Virtual Worlds as a Model-View Approach to the Communication of Business Processes Models

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Abstract. Although business process analysis methods are mature today, business analysts and stakeholders are still hampered by communication issues. We argue that using a virtual world to model a business process can benefit communication activities. We believe that virtual worlds can be used as an efficient model-view approach, increasing the cognition of business requirements and analytic results, as well as the possibility of business plan validation. As an exploration paper, we believe that this promising research can encourage people to investigate more research topics in the interdisciplinary area of information system, visualization and multi-user virtual worlds.

Keywords: Virtual World, Business Process Management, Visualization

1 Introduction

An optimization and improvement process for a workflow system involves an intensive communication process between the stakeholder and business analyst [1]. According to communication theory [2], a general communication model adapted in the workflow system optimization and improvement process can be depicted in Fig.1. It is reported that business analysts and stakeholders often have communication problems [2-4]. On the one hand, stakeholders cannot always elaborate their business activities in a well structured way [3]. On the other hand, the visual code used by business analysts inevitably has noise, interfering with cognitive processes in the reader [2].

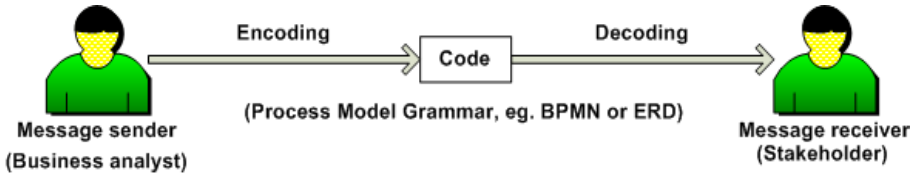

Fig. 1. A general communication model can be applied in the communication process between a business analyst and stakeholder.

Thus, it can be concluded that noise exists in the encoding and decoding process, as well as the visual code, reducing the possibility of stakeholder buy-in to the plan.

As a result, a solution to this problem is to use a semantically transparent code that can assist the reader in inferring the meaning of a code from its appearance [4].

Recently, it has been realized that 3D virtual worlds can be applied in social science [5]. This is because its richer visualization representation abilities enable people to effectively process more information [6]. This strongly suggests that 3D virtual worlds could be a superior process visualization platform, enabling people to recall and cognate about conceptual and non-conceptual content, facilitating the communication process in analyzing, modeling and validating organizational structure and resource behaviors, see Fig. 2.

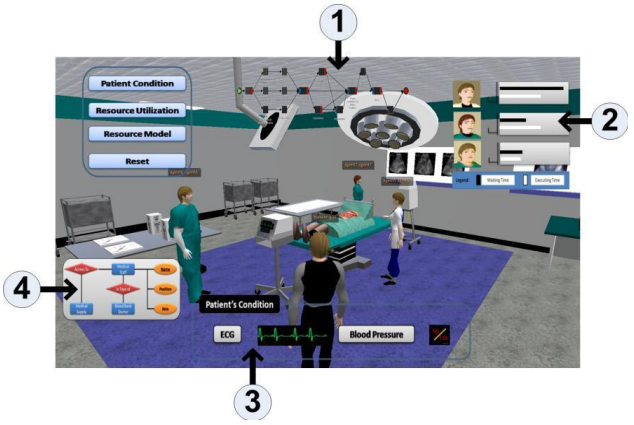

Fig. 2. Snapshots of an emergency treatment workflow visualized in a 3D virtual world, where several avatars are about to revive an injured person. Four HUD images indicate the current state of the visualized workflow system (1) and human resource workload (2), patient's condition (3), and entity relationship (4). This can help virtual world participant (black vest in the middle), whether a business analyst or stakeholder, recall what happens in reality or comment on the conceptual model.

This paper is organized as follows: Section 2 discusses related work. Section 3 explores the rationality of using a virtual world as an alternative communication approach. Section 4 uses a case study in the healthcare domain to demonstrate a set of visualization benefits offered by such a communication approach. At last, Section 5 concludes with a discussion of achievements, and points towards further work.

2 Related Work

The Entity-Relationship Diagram (ERD) can be used as a hands on modeling approach for native stakeholders. However, several researchers [7,8] pointed out the inappropriateness of the representation when an ERD is extend with attributes to represent complex relationships. In addition, Weber [9] concluded that applying an ontology in the modeling process can increase the understandability and perception of the information in a conceptual model.

However, these researchers did not address the issue that sound professional knowledge in information systems plays an important role in understanding modeling results [10], and we cannot guarantee that every stakeholder has such necessary knowledge. Compared with these previous works, this paper intends to provide a new model-view approach that can facilitate communication between stakeholders and business analysts, by allowing participants to observe actual activities at the operational level being juxtaposed with a conceptual model.

Currently, 3D virtual worlds have become popular research topics in E-commerce domains. Some researchers [11,12] have visualized a process models from the control, resource and data perspectives in a virtual world. Perkins [13] proposed an agent system that plays as an intermediate between a simple workflow engine and a virtual world for representing human resource behavior. Bogdanovych [14] established a methodology called Virtual Institutions (VI) to facilitate the communication between the customer and product sellers, which has a similar purpose to ours.

These works [12,11,13,14] have realized that the virtual world is powerful in demonstrating what is happening in an enterprise. However, they did not address how virtual worlds can be used as an alternative tool for facilitating communication in business process modeling tasks, in particular, how human resource models relate to process models.

3 Virtual World as the Model-View Communication Approach

3.1 Business Improvement and Optimization Activity Review

At the operational level, people are interested in the specific sequence of task events, personnel arrangement and resource behavior [15]. To satisfy these interests, we believe the following list of visualization aspects (but not limited to) should be addressed: Physical Environment and Human Resource Behavior, Entity Representation, Information Display, Business Scenario Rehearsals. These are diagrammatically represented as supporting points in the improvement process life cycle shown in Fig.3.

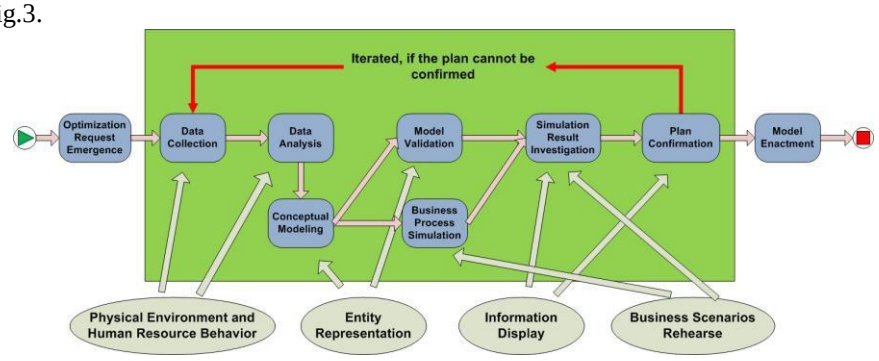

Fig. 3. The life cycle of a business process improvement. The phases requiring visual assistances are highlighted in a green rectangle by the ellipses at the bottom of the diagram.

- Physical Environment and Human Resource Behavior --- The states of a physical environment impacts the behavior of a human resource and business task transition [16]. Visualization of this aspect enables insight into relationships between a physical environment and business processes.
- Entity Representation --- Business analysts usually use simple 2D objects to abstractly represent real objects. For example, process models grammars, such as BPMN, are used to describe the state transition of tasks, ER diagram are used to reflect the relationship between human resources and non-human resources.
- Information Display --- Information may be loosely classified as qualitative and quantitative information. Representations of this information will provide people with insight into the workload of human resources, and utilization rates of non-human resources.
- Business Scenario Rehearsals --- Sometimes, business analysts need to use simple visual approaches, such as sliders, to demonstrate the consequence of enacted business models [17]. Such visual assistance is an essential approach in requirements elicitation and analysis.

3.2 Virtual World Introduction

A virtual world is a network-based, computer synthesized dynamic environment, where participants can communicate with each other and observe computer-generated environmental objects [18]. Some selected features are discussed below:

- Geometry Representation. The geometry in a virtual world is composed of a metadata called geometric meshes. The combination of geometric meshes can form the shape of real objects.
- Programming. People can use programming languages to implement system functions, such as the reaction of an object based upon the current state of the virtual world and database connections and/or document printing.
- Avatars. An avatar is a 3D graphical representation of a virtual world participant with a humanoid appearance, it can be used as a vehicle for virtual world creation, exploration and modification, or for presenting an artificial agent.
- Behavior Modeling. A behavioral model is the mathematical formulae of the movement logic implemented by a programming language. Examples of a behavior model can be a picking up goods from the table of an avatar receiving an order.
- Information Visualization, depending on the analysis task, information can be represented in 3D, or can be represented via a 2D representation on a Heads Up Display (HUD).

3.3 Virtual World As Alternative Communication Approach in Business Process Improvement

We now explore the rationale behind using a virtual world as a communication approach in business process modeling. An overview of how the virtual world can satisfy visualization needs during the communication process is described in Table.1.

Table 1. The table shows the relationship between visualization needs and supported virtual world features.

Visualization Needs	*Supported Virtual World Features*
Physical Environment and Human Resource Behavior	Avatars, Geometry Representation, Behavior Modeling
Entity Representation	Geometry Representation
Information Display	Programming, Geometry Representation, Information Display
Business Scenarios Rehearsals	Avatars, Geometry Representation, Behavior Modeling, Programming

In a virtual world, a complex environment can be built up from basic geometries. Creators can twist, squeeze, and stretch basic geometries into the certain shape to satisfy a particular need. The dress and behavior of people can be a form of self expression and social identity [19,20]. People can see the profession of these avatars. In Fig 4, we illustrate such a creation process, as well as appearance and behavior of avatars.

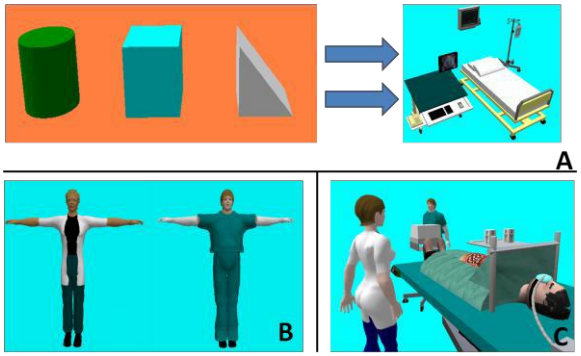

Fig. 4. Illustration of geometry creation process (A), avatar appearance (B), and avatar behavior (C).

Thus, synthetic environments and observable inhabitants of a virtual world, if being correctly translated from reality, enable business analysts and stakeholders to have a concrete observable instance as an object to assess, evaluate, predicate and identify.

4 Case Study

4.1 Visualization Applications

We utilized the YAWL system [21], JADE[1], OpenSim[2], Hippo OpenSim Viewer[3] and OpenMetaverse[4] API to implement our prototype as a proof of concept. The YAWL

1 jade.tilab.com

2 www.opensimulator.org

system is a WfMS that employs a workflow language called YAWL (Yet Another Workflow Language) [22]. JADE (Java Agent DEvelopment Framework) is a JAVA based agent platform, providing developers with an agent system infrastructure platform. These two packages are used to implement our previous agent system [23] that provides underlying agent behaviors, with reference to workflow activity allocation commands. OpenSim, Hippo OpenSim Viewer and OpenMetaverse are 3D application server, 3D application client, and API for behavior modeling of human resource. These three API packages are used to implement our prototype visualization system on top of the agent infrastructure, to produce the images seen in this paper. The architecture of our system is available in Fig.5. We illustrate this architecture with model-view-control (MVC) design pattern.

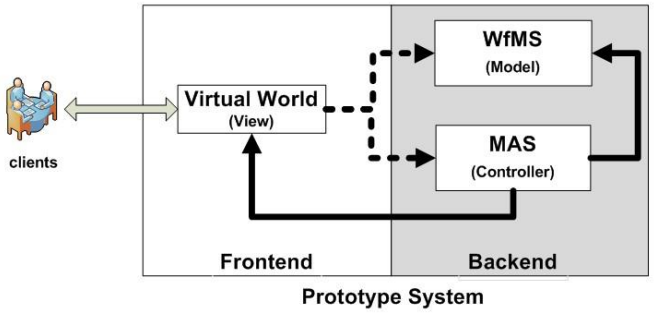

Fig. 5. The architecture of this prototype MVC-based system.

Application in Conceptual Modeling and Modeling Validation.

In a virtual world, people can work together to discuss conceptual models in a direct manner. They can create geometries attached with different textures representing the artifacts used in the reality, and juxtapose these geometries with a modified form of conceptual model. Due to the ability to see the conceptual model in the same space as the person's workplace, business analysts can easily sketch up the components of a model, see Fig.6, and then display them to stakeholders, who can confirm validity of the model.

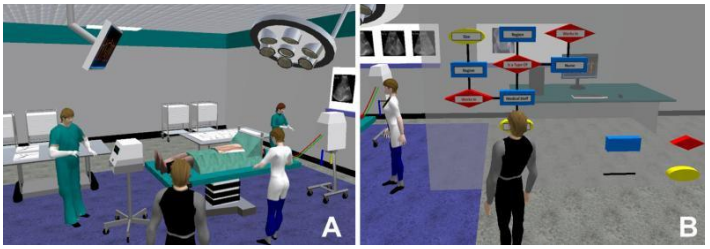

Fig. 6. Conceptual modeling visualization in the virtual world. A business analyst can sketch and observe the behavior of simulated medical staff, see picture A. Based on observations, he is sketching an ER diagram, right picture B.

3 www.mjm-labs.com/viewer

4 www.openmetaverse.org

Application in Business Process Simulation.

In a virtual world, the actual human resource performance and corresponding abstracted information can be simultaneously observed. For example, the concrete and abstract information of task blood transfusion are available to participants, see Fig.9. A local view toward this task such as the responsibility of human resource and non-human resource utilization (the blood bag) can be obtained by native stakeholders. The abstracted information, such as the temporal ordering of task and entity relationship, can be represented through a process model in the HUD (Image D, Fig. 7).

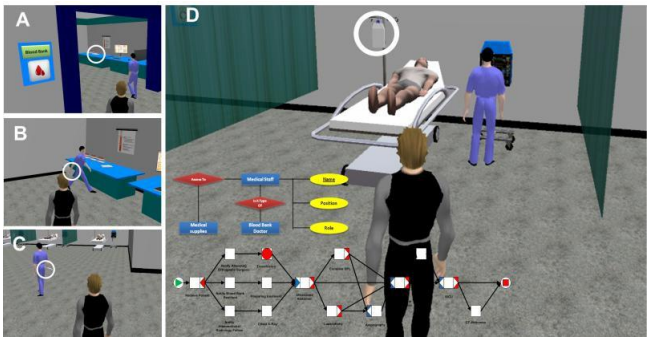

Fig. 7. Illustration of resource behavior observation. The pictures A to D are snapshots from the system. The participant (black vast) can see the actual avatar performance, while executing YAWL model information is displayed in the HUD, (with the red token indicating current workflow state) along with an ER diagram and task description in D.

5 Conclusion

The main purpose of this paper is to provide a visualization approach to strengthen the communication channels between business analysts and stakeholders, before any improvement and optimization activity is conducted. Based on this research, one possible direction forward is the visualization of deviations between two conceptual models that need to be considered. Currently, our system can visualize a workflow system with different simulation configurations by converting the "as-is" result in to 3D visualization of the "to-be". An intuitive indication is still needed for native stakeholders to understand the changes to be introduced by the new model.

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