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Using natural user interfaces for collaborative process modelling in virtual environments

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Abstract. Modelling business processes for analysis or redesign usually requires the collaboration of many stakeholders. These stakeholders may be spread across locations or even companies, making co-located collaboration costly and difficult to organize. Modern process modelling technologies support remote collaboration but lack support for visual cues used in co-located collaboration. Previously we presented a prototype 3D virtual world process modelling tool that supports a number of visual cues to facilitate remote collaborative process model creation and validation. However, the added complexity of having to navigate a virtual environment and using an avatar for communication made the tool difficult to use for novice users. We now present an evolved version of the technology that addresses these issues by providing natural user interfaces for non-verbal communication, navigation and model manipulation.

Introduction

Virtual worlds have received continuous attention in industry and research for purposes of training and remote collaboration (Messinger et al., 2009). While there have been studies showing the successful use of virtual worlds for such scenarios, there is also evidence that a key factor in their success is the familiarity of the users with virtual environments (Montoya, Massey, & Lockwood, 2011).

In previous work we have explored the use of virtual worlds for remote collaborative process modelling (Poppe, Brown, Recker, & Johnson, 2013). Process modelling involves the capture and documentation of organizational processes in semi-formal diagrammatic specifications for purposes of execution, automation, analysis or redesign.

In our ongoing experiments on the use of virtual worlds for collaborative modelling, we often note that relatively inexperienced users find using a mouse and keyboard to navigate the

virtual environment difficult, in turn impeding their ability to focus on the task at hand – process model creation, analysis or manipulation.

Prototype

We have previously presented a prototype process modelling tool (Figure 1) that uses a virtual environment and avatars to enable visual cues such as pointing and gesturing to facilitate communication between remote collaborators (Poppe et al., 2013). In this tool, collaborators control representations of themselves in a 3-dimensional space to view, create or manipulate process model elements such as tasks, events, gateways or other.

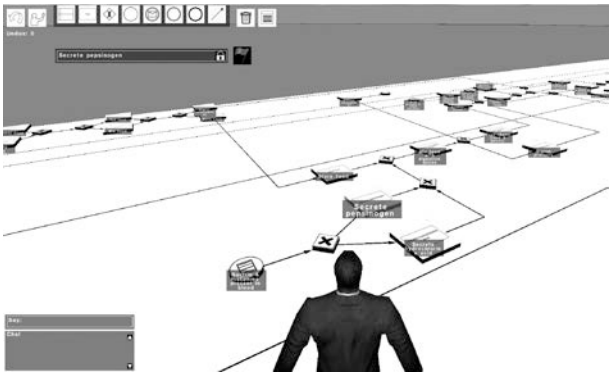

Figure 1. BPM Virtual Modeller (Poppe et al., 2013)

While our evaluation of this tool remains ongoing, we have identified three general usability issues in regards to user interaction with our tool:

- How do we animate an avatar with a large degree of freedom intuitively?
- How do we make model manipulation as intuitive as possible?
- How do we make navigation as intuitive as possible?

Answers to these questions have been suggested in the HCI and Virtual Worlds literature (Marks, Windsor, & Burkhard, 2012; Mazalek et al., 2011; North et al., 2009). On basis of this research, we have implemented *body-tracking*, *head-tracking* and *touch input* to address the issues described[1].

We address the first issue by tracking the posture of the user with a consumer depth camera and applying this posture to the avatar in real-time. This approach enables the use of gestures such as waving, gesticulation, and head nods and shakes, without having to navigate menus or remember buttons. Furthermore, this input method allows for gestures that have not been predefined or subtle variations of typical gestures.

Second, we have implemented a feature for model manipulation via touch input. Instead of having to use a mouse to edit the process model, the user can touch the process model on the screen to create, move, scale or delete elements.

A final issue of using a virtual world compared to other modelling tools is navigation. The 3D view requires users to navigate their virtual bodies in the virtual space, both for

[1] A demonstration video of the prototype can be seen at: http://www.youtube.com/watch?v=nvfoBfWpxKU

communication purposes and for viewing all parts of the model. This navigation requires movement along 3-axes and rotation around 2-3 axes and is commonly achieved using a combination of a mouse for rotation and multiple keyboard keys for movement. In our experience, this is confusing for users with limited experience with virtual environments. We therefore implemented head-tracking for camera control. The user can now turn her head to either side, up or down, to have the view turn that way and move his head forward, backwards, sideways, up or down to move the camera in the according direction.

Between these input methods, the keyboard is now required only for labelling model elements. Also, we have reduced the number of keys the user needs to remember to a bare minimum. These interfaces should now enable users to focus on the task of collaborative modelling instead of handling input devices.

Conclusion

We have presented a prototype virtual world that uses natural user interfaces to minimize usability issues for users that are unfamiliar with virtual worlds. In our ongoing work we are executing experimental tests to examine (a) whether this interface indeed facilitates the use of the tool by novice users, and (b) how collaborative modelling processes are enacted by users in a virtual environment.

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References

Marks, S., Windsor, J., & Burkhard, W. (2012). Head Tracking Based Avatar Control for Virtual Environment Teamwork Training. *Journal of Virtual Reality and Broadcasting*, *9*(9).

Mazalek, A., Chandrasekharan, S., Nitsche, M., Welsh, T., Clifton, P., Quitmeyer, A., Peer, F., et al. (2011). I'm in the Game : Embodied Puppet Interface Improves Avatar Control. *International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 129–136). Funchal, Portugal: ACM.

Messinger, P. R., Stroulia, E., Lyons, K., Bone, M., Niu, R. H., Smirnov, K., & Perelgut, S. (2009). Virtual worlds — past, present, and future: New directions in social computing. *Decision Support Systems*, *47*(3), 204–228.

Montoya, M. M., Massey, A. P., & Lockwood, N. S. (2011). 3D Collaborative Virtual Environments : Exploring the Link between Collaborative Behaviors and Team Performance. *Decision Sciences*, *42*(2), 451–476.

North, C., Dwyer, T., Lee, B., Fisher, D., Isenberg, P., Robertson, G., & Inkpen, K. (2009). Understanding multi-touch manipulation for surface computing. *Human-Computer Interaction - INTERACT* (Vol. 5727, pp. 236–249).

Poppe, E., Brown, R., Recker, J., & Johnson, D. (2013). Improving Remote Collaborative Process Modelling using Embodiment in 3D Virtual Environments. *Asia-Pacific Conference on Conceptual Modelling*. Adelaide, Australia.