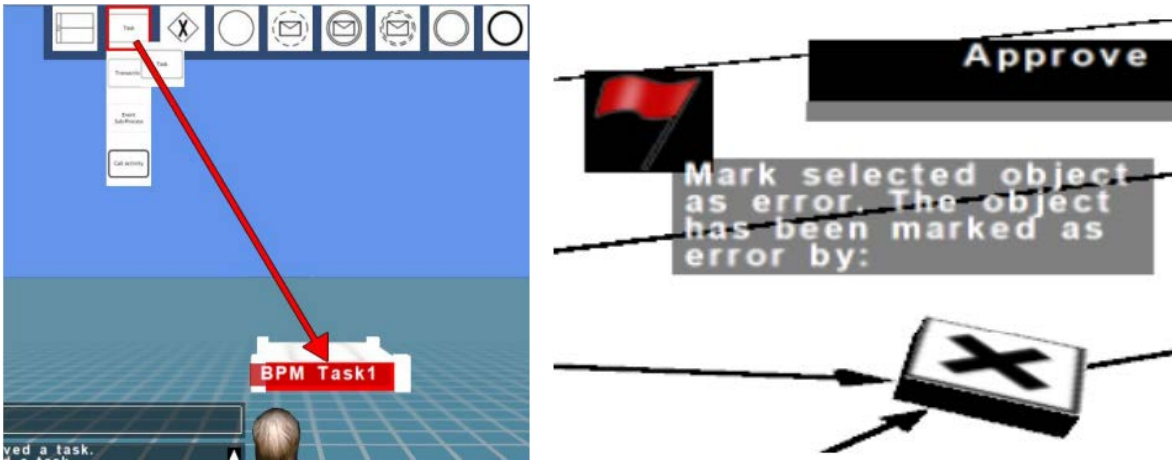


Figure 2: Image of the prototype being used to edit a BPMN process model. The two avatars represent two remotely connected collaborators.

We also decided to represent the process model in a 2D plane, so that users can interact with the model in the same way they would normally interact with process models in present 2D tools. Furthermore, we implemented a graphical drag & drop interface (see Figure 3a) similar to commonly used modelling tools. Users can create model elements by dragging the image of the required element from a bar at the top of the screen into the 3D space. They can move and scale elements by dragging markers on their corners. Even though the process model is two dimensional it is placed in a three dimensional virtual environment, facilitating viewing from different angles.

Since the tool is primarily built to support collaborative process modelling, it provides a number of features for collaboration. First of all, it allows users to host a server or connect to a server. This server synchronizes all actions between the different clients. Connected users can then create, view and edit process models in a shared virtual 3D space. All participants can see these changes in real-time to allow for communication and coordination by actions.

For purposes of communication the tool supports Voice-Over-IP (VOIP), as well as text chat. Furthermore, each remotely connected user is embodied in this space with an avatar, therefore allowing referential shortcuts such as — "the gateway over here." A history display contains an awareness display that shows what participants are currently doing (e.g. — User X is typing) to allow for better coordination of both communication and editing.



a b

Figure 3: Drop and drag interface (a) and consensus mechanism (b) examples

Due to the nature of the process modelling task, we have also implemented two consensus mechanisms (see Figure 3b). The process model can be locked for validation. In this mode changes to the model cannot be completed until every participant has marked a model element as being in error. Thereby, participants have to reach consensus before editing the model. Once a model element has been marked as an error, changes to the element can be applied. Before these changes are made persistent, each participant has to approve a presented list of the changes.

At this stage we have implemented animated avatars. For example, avatars show a typing animation while the user enters text via the keyboard. In addition, users can select from a menu specific, predefined animations such as a head nod or waving an arm. We also provide a contextual pointing animation, which users can execute by clicking on a model element while holding the Ctrl-key. This will make the avatar point at the selected element.

In a future phase of this project, we will use the Microsoft Kinect as an immersive interface to automatically capture the user's body posture, motion and facial expression, displaying them in real-time on the avatar.

You can check out the latest version of this editor prototype in a video demo by visiting http://www.youtube.com/watch?v=hYMgI6R4iHs.

How Virtual Environments Helps Communicating and Diagnosing Processes

The aim of the diagnosis phase in the BPM life cycle is to capture and analyse business processes in an effort to identify optimization potential. Business analysts review running results from the business processes of stakeholders and revise the said business process, if the stakeholders request changes. Issues such as measuring the gap between current business processes and desired business processes should be discussed in this phase. An accurate and mutual understanding between business analysts and stakeholders is therefore critical in decision making regarding process improvements.

From a communicative viewpoint, the business analysts and other stakeholders alternatively play the role of message sender and receiver in a communication process. The information about business processes are "encoded" by message senders (business analysts and/or stakeholders) in specialist conceptual models with predefined visual notations, such as BPMN.

This explicit visual encoding clearly has some benefits [6] but it also has drawbacks. On the one hand, stakeholders may not always represent their understanding and thoughts about business activities in such a structured manner. Their goal may not be clearly defined and a variety of unexpected factors can influence their satisfaction with meeting results. On the other hand, the visual notations used by business analysts are, at times, difficult for stakeholders to comprehend. As a result, analysis results (often visualized in conceptual models), can be incorrect, or too abstract in comparison to the operational view that stakeholders often have of their work.

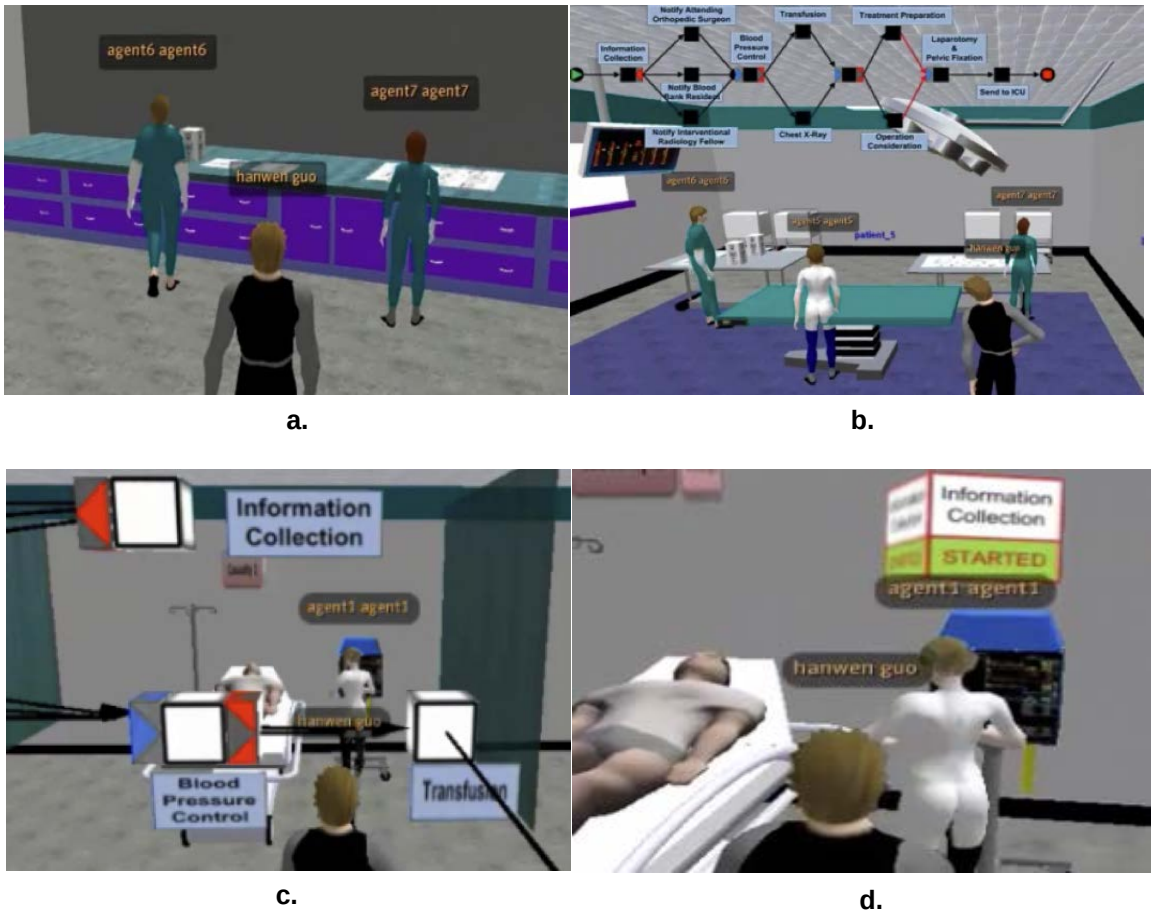
One of our research goals has been to create a business process visualisation approach that provides less ambiguity in the way that processes are encoded and transmitted between communication partners (say, analysts and operational stakeholders). Our initial research has focussed around human resource and control patterns that can be found in typical business processes. Our intention was that an easy to use and flexible visualisation tool could be developed to assist business analysts in the validation of process models in a simulation of an operational environment that is easier to understand than an abstract diagram.

We have developed an agent-based human resource simulation architecture [7], which utilises software planning agents, and a workflow tool called YAWL, to simulate the actions of humans performing work. This simulation is then visualised within a 3D virtual world. A number of visualisation configurations have been developed to investigate user preferences and the possible communication capabilities of such representations.

The rudimentary visualization is our initial configuration; it represents human resource activities in a virtual world, without embedding extra information. We label this visualization approach Type A (see Figure 3a). Based on this visualization, three other visualizations have been developed, where extra information is embodied to enhance cognitive processes.

The following examples show an implementation of our architecture, utilising a hospital patient admission process model within a 3D virtual world. The visualization approaches presented here provides extra global and local views of the current process state. Figure 3 shows three new visualization approaches: 2D HUD information (text and diagram), embedded 3D geometry and resource aligned displays. The Type B HUD configuration in Figure 3b provides information readers with a global view about the process being executed in the virtual world. The embedded

configuration Type C in Figure 3c indicates a local view about the virtual world, with embedded 3D process model components guiding users in the next process steps. The human resource aligned view, Type D in Figure 3d, displays control and resource pattern information aligned (overhead) within the context of the resource carrying out the work in the simulation.



a. **b.**

c. **d.**

Figure 3: Virtual world visualisations, a. - rudimentary visualization approach, b. - workflow model as a HUD, c. - visualization approach embedding a workflow model and d. - visualization approach aligning process information over the head of human resources

Performing preliminary subjective analysis on each of the visualisations, the results have indicated that Type B and D are preferred by users. In addition, there is some evidence of an increased efficacy in information communication for certain tasks when augmenting the rudimentary visualisation with other information, and that this is best performed by the Type B and D configurations.

The good news is that you can access our work freely to build your own impressions. A video demonstration can be viewed at http://www.youtube.com/watch?v=m6Losma61-U.

What's in it for you?

So why did we tell you all this? From a broader perspective, we were hoping to show how research in Business Process Management sometimes seeks to explain current practices (like we did in papers [2, 6]), and sometimes the goals of research are to paint the picture of a yet distant future, and to develop prototypes of tools and techniques that can change – and improve – the

way we conduct Business Process Management. This Column was dedicated to the latter. Do we believe in the ideas presented? Absolutely. In fact, we expect a range of positive impacts to emerge for BPM organisations upon the implementation of final versions of this technology at an enterprise scale (once, of course, these technological ideas have matured and are "ready for the market"). We structure these possible impacts around the two key BPM challenges the technology addresses – collaboration and communication:

Collaboration Benefits:

1 **Increased ease of remote collaboration**: intuitive interfaces that enable non-verbal gesture-based communication will provide a much more painless environment for remote collaboration than present systems.
2 **Cost and resource savings:** along with increased uptake, we expect practical savings in the need to travel to perform face to face consultations, in particular, less of a need to have table meetings for face to face validation.
3 **Reducing errors and improving quality**: communication enhancement should improve the process of modelling so that models are of a higher quality.

Communication Benefits:

1 **Higher validity:** validation outcomes should be improved via the use of representations that assist stakeholders and analysts in discussing process problems. In particular, we expect that stakeholders will be able to recall more information due to the visual representation being close to their actual workplace.
2 **Efficiency gains:** Visual forms of what-if scenarios can be generated instantly, to provide immediate feedback from stakeholders on process models and their execution.

Of course, only the future will show how and where these benefits manifest. We should also add that researchers like my colleagues can only ever do the first step – show that a new technology, a new idea works and has merits. The development of full-scale solutions is then up to software agents, organizations or simply interested individuals – maybe you?

Some final words: Introducing Jan vom Brocke

The nice element of this Column is the forward-looking nature of the research presented. Indeed, I look forward to looking back in 2015 to see whether the ideas proposed have made an impact, have found their way into organizational BPM practice.

Yet, it will not be our position to do this piece of reflection in two years time. But we hope that one of our colleagues, Jan vom Brocke, will be in this position when he takes over the role as BPTrends columnist from now on.

Most of you will have heard of Jan. Jan holds the Hilti Chair of Business Process Management at the University of Liechtenstein. He has more than fifteen years of experience in IT and BPM projects and has published more than 200 refereed papers in the proceedings of international conferences and established journals. Importantly, Jan is the coeditor and coauthor of some of the globally leading textbooks on BPM – The International Handbook on BPM [8, 9], and a new volume on BPM for sustainability [10]. He truly is a thought-leader on BPM as a holistic and comprehensive practice, and so I ask you to join us in welcoming Jan to his role as BPTrends Column contributor. We all look forward to his views and experiences.

Acknowledgments

As usual, this Column describes some of our personal interpretations of research, practices, problems and potential solutions and all statements should be considered as the authors' personal views. We further wish to acknowledge explicitly the support of the Smart Services Collaborative Research Centre in Australia, which has financially supported the development of the research presented in this Column.

We would also like to use this opportunity to extend our gratitude to BPTrends and especially Carolyn Potts for all her editorial efforts and support. We firmly believe in the role and value of BPTrends to the BPM global community and we wish Carolyn and everyone else in the BPTrends ecosystem all the best.

Finally, as usual, please feel free to contact us with your suggestions, feedback and comments, or for a copy of articles related to the topics above.

About the Authors

Jan Recker *is a Full Professor and the Woolworths Chair of Retail Innovation at the Queensland University of Technology in Brisbane, Australia. Jan's research interests focus on the use of process design in organizational practice, business transformations and organizational innovations. Jan has authored and edited several books. He also co-authored over 100 academic papers in journals and conferences and presented his research all over the globe. He holds a PhD in Information Systems from Queensland University of Technology and a MS in Information Systems from the University of Muenster, Germany.*
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Ross Brown *is a Senior Lecturer with the Science and Engineering Faculty at the Queensland University of Technology in Brisbane, Australia, where he is a member of the Business Process Management (BPM) Discipline. He also teaches computer graphics and final year project units in the Bachelor of Games and Interactive Entertainment. His main research interests are in the application of 3D games technology to other research domains. In particular, his latest research involves the development of virtual world technology for the representation of BPM information. A number of projects are currently underway, including: the embedding of executable workflows in virtual environments, collaborative 3D process modelling, 3D spatial visualisation of process models and the development of game-like consumer interfaces for personal processes. More information on Ross's work can be found at: http://www.bpmve.org. Ross can best be contacted via email at r.brown@qut.edu.au.*

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References

1. Brown, R. and F. Cliquet, *Communication of Business Process Models via Virtual Environment Simulations.* BPTrends, 2008. **12**(9): p. 1-7.
2. Recker, J., *"Modeling with Tools is Easier, Believe Me" - The Effects of Tool Functionality on Modeling Grammar Usage Beliefs.* Information Systems, 2012. **37**(2): p. 213-226.
3. Brown, R., J. Recker, and S. West, *Using Virtual Worlds for Collaborative Business Process Modeling.* Business Process Management Journal, 2011. **17**(3): p. 546-564.
4. Poppe, E., et al., *Evaluation of an Augmented Reality Collaborative Process Modelling System*, in *Cyberworlds*. 2012, IEEE: Darmstadt, Germany. p. 77-84.
5. Poppe, E., et al., *Improving Remote Collaborative Process Modelling using Embodiment in 3D Virtual Environments*, in *9th Asia-Pacific Conference on Conceptual Modelling*. 2013, Australian Computer Society: Adelaide, Australia.
6. Indulska, M., et al., *Business Process Modeling: Perceived Benefits*, in *Conceptual Modeling - ER 2009*, S. Castano, U. Dayal, and A.H.F. Laender, Editors. 2009, Springer: Gramado, Brazil. p. 458-471.
7. Guo, H., R. Brown, and R. Rasmussen, *Workflow Resource Pattern Modelling and Visualization*, in *36th Australasian Computer Science Conference*. 2012, Australian Computer Society: Adelaide, Australia.
8. vom Brocke, J. and M. Rosemann, eds. *Handbook on Business Process Management 1: Introduction, Methods and Information Systems*. International Handbooks on Information Systems. 2010, Springer: Berlin, Germany.
9. vom Brocke, J. and M. Rosemann, eds. *Handbook on Business Process Management 2: Strategic Alignment, Governance, People and Culture*. International Handbooks on Information Systems. 2010, Springer: Berlin, Germany.
10. Seidel, S., J. vom Brocke, and J. Recker, eds. *Green Business Process Management: Towards the Sustainable Enterprise*. Progress in IS. 2012, Springer: Heidelberg, Germany.

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