A Participative End-User Modeling Approach for Business Process Requirements

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Abstract. A business process can be characterized by multiple perspectives (intentional, organizational, operational, functional, interactional, informational, etc.). Business process modeling must allow different stakeholders to analyze and represent process models according to these different perspectives. This representation is traditionally built using classical data acquisition methods together with a process representation language such as BPMN or UML. These techniques and specialized languages can easily become hard, complex and time consuming. In this paper we propose ISEA, a participative end-user modeling approach that allows the stakeholders in a business process to collaborate together in a simple way to communicate the business process requirements in an accurate and understandable manner. Our approach covers the organizational perspective of business processes, exploits the information compiled during the simulation of the processes in the organizational perspective and touches lightly an interactional perspective allowing users to create customized interface sketches to test the user interface navigability and the coherence within the processes. Thus, ISEA can be seen as a participative end-user modeling approach for business process requirements.

Keywords: business process management, requirements engineering, domain modeling, user interfaces modeling, participative approach.

1 Introduction

Business Process Management is an important best practice that is critical for the long-term success of an organization and provides important benefits to organizations [18]. Modeling business processes may have different goals: align the organizational processes with users' needs, explain or automatize the different processes, evolve the conduct of the business in order to adapt it more rapidly to change, etc. Business process modeling techniques must enable the different stakeholders to analyze and represent business processes according to different and adapted perspectives (intentional, functional, organizational…) [8, 21, 24, 29].

Moreover, business process representations are traditionally built using classical data acquisition methods (interviews, observations, transcription of activities, text analysis, etc.) together with a process representation language such as BPMN or

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UML. These techniques and specialized languages can easily become hard, complex and time consuming particularly if the organization does not have formal and clear process description documents or if the stakeholders proceed mechanically without real conscience of the task.

On the contrary, participative approaches for business process improvement recommend a strong implication of the users [20, 28]. These approaches improve time and quality needed for the acquisition of the useful information to understand and improve the processes. However the obtained representations are not enough formalized, they don't correspond to models conformed to a formal modeling language.

Aware of these facts, we adopted an iterative and end-user centered design approach to involve functional actors of specific business processes throughout the representation of the useful process perspectives. End-users are indeed the ones that have the knowledge and have to use the system in the end, thus they should really know what is expected. Our approach called ISEA[1] can be seen as a participative end-user modeling approach for business process requirements in order to obtain sketches of models convertible in standard languages, all of them elaborated in a consensus-based manner. It is particularly adapted to existing business processes which need to be improved. Although it was developed and evaluated in the context of university business processes, it is generic and can be suited to different business processes domains to model and improve existing processes.

In the following, section 2 gives an overview of ISEA and describes by a MAP [10] the three perspectives yet covered by ISEA. Section 3 focuses on a particular path of ISEA, detailing some participative modeling activities proposed in the method. Section 4 presents an experimental research method used to co-construct and validate ISEA, this experimental research method is based on a user centered experimental validation cycle. Section 5 compares our approach to some related works in multi-perspective business process modeling and participative approaches for business process improvement. Finally, section 6 concludes the paper and describes the further works to be carried out.

2 ISEA a Participative End-User Modeling Method

The ISEA method allows modeling business processes following organizational, informational and interactional perspectives. We emphasized at first these three perspectives that are particularly suited for modeling and improvement of existing business processes. The informational perspective is based on the information compiled during the simulation of the process in the organizational perspective. The interactional perspective, based on organizational and informational perspectives, allows users to create customized interface sketches to test the user interface navigability and the coherence with the process. Figure 1 describes by a MAP [10] these three perspectives. Each perspective is characterized by three goals:

[1] ISEA: Identification, Simulation, Evaluation, Amelioration (`http://www.iseamethod.com/`)

- Model elicitation allows representing each view of the process using a Domain Specific Language (DSL) adapted to business process modeling [25]. Such DSL are use in similar works like PICTURE [31]. The strategies for model elicitation are participative and use role-playing simulation games [26]. For example, section 3 will describe the DSL as simple languages and graphical representations such as trees that we use in order to make them understandable by the functional actors of a process.
- Model evaluation highlights the process difficulties and dysfunctions. This evaluation is realized from the end-user process models.
- Model transformation aims at transforming the different perspectives into standardized or common languages. The transformed models called analysis models are obtained from end-user models; they are quite poor, representing the concepts identified by the users. The development team should be enriched them in order to be automated.

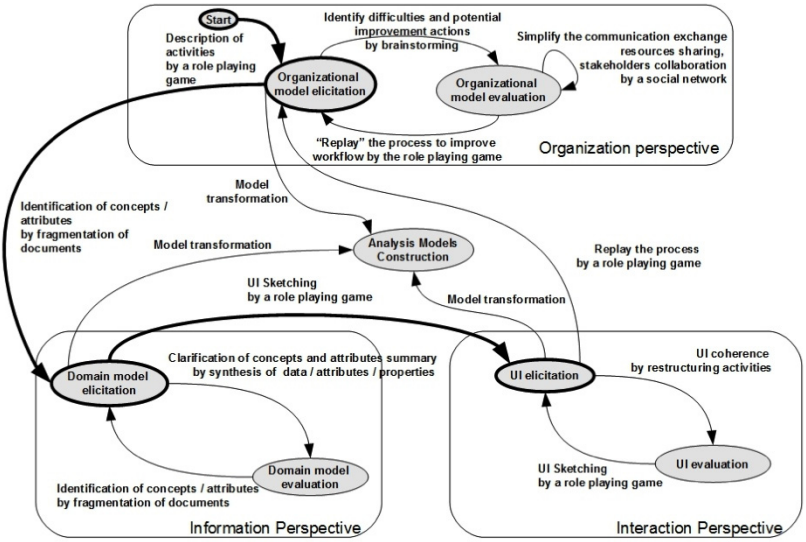

Fig. 1. The ISEA method

In an initiative of business process cartography, all the goals are not necessary reached. If the goal is only to facilitate the communication in the business team by a better understanding of each actor's role, the first purpose (elicitation) is sufficient. The second goal (evaluation) is essential to improve the processes. The third goal (transformation) is necessary to automate the processes. In this case, the end-user models constitute consensual requirements models allowing the development of process-aware information systems.

Figure 1 also highlights the strategies for achieving these three goals. All the strategies have in common to be based on participative and playful approaches. Each strategy is supported by a partially ordered set of individual or collective activities. For example, the strategy "Description of activities by a role playing game" is

supported by several activities. The main activity is collaborative: the functional actors of a business process, with the help of an animator, collectively elaborate the description of the business activities and the exchanged documents. A particular path of the map, in fat-line in figure 1, is detailed in the following section.

3 Exploring a Path in ISEA

This section illustrates one possible path of the ISEA map, this path (in fat line in Figure 1) allows:

- Elicitation of the organizational perspective by a role playing game in which each participant plays its own role,
- Elicitation of the informational perspective by individual and collective activities dedicated to the exploitation of the documents identified in the organizational perspective,
- Elicitation of the interactional perspective by individual and collective activities dedicated to the sketching of the business activities identified in the organizational perspective.

3.1 Elicitation of the Organizational Perspective

We illustrate here the strategy starting from "Start" to "Organizational model elicitation". This strategy corresponds to the first phase of the ISEA method where end-users collaborate around the creation and maintenance of existing process cartographies. The goal is to elicit an organizational model corresponding to a business process expressed using a very simple domain specific language and representing all the activities and documents exchanges. In this strategy as in the whole ISEA method, all stakeholders are involved, and more particularly the end-users, who are the domain experts and possess the necessary knowledge of how the processes should operate, which tasks have to been carried out, which business rules need to be enforced, the validation checks to perform, etc.

The DSL is composed of graphic elements (see Figure 2), which are involved in the construction of the organizational perspective:

- A yellow post-it represents an activity, which may be decomposed in several actions. An action consists of a verb conjugated in the first person singular (e.g. "I ask") and a medium (e.g. "by email") or document if needed (e.g. "a quote").
- A pink post-it represents the intervention of an external actor in the process.
- The colored lines show the flow between activities.
- A “loop symbol” represents a repetitive activity, a “clock symbol” is a timer event that executes an activity at a specific time or at a given time and a “stop symbol” represents the end of an actor participation in the process.
- A “document symbol” is used to represent a document produced or used by an activity. The documents of the same process have different colors. A document is described by a short description (document name, abbreviation). A pdf file which corresponds to the real document, can be attached.

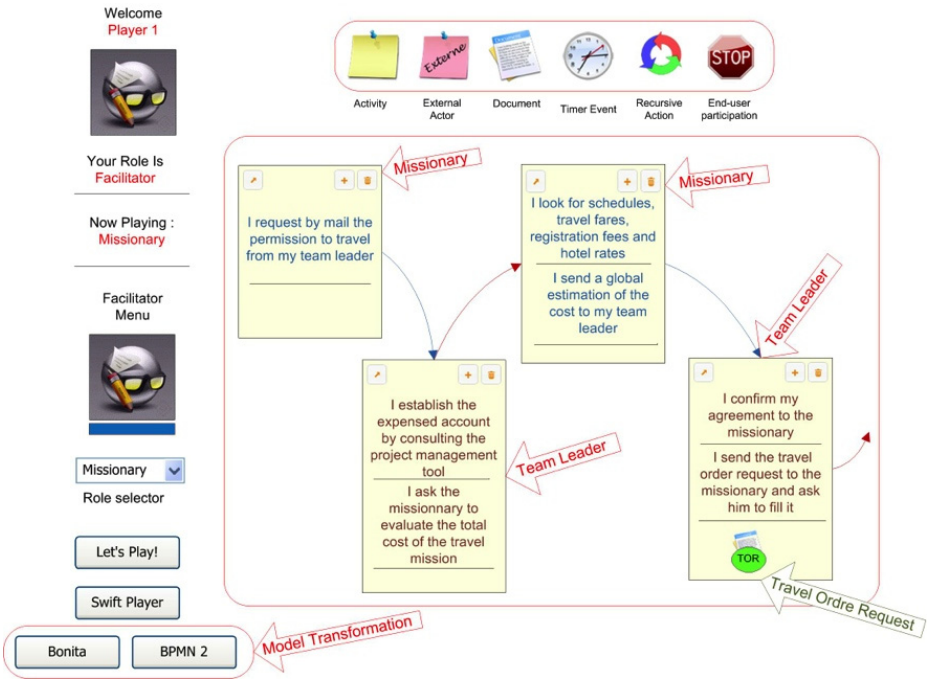

Fig. 2. Organizational perspective: a business process representation in ISEAsy

Figure 3 shows all the participants playing with the role-playing simulation game and using the tool support ISEAsy. In this game, participants assume a role and act out a real-life situation in order to get in a participative way, a description of the daily activities during a specific process. Each participant plays the same role as he has in real life. He uses the set of graphic elements with which he represents the actions performed during real life. A participant places a virtual post-it on the workspace to represent an activity he accomplishes during the process and draws one or more arrows handing over the turn to the next participants. Participants take their turn, one after the other, depending on the situation, as would occur in real life. As an example, in a travel management process, the game begins with the missionary, who needs to establish a mission request. The Document creation is a specific action. If a participant needs a document previously created, he drags the respective color coding label into his post-it. If the intervention of an external actor is necessary, the facilitator plays this role by dragging a pink post-it. No action is noted on this post-it, only documents may move on it. Figure 3 shows the result of the role-playing game in the tool ISEAsy support of the method ISEA. The result is very similar to a BPMN basic process. Just like the models described in BPMN, the organizational perspective includes behavioral (dependences between activities) and informational (documents) dimensions.

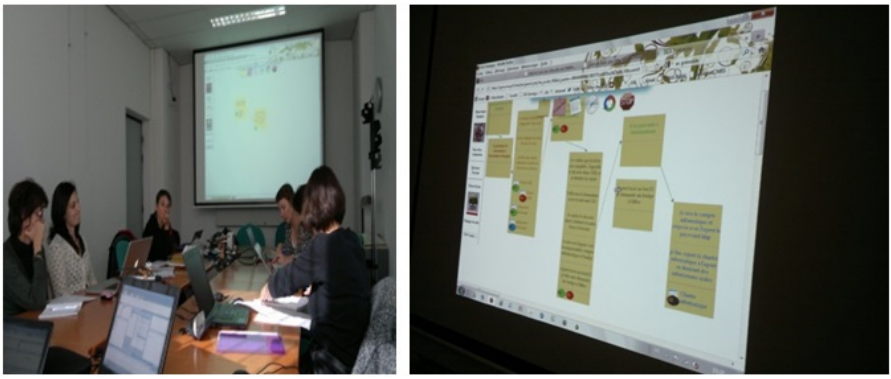

Fig. 3. The role playing game using the tool ISEAsy

3.2 Elicitation of the Informational Perspective

We illustrate here the strategy starting from "Organizational model elicitation" to "Informational model elicitation". The goal here is to get, once again using a participative approach, a simple domain model that could be transformed and completed by an analyst in a more formal domain model using modeling standards such as UML or Entity/Association. The starting point is the files attached in the documents elicited in the organizational perspective. Three main activities are proposed:

- Individual activity "Cutting ": in a first phase, the facilitator distributes 2 or 3 documents to each actor who is individually asked to cut in each document the different fragments that seem pertinent to be grouped together. For example, a participant may cut fragments on a document corresponding to information on a missionary, and in the same document, information on the travel (departure date, arrival date, etc.) (see Figure 4). This activity is individual and must not exceed ten minutes; otherwise the participants may be bored.
- Collective activity "Model elaboration": participants are collectively asked to place the document fragments on a tree symbolizing a tree of concepts. One after the other, the actors place the different fragments either in a new branch of the tree symbolizing a new concept (for example, the new concept Travel), either in an existing branch symbolizing new elements to describe an existing concept (for example, information added to the concept Missionary) (see Figure 5). When all fragments are placed on the tree, the individual activity "Cutting" iterates until the whole documents are cut.

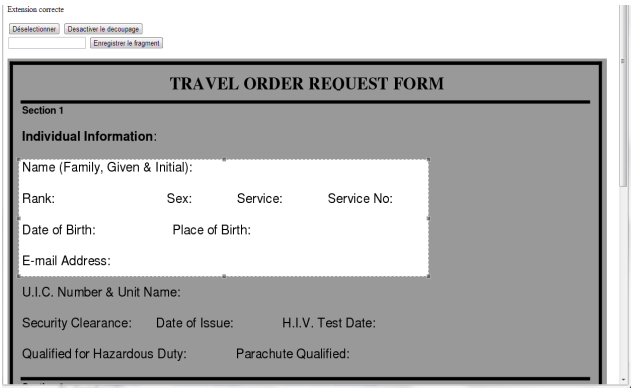

Fig. 4. The "cutting" activity: a fragment in a document

- Collective activity "Conflict resolution": several fragments of different documents may represent the same information. For example, name and date of birth of a missionary may exist on different documents. In this case, actors place the information on the same branch, and the facilitator will take a time to resolve these conflicts. The final result is a tree of concepts representing a simple domain model, each branch corresponding to a concept. The tree of concepts can easily be transformed, thanks to automatic transformation rules, into a more formalized domain model (in UML for example) in which the main concepts (branches) and sub-concepts (branches of branches, see figure 5) are identified. An analyst should then work on

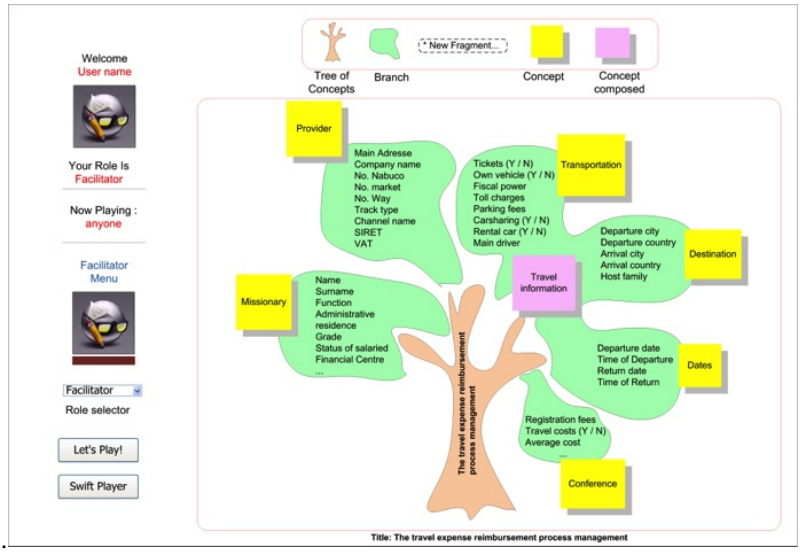

Fig. 5. Informational perspective: the tree of concepts in ISEAsy

the domain model in order to add relationships and multiplicities, and make the domain model more precise (for example, adding specializations or aggregations).

3.3 Elicitation of the Interactional Perspective

We illustrate here the strategy starting from "Informational model elicitation" to "interactional elicitation". The goal here is to create customized interface sketches to test the user interface navigability and its coherence within the process and perhaps to propose process improvements. The proposed sketches could then be transformed and completed by a user interface specialist in executable and standardized UI models. As for the other perspectives, different activities are proposed:

- Individual activity "Sketching": thanks to the business process model resulting from the elicitation of the organizational perspective and to the tree of concepts resulting from the elicitation of the informational perspective, each participant is asked to imagine the user interface he would like in order to realize its activities in the most efficient way, and perhaps to resolve the potential difficulties identified during the organizational model evaluation (see Figure 1). For example, in this last phase (not illustrated here for space reasons), missionary and team-leader were bored with too much message exchanges at the beginning of the process (different message exchanges between them in Figure 3). To resolve this difficulty, the missionary may first imagine to be proposed a menu where he could estimate the price of the mission, look for an estimation of the price of the hotel and transport on adequate web sites, look for the conference rates on the conference website, and only then contact his team leader to get an approval (see the screen of the missionary in figure 6). In the same way, the team leader could imagine the sketching of the user interface allowing him to receive emails when he has to validate or refuse a request (see the screen of the team leader in figure 6). To construct their interfaces, missionary and team leader can use existing UI sketching tools such as Balsamiq[2].
- Collective activity "Navigation validation": the facilitator draws the navigation between the proposed sketches using tools such as Gambit [27]. Participants are then asked to validate the navigation or to correct their interfaces in order to be satisfied (see Figure 6).

The result of this perspective is a representation of the ideal interfaces and screens navigations between actors. This ideal representation may have an impact on the process model evolution (process "to be"). In this case, the process model should be corrected in the organizational perspective.

[2] Balsamiq, `http://www.balsamiq.com`

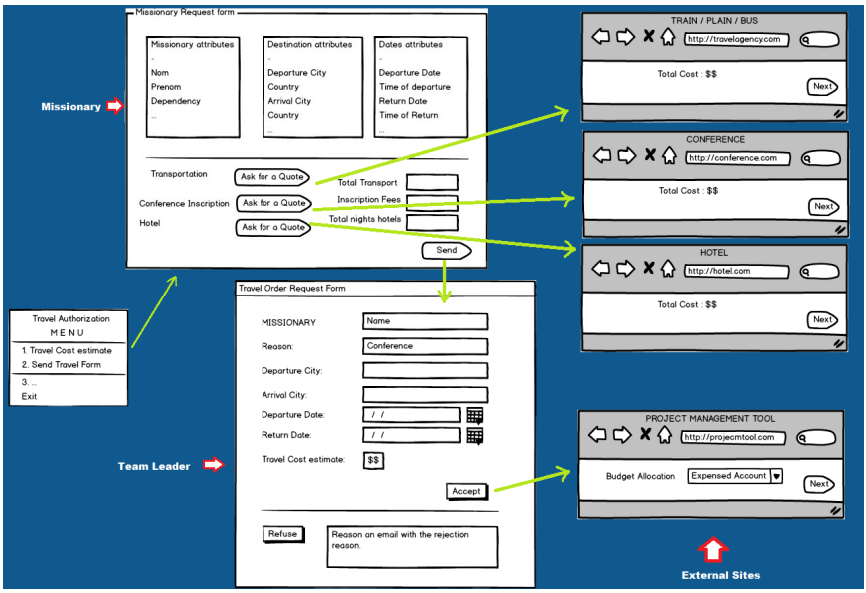

Fig. 6. Interactional perspective: navigation between sketches

4 Validation of the ISEA Method

The modeling languages and elicitation/evaluation/transformation activities were designed and validated adopting a modeling language development cycle that we proposed as previous research results [16]. This development cycle for modeling languages (see figure 7) is based on the integration of user centered experimental practices and is based on three stages:

- Analysis stage aims to validate the language dictionary and to sketch the language notation (concrete syntax).
- Design stage allows validating the notation and the abstract syntax (meta-model).
- Operationalization stage is dedicated to validate language support tools.

During the analysis stage, the languages and elicitation/evaluation/transformation activities are validated by a restrict circle of users, on average two processes, each process involving from 6 to 8 actors. This restrict circle is spread during the design stage (from 4 to 6 processes). The tools are generally validated by the same users as in design so as to measure the acceptability degree of the method in a mediatized mode. During each stage (analysis, design, operationalization), experiments are led in a purpose of validation, but also exploration and co-construction with the future users. For the co-construction of the end-user modeling language, we generally start with a standard language (BPMN, EA, etc.) that we prune until it is easy to understand and to use in a participative mode. The notation is adapted to be pleasant and talking related to the ergonomic criteria defined in [2, 17]. The concrete syntax once integrated in the

tool is again considered as a component to be estimated. Indeed, the concrete syntax in its operational shape is frequently slightly different from that produced in the design time: in particular, icons may be different in a tool or with a pencil/paper.

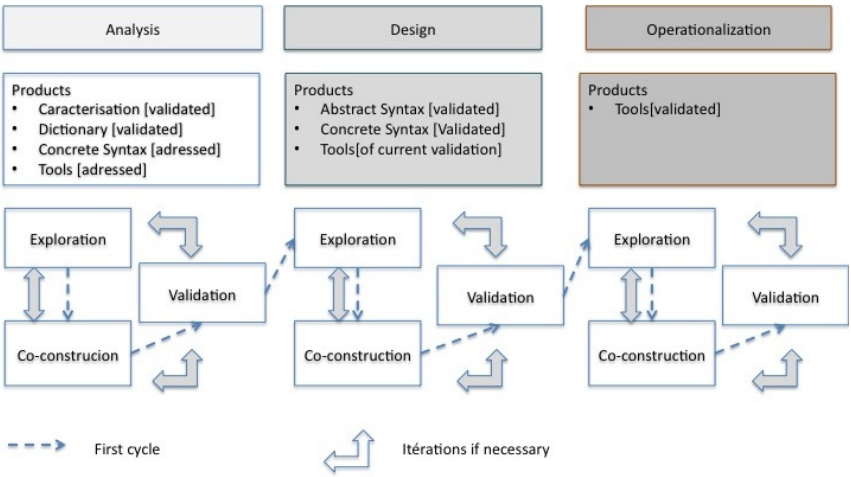

Fig. 7. User-centered validation cycle integrated in a language development process

Following this development cycle, the different perspectives of the ISEA method are in different maturity levels:

Organizational Perspective
The organizational perspective language (dictionary, notation and abstract syntax) and the elicitation/evaluation/transformation activities dedicated to this perspective are completely validated with end-users. In particular, the tool ISEAsy was validated with around twenty business processes. The multiple user-centered experimentations lead us to different evolutions of the language and the activities. In particular during analysis and design stages, the language was considerably simplified in order to be comprehensible by the end-users. We suppressed a lot of elements that we firstly thought useful for the end-users to model the processes: conditions, repetitive actions, actions composing an activity, etc. At the end, the DSL proposed in the organizational perspective contains very few simple elements: activity, external actor, document, timer event, recursive action, end of participation and change of actor (see Figure 3).

Informational Perspective
The informational perspective language (dictionary, notation and abstract syntax) and the elicitation activities dedicated to this perspective are completely validated. The tool supporting the language and the evaluation/transformation activities are on current validation. The user-centered experimentations we made lead us to different evolutions. In particular during the analysis and the design stages:

- other types of model domain notations were experimented, for example houses composed of different levels (a house being a concept and a level being an element

of this concept), towns composed of different houses (a house being a concept and roads between houses being relationships between concepts), ... These representations were not approved by the end-users which finally proposed the idea of the tree (see Figure 8) that we adopted in our last version of the method (see Figure 5).

- during the first experiments, we proposed notations allowing to express entities but also associations. The associations expressed were not exploitable to build an analysis model and we removed this notion, letting the analyst complete the model with associations if needed.

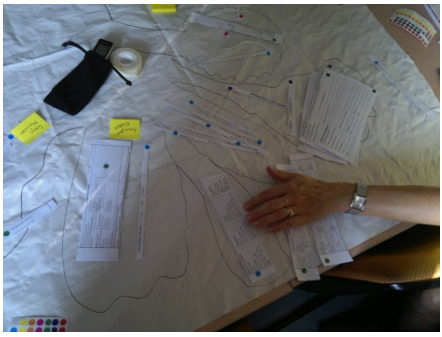

Fig. 8. Co-construction with the end-users of the informational perspective representation

Interactional Perspective

As for the two other perspectives, we lead several user-centered experimentations in order to co-construct with the end-users the interactional perspective language and elicitation activities. Figure 9 shows examples of hand-made sketches using the domain model to help the user to design the desired sketches.

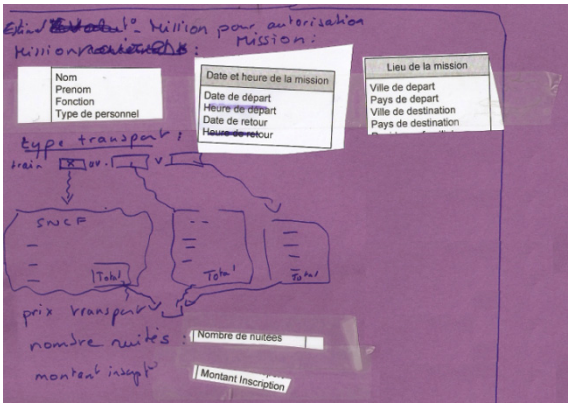

Fig. 9. Co-construction of the interactional perspective: an "hand-made" screen

The interactional perspective is yet in co-construction. If the dictionary and the concrete syntax are validated, the abstract syntax is under definition. The tool

supporting the language and the elicitation activities is only addressed: it is a prototype built with existing tools such as Balsamiq and Gambit, allowing us to lead experiments.

5 Related Works

The ISEA method is based on one hand on the multi-perspective business processes modeling domain and on the other hand on participative approaches for business processes improvement.

Business processes modeling usually combines multiple perspectives. In [30], Sheer presents an Architecture of Integrated Information Systems (ARIS) based on four business process perspectives: organizational, data, control and functional. In [29] five perspectives have been proposed: functional (what has to be executed during a process), process (conditions to execute a process and the activities that have to be performed), organization (organizational structure and actors), information (which data have to be processed by business processes) and operation (elementary operations performed by resources and applications perspectives). In [7], authors extend these perspectives with the intentional perspective that represents goals and strategies that the enterprise implements in its processes. Furthermore, several works have been proposed in order to bridge the gap between the different perspectives, in particular between intentional and organizational perspectives [4, 6, 12, 13, 19, 22]. For example, [8] describes a business process-driven requirements engineering approach to derive requirements from organizational models that express business strategies and from business processes in BPMN. In [4], authors propose a method for eliciting non-functional goals from business processes. Moreover, [6] introduces the notion of intentional fragments to bridge the gap between process models and goal models. These multiple perspectives business processes modeling approaches are formal and allow achieve a global vision of the different characteristics involved in a business process. They can be used by analysts in order to help them to bridge the different perspectives of a business process. Different BP modeling perspectives can be explored and extended according to the organization and different needs or situations that enterprises can encounter. However these approaches are not participative, prioritize the results and do not provide the resources that stimulate collaboration between the different stakeholders of the process.

In the other side, participative approaches, mainly based on quality tools, involve the stakeholders of a process in the proposition of ideas for process improvement, use techniques to stimulate and motivate people, help to solve problems and propose creative solutions. Process improvement concerns the set of actions realized to identify, analyze and improve existing business processes to better match the organizational users' needs. There are several proposals, methods, tools and techniques in the field of processes improvement, from individual problem solving, rapid team problem solving, and quality tools to improve processes. Thus, Ishikawa [11], McConnell [14] and McQuater [15] propose a list of tools and techniques for quality improvement. Based on these quality tools, approaches such as [3, 5, 20, 28] are participative

approaches, using for example brainstorming tools to generate new ideas for process improvement. The DMAIC methodology [23, 28] also uses quality-management tools to improve existing business processes. A participative problem-structuring methodology is presented in [1]. According to the authors, the proposed framework stimulates the interaction and makes participants more accountable to improve business processes in a holistic manner.

In general, such participative approaches don't propose multi-perspectives modelling, they are not based on modeling languages and they are not integrated in a traditional business process development cycle. The goal of ISEA was to propose a participative end-user modeling method for business processes modeling. Such an approach was also proposed in [9] where BPMN diagrams are validated by end-users and analyzed by systems analysts in order to reach an agreement on the effect that the information system will have on the organization, but this approach doesn't propose multi-perspective modeling.

6 Conclusion and Further Works

ISEA is a participative end-user modeling method for business process which proposes multi-perspective business processes modeling and improvement. The modeling process is defined in a map where the goals are to elicit and evaluate end-users models and to construct analysis model. The strategies between the goals are realized by participative and playful activities.

For the moment, ISEA allows modeling three perspectives: organizational, informational and interactional. All the proposed strategies have not the same maturity degree. The strategies for the elicitation/evaluation/transformation of the organizational perspective were the results of several evaluations. ISEAsy, the support tool of ISEA method, is used for the elicitation and improvement of the Grenoble University business processes. Discussions are in progress for its use within the RELIER network (Quality network for higher education and scientific research). The tool integrates a basic transformation into BPMN, the resulting models are accessible with the BPM tool Bonita[3]. Proposals for the informational perspective are in the operationalization stage: the tool integrated in ISEAsy was the object of demonstrations, which allowed improving the elicitation of the informational perspective. However, the validation experiments remain to made. The proposals for the interactional perspective were only evaluated by a restricted set of users (only one process with 6 participants).

The first purpose is to complete the evaluation of models and strategies of the informational and interactional perspectives, and to complete the map with other perspectives, for example, intentional or decisional perspectives that are particularly useful for elicitation of innovative processes. The second purpose is to take into account new types of processes: right now, ISEA is suited to existing administrative processes: we have started a study to evaluate the usability of ISEA on co-design processes in industrial organizations. Long-term perspectives are to apply ISEA to

[3] http://www.bonita.com

other domains than business process management, more particular for knowledge acquisition in the context of innovative collaborative projects.

We are convinced that the two purposes "new business processes perspectives" and "new types of processes" are linked. For example, intentional and decisional perspectives will be essential to elicit innovative processes. During the previous experiments on the university processes, we first proposed an intentional perspective aimed to identify process goals. Nevertheless, in the context of our experiments (existing processes which need to be improved), this step didn't seem to be useful to the participants who wanted to focus on their daily activities and on the encountered problems.

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