Model-Driven Approach for User Interface — Business Alignment

Kênia Sousa

Université catholique de Louvain, Louvain School of Management, Belgian Lab of
Computer-Human Interaction, Place des Doyens, 1, 1348 Louvain-la-Neuve, Belgium
+32 0 10 47 83 91
kenia.sousa@uclouvain.be

ABSTRACT

Organizations that adopt Business Process (BP) modeling as a source to implement enterprise systems struggle to maintain such a link. However, not all types of organizations are structured for professionals to adequately manage processes and supporting systems. Even though there are techniques to align business processes and systems, there lacks a solution that addresses User Interfaces (UI). The negative impact of focusing only on functional aspects is that many changes on processes that affect UIs are not carefully considered. Therefore, our solution aims at aligning business processes with UIs by adopting a model-driven approach. Such support is targeted at large organizations to enable them to manage those links.

Categories and Subject Descriptors

H.1.0 [**Information Systems**]: Models and Principles - General, H.5.2 [**Information Interfaces and Presentation**]: User Interfaces - Theory and methods, User-centered design.

General Terms

Design, Human Factors, Management.

Keywords

Business Process Modeling, Model-Driven Engineering, User-Centered Design, Requirements Engineering.

1. INTRODUCTION

The use of Information Technology (IT) has evolved over time from its traditional use as administrative support towards a more strategic role to enforce business processes (BP). It is observed in the IT domain that most researches support propagating changes by associating models from business and IT ([1],[11]). Many of these researches use software engineering models to address alignment issues. However, such strategies do not consider a major aspect of information systems: their UIs. The impact of focusing only on functional aspects is that many changes on business processes that affect UIs are not carefully treated, thus, leaving the decision of how changes impact UIs to be done in an ad-hoc manner. This effect is even more negative when we address large systems in which changes in business process rules

are common and may have impact on even hundreds of UIs, leading to the need to define strategies to maintain the traceability between business process and UIs whenever changes are requested.

Changes on business processes that directly impact UIs may be related to details of ordering of UI components, of screens, positioning of UI components on screens, and navigation aspects. These aspects are only expressed in UI models, not present, for instance in use case, class, and activity diagrams of UML. However, there are few works in the literature that study the alignment of business process and UI models.

The power of models to represent complex problems, their maturity supported by model-driven engineering principles, and the recent contributions in the Human Computer Interaction (HCI) field to address the user interaction through models, form the basis of this research. The links between models promote traceability. When an activity in a BP changes, the links between the models determine the revision of the user interactions necessary to execute such activity. It could involve one or more screens, depending on the complexity of each case. Changing the right model keeps the alignment between processes and UIs [6]. The need to focus on user interaction has led us to innovate on aligning IT with business processes through UI models by originally calling the term *UI-Business Alignment*.

It is no longer only system processing time that is pivotal for large organizations to improve their services for customers. A consultant from the Center of Excellence in Process-Efficient Technology has presented results of a study, which was conducted with 29 companies that had their enterprise systems developed aligning business processes with UIs and 23 companies with systems developed using traditional approaches. It has shown that the alignment primarily contributed to 100 to 200 percent user productivity gains, as presented in [5].

2. NEED FOR UI-BUSINESS ALIGNMENT

Academics and practitioners agree that the potential of IT in enterprise systems depends on how it is used, which is directly influenced by the UI [8]. Therefore, there is a new interest on UI for the business domain, for instance, the work in [9] designs low-fidelity prototypes based on business process models. Some works on model-driven UI development state that relying only on processes is problematic to represent user interaction [7], thus there is a tendency for a hybrid approach combining task and process models. However, they lack important characteristics for UI-Business alignment, listed as follows:

• **Vision for user interfaces, but not for user interaction**: Some works propose aligning business processes with UIs with direct links between activities in processes to UI elements. However,

such strategies do not considerer the user interaction, which is much more detailed than what can be specified in business processes.

• **Absence of generic structure**: The decomposition of a business process in layers may vary depending on the organization, which makes one proposal applicable or not on certain organizations. However, there are proposals that have been defined based on specific case studies, with constraints that lead to a limited applicability.

• **Scarcity in tool support for traceability**: Most works propose a framework with principles, but not all provide a tool to help in making decisions when changes are made in business processes or in related models. Other works have tools to support the development life cycle, but no support for traceability is offered. This fact brings less efficiency when searching for information spread in different sources.

• **Not enough concern with people**: Works that focus much more on how the artifacts are linked, handled and maintained than on the people who actually use enterprise systems, fail to consider that it is actually these people the ones who are key to executing corporate activities.

Aiming at supporting the alignment of UIs with business processes, the main research question is: How do business processes influence UIs (and vice-versa)? For that, we need to analyze processes in the context of selected organizations, their methodology, standards, profiles of those involved, tools, etc. How changes in processes impact on the systems' UI. How the work of system users is affected by these mappings and changes, etc.

As a first step to address this research question, we have conducted a case study with a large Belgian bank/insurance organization, which, as is the case of several major financial institutions, also acts in the insurance industry. We conducted interviews with three business analysts, two system analysts and developers, and two UI designers, and we worked with examples from insurance contracts. The main detected issues were: lack of correlation between business process and UI design; difficulties in doing impact analysis after changes; and difficulties to find and keep updated information spread in several artifacts.

To address these issues, the research goal is to correlate business and UIs. The proposed solution is to define a framework composed of a methodology to associate business process with UI models and a tool for model traceability. This proposal is aimed towards large organizations that are driven by business processes, and want the systems' UIs to represent added value for business improvement in a way that as the processes are created, maintained, and evolved, so are its UIs and vice-versa.

3. EXPECTED RESULTS AND CONTRIBUTION

The framework has an innovative goal that is to enable fast adaptation to new business challenges considering business context and user perspective. To support user interaction by designing systems focused on users' tasks, we provide a traceability chain between business process and UIs through task models. The mappings rely on UsiXML [10], a UI definition language, which provides support to represent models in a structured form and supports the flexibility necessary to define model-driven UIs.
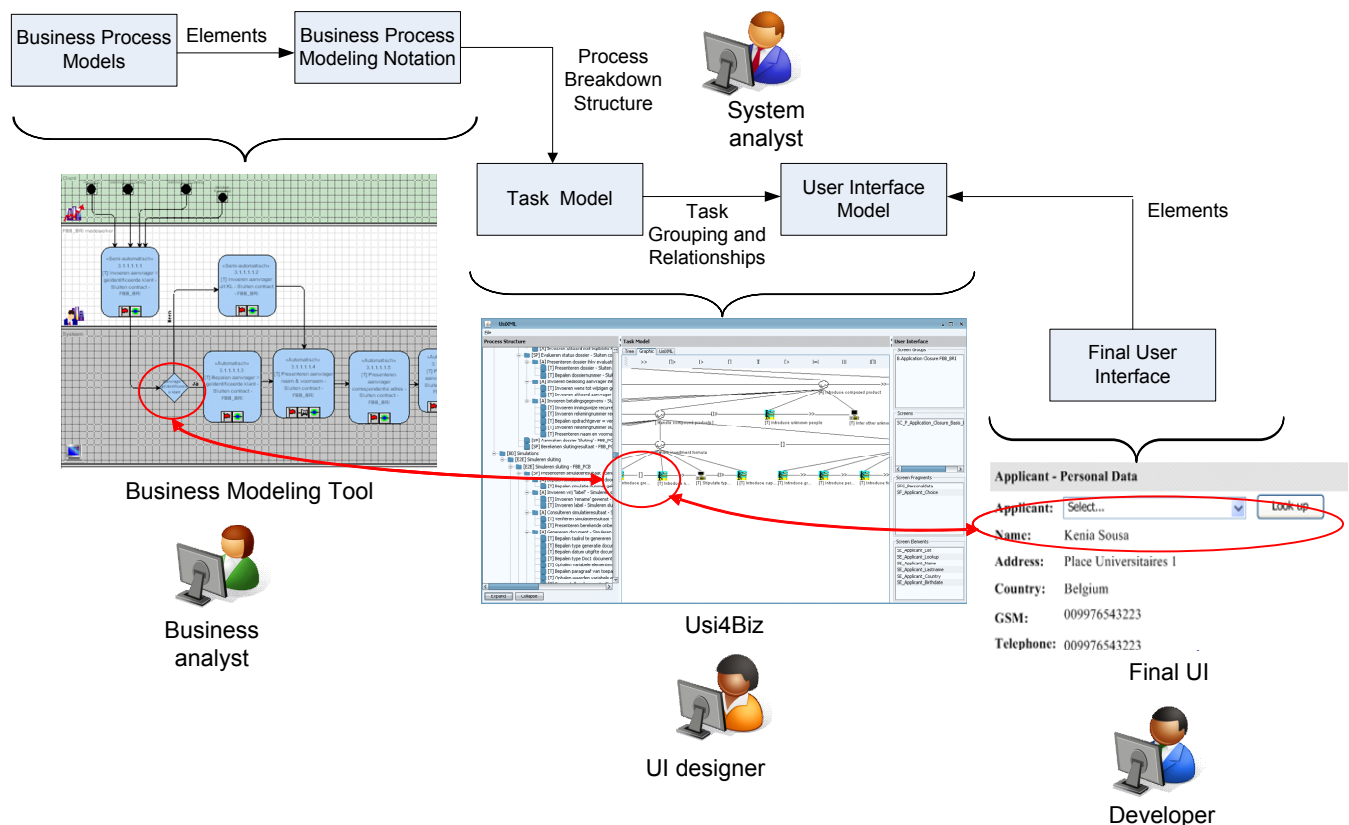

Figure 1. UI-Business Alignment Methodology.

Mappings are also founded on the Cameleon Reference Framework [3], extended with BP modeling. The alignment methodology (Figure 1) is composed of core actions to be integrated with any software development method and HCI method, as applied in the organization, whether traditional or agile. With minor changes on the way they work, highlighting that the core actions are mandatory to guarantee UI-Business alignment. It starts with BP models that can be done in any notation and specified either in an operational perspective (activities defined until the smallest action) or in a process perspective (activities specify what is performed, not details of how it is performed) [2]. The BP elements are transformed into BPMN unifying the business representation. The BP breakdown structure is associated with UI models through the hierarchical levels of task models. Each level of the BP is mapped with the different levels in the task models, then the task model is associated with the UI model that has UI components ranging from composable to atomic components, namely: *screen group*, a group of closely related screens; *screen*, a state of the user interface when executing a task or part of a task; *screen fragment*, a container of related elements; and *screen element*, the most atomic component [6]. This methodology contributes with a stronger relationship between BP and UIs; predicting impact analysis when changes are made on business processes or on UIs; and supporting decision makers with strategic information. The main characteristics of this methodology are:

User-Centered: The task model is recognized as the best model to precisely represent how users interact with systems and that piece of information is primordial to be linked with UI elements and monitor users' interaction aiming at optimizing user experience and consequently the processes that they execute. Without the task model, linking processes directly with UIs is not optimal because processes with high-level description do not express how activities are performed. The detailed specification of users' tasks represents a strong source for analytical data concerning process optimization.

Traceable: The tool supports the traceability from the business process until the UI to help in the prediction of the impact of process changes on the user interaction and to propose changes in the processes when the user interaction is improved. We have defined the ontology of the main elements necessary for the traceability. This taxonomy serves as foundation for the definition of rules: *transformation rules* to transform BP into task models; *verification rules* to check the coherence of the association of tasks with UI components; and *change management rules* related to changes on the business process that have an impact on UI components and vice-versa. We have defined 53 transformation rules; each of them has been explored for different operations, totalizing in 212 change management rules for forward engineering. The result of transformation rules are task models that represent an initial version that is yet to be evolved by UI designers/ usability experts to consider grouping tasks, detailing tasks relationships and defining specific users' tasks that are intrinsic to user interaction, not BP. The transformation rules are not applied to generate UIs since this methodology considers that UI designers create UIs that are used as input to specify the UI components.

Human-Centered: One of the core aspects of our solution is considering users as active agents who open a new channel for business improvement by informing any sort of problem they face with systems. The identified issues may lead to changes on the processes, on the UIs or on both. This is in accordance with the theory of structuration [4], which considers structure, but positions them in human practice, recognizing that the agents have and apply their knowledge when acting.
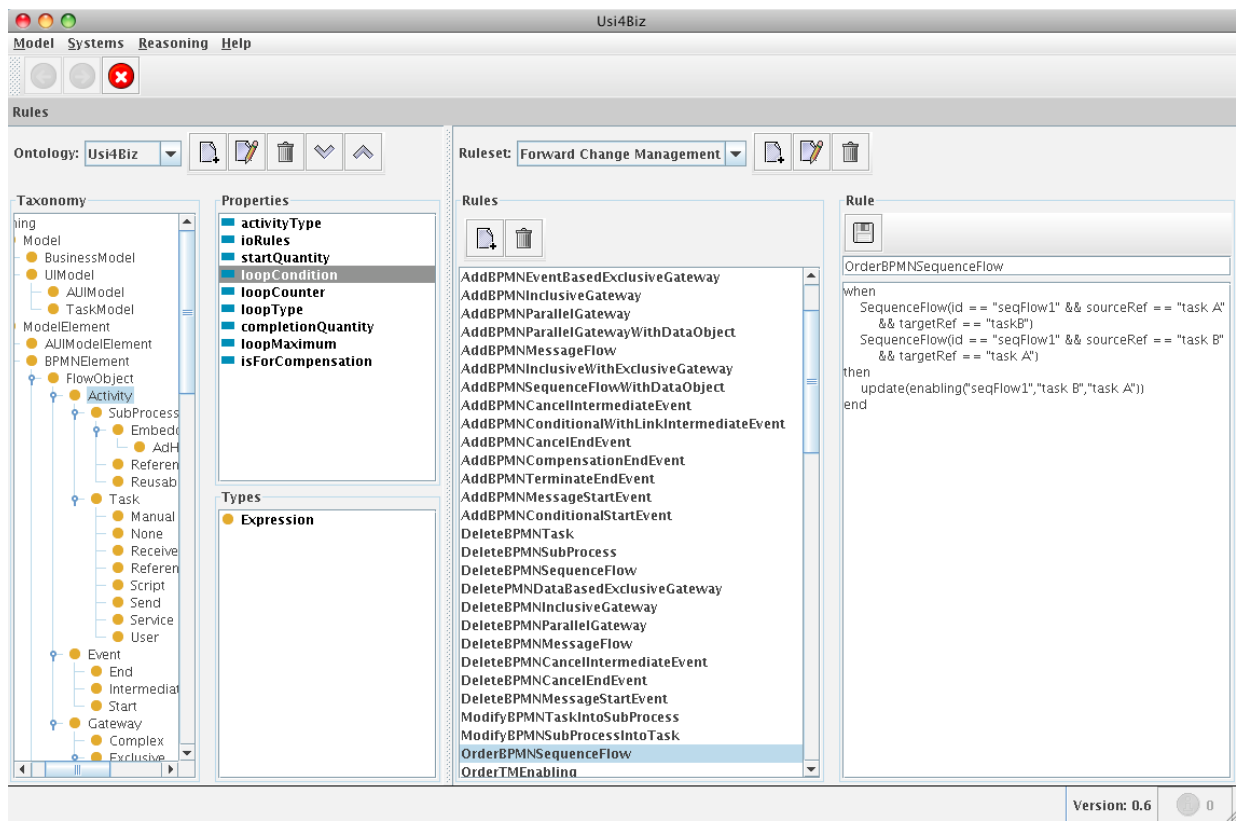

Figure 2. Overview of the reasoning module in traceability tool.

Adaptable: This framework is adaptable to changes in the organizational context, it accepts that the way that processes are modeled and structured in different layers may change and that the philosophy of user interaction may be evolved, thus leading to the need to update how these core models are managed. For this purpose we have selected an expert system approach based on production rules, where these rules specify how these models are managed to provide more flexibility. When there are changes in the structure of the models that impact the form of managing them, the rules can be directly updated, without the need for maintenance of the traceability tool. Figure 2 depicts the reasoning module composed of the ontology and rule set panel. On the left of the ontology panel, there is a list of the elements of the taxonomy. Each element of the taxonomy has properties (listed on the right of the taxonomy tree) and properties have types (listed below the property list). On the right of the ontology panel, there is the rule set panel used to create the rules. On the left of the rule set panel, there is a list of rules, depicted by name. Each rule is composed of name and content (depicted on the right of the rule set panel).

The return on investment from the tool is achieved through improvements on process execution and user interactions that are detected and put into action by applying the framework. When improvements are done in business processes and UIs that are executed and used very frequently, the return on investment is achieved even faster through an effective influence on process improvement and user experience.

Our proposition is that organizations that apply the framework are expected to be able to visualize how activities from business processes are executed through UIs. Our hypothesis is that end-users, project managers, business analysts and other stakeholders can communicate in concrete terms of UIs and the application of the methodology results in the identification of how improvements in UIs impact business processes and vice-versa. UIs are considered a source of process optimization because the way end-users perform their activities directly impacts time, budget and resource allocation for process execution. As a consequence, when each of the end-users gain minutes in productivity, it is actually the entire organization that wins time and money.

4. CONCLUSION

This paper presented a model-driven approach to link software requirements with business processes and UI models. With this approach, models are mapped in order to more efficiently propagate changes when needed. In addition, the user perspective is considered in alignment with business needs.

The consequent benefits of traceability is that all the models used to develop enterprise systems are internally mapped and that any attempt to make changes in at least one of them is alerted with warnings about the possible impacts. In scenarios in which changes have not been analyzed beforehand, the tool reviews the performed changes and suggests a list of actions that should be executed in order to maintain the alignment.

The experience in a large bank/insurance organization enabled us to propose a solution for the alignment of business processes and systems UIs, a major issue in this company as well as in many others in the competitive business word. This reality encourages us to validate this framework in more organizations. As future work, UI designers/ usability experts can rank the results of the transformation rules as a way to improve the support the rules give to the methodology.

One of the main advantages of this framework is that it puts the user perspective forward: 1) it considers users' needs as input for user experience enhancement; 2) considers UIs as a source for process improvement; 3) the richness of UI design and behavior is considered and UI designers/usability experts are active stakeholders; 4) user interaction is considered a major aspect through the use of task models as a bridge between business processes and UIs; 5) user interaction optimization is an aimed target since user interaction is seen as the concrete execution of process activities.

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