Acquiring knowledge on business processes from stakeholders' stories

Flávia Maria Santoro[1], Marcos R. S. Borges[2] , José A. Pino[3]

[1]*Departamento de Informática Aplicada, UNIRIO, Brazil*

flavia.santoro@uniriotec.br

[2]*Graduate Program in Informatics, Federal University of Rio de Janeiro, Brazil*

mborges@nce.ufrj.br

[3] *Computer Science Department, University of Chile, Chile*

jpino@dcc.uchile.cl

Abstract

Business process modeling is expensive and time consuming. It largely depends on the elicitation method and the person in charge. The model needs to be shared in order to promote multiple perspectives. This paper describes a group storytelling approach as an alternative to the traditional individual interviews to elicitate processes. Information gathering is proposed to be done through capturing the stories told by process performers, who describe their work, difficulties and suggestions. A process to abstract and transform stories into business process representations is also part of the method. A tool to support storytelling and this transformation is described as well.

Keywords: Business Process Modeling, Process Elicitation, Group Storytelling, Knowledge Externalization.

1. Introduction

A key step in the development of a software system is business process modeling [1][2][3]. Much research work has been done in this area, and yet, the activity is often expensive and time consuming. A typical initial approach involves a person (analyst) who interviews the people currently performing the

tasks the future system is intended to support. The goal is to try to determine the system workings by asking questions concerning the current procedures and people's needs. However, this method has several shortcomings.

One of the problems with interviews is that the analyst's questions *guide* the user. Thus, emphasis may be placed on aspects the analyst thinks are important and the process modeling then heavily depends on the analyst in charge. A second problem may occur by a biased choice of the users reporting the current processes and needs: people may have different perspectives due to the roles they play or simply because they have different experiences and perceptions.

We present an alternative approach to the traditional one. It promotes the incorporation of several users in the analysis of the current processes. The proposal also tries to let users express their experiences in a free way rather than trying to guide them. This may provide multiple perspectives on the current processes, which is desirable when a comprehensive understanding of the situation is needed.

The proposal is a method based on a story telling approach. The basic information gathering activity consists of collecting the stories told by process performers, who describe their work processes, report their difficulties and provide their suggestions.

A story is a natural way to transmit and share knowledge. It has been successfully used in other contexts to make knowledge explicit [4][5][6][7]. Using natural language and contextual elements, story tellers are able to express their experience with working processes.

Collective stories, i.e. stories told by groups of people can be a good way to reach consensus and to discover hidden details that can be a significant contribution when designing a new process model. Stories have the advantage of reproducing situations associated with their contexts - knowledge that is difficult to capture solely from interviews. Being collective, participants are able to cooperatively check the processes described through their perspectives and tell new stories with additional or alternative descriptions.

A process to abstract and transform stories into business process representations is also part of the method. A tool to support storytelling and this transformation is also described.

The paper has five additional sections. Section 2 provides some background work on business process elicitation and it exposes the problems associated with this activity. In Section 3 we discuss our approach and the justification for using stories in natural language. Section 4 describes the proposed method in

detail and a tool that supports the first part of the method. Section 5 presents an example that illustrates part of the method. Finally, Section 6 concludes the paper.

2. Business Process Elicitation

One common feature among various Business Process Improvement strategies and methodologies based on the improvement approach is to capture a description of existing processes [8][9]. There is research suggesting that the use of current state of organizational processes can contribute to the design of efficient process models [10]. In many organizations, however, a description of the current process model does not exist as such; it needs to be elicited [11]. Although this can be seen as another justification for a clean slate approach, a neat elicitation and standardization of the processes can represent an important step towards improvement.

Few organizations have well-documented processes. In some cases they have never been defined [12]. In others, they were done once with no updates. As a result of the latter situation, changes and new business practices have not been incorporated in the model. In one Organization, where the authors have worked, a new product was launched without the approval of the Executive Board, because this step was removed from the product launch process due to an exception that occurred in the past. Situations such as this suggest the convenience of having a full elicitation of current processes in order to discover inconsistencies, ambiguities and anomalies of those processes.

Participation and commitment to the elicitation of current processes and their problems is not obvious. In addition to well-handled human relations, adequate method and supporting tools are important for a successful outcome. Selecting the right people and process context, e.g., is essential. Insufficient stakeholder involvement can lead to incomplete and outdated information [13] . Inadequate method and tools can lead to poor or partial capturing of the current situation [14][15]. Guidelines and best practices are important sources of information to Business Process Re-engineering (BPR) practitioners [16].

Process elicitation has much in common with software requirements elicitation, because the problem is basically the same: gather information about a computer-based system from users who are not IT specialists. A number of methods[17][8] and techniques [18][19] have been proposed to obtain software requirements elicitation, including one also based on Group Storytelling [20]. It has also been argued that a combination of techniques should produce quality results due to the relative strengths and weaknesses of the various approaches [21] . Group approaches to software requirements elicitation have been found

effective and successful [22][23] . Included in these group approaches are facilitated workshops [24] and ethnographic studies [25][26].. Nevertheless, interviewing is by far the most used technique; indeed, some authors consider it “the” technique for software requirements elicitation [27].

An interesting classification of the problems encountered in software requirements elicitation has been suggested by McDermid [28]. According to this classification, the problems are of three types: i) problems of scope, ii) problems of volatility, and iii) problems of understanding. The problem of scope is related to the difficulty of defining the system's boundaries. Moreover, it is inevitable that requirements evolve over time, making it difficult to establish them in the initial phase of the project and keep them, causing this way the problems of volatility. The problems of understanding clearly apply to process elicitation as well. There are several problems in this category, including users omitting mentioning “obvious” information, analysts having poor understanding of the problem domain, users’ vague expression of their requirements or activities, and conflicting perceptions from different users.

The use of collaborative tools to support process elicitation has been proposed by Santoro et al. [29] and further refined by Freitas et al. [30] . The latter designed a collaborative editor for process elicitation (CEPE – Cooperative Process Editor) and used it in some case studies. The initial experiments showed promising results. This paper incorporates these initial reports, detailing the basis for a participatory process elicitation.

As indicated above, the typical method used by organizations to elicitate processes is based on interviews. Business Process Analysts (BPA) - usually external consultants - gather the information captured during the interviews and present their view of the processes. Then, they submit these models to process participants and refine them to achieve as much accuracy as possible. The main disadvantages of this approach are the possible biased selection of the interviewed people and the BPA’s own bias when directing the interviews, as already mentioned.

The collaborative method using CEPE was an alternative to the typical approach based on interviews. Here, the main advantage is the direct participation of stakeholders. They are supposed to describe the process themselves using the CEPE tool. The main disadvantage is the formalism knowledge and the training required by the users to deal with the complexities of being able to generate process descriptions with the computer tool. This occurs despite the efforts placed on making the tool as much graphical and intuitive as possible.

Formal models are very difficult to read and interpret by non-trained users. Therefore, they cannot be used to establish adequate communication among users and analysts. Besides, each user, even when playing the same role, describes his/her activities differently. In these circumstances, the processes represented by the analysts are in many cases incomplete and ambiguous.

In this paper we try to overcome the just mentioned complexities by using a new approach to process elicitation based on storytelling. Instead of describing a process, participants tell stories about their activities. We expect to extract the processes by analyzing these stories.

The idea of using a Group Storytelling mechanism is simple, but its execution or implementation is not. The implementation gets easier if there is a knowledge management culture as well as a collaborative culture within the Organization, but frequently this is not the case. A collective story may be difficult to obtain but in many cases it is also rich in contents.

3. From stories to business process

The metaphor we propose is based on the stories about the users' daily activities, told by who has information that can contribute to the understanding and the elicitation of the working processes. Telling a story is an easy way to explain things informally, because of the need for contextual cues to underline it. The popularity and importance of stories made storytelling a technique applied in many fields and for various purposes, e.g., education and learning [6], knowledge management [5] , and artificial intelligence [31].

The basic concept in Group Storytelling is that a group of people can recall portions of knowledge from the past and can describe them in their own words. It provides a natural way for users to report their experiences with process activities. Without being confined by the limitations of a formal language, users can express freely and the analysts can use the reports to extend their knowledge about the processes. Since the stories are built collaboratively, they do not state a single view of the process. Instead, they can mirror the collective knowledge about the processes.

These stories can be combined with stories from other stakeholders, from the technical to management staffs, including of course the process operators. Thus, someone has to reconstruct the facts putting together the pieces given by the story tellers. Of course, there still might be gaps between pieces or contradictory information. These problems may be solved by the group of story tellers in a later session:

reading and commenting on other participants' narratives activate recall, increasing people's ability to recount what they have witnessed.

Valle et al. reported the use of Group Storytelling for recalling decision processes [31]. Carminatti et al. compared the Group Storytelling approach against the interviews and the group dynamics techniques [33], demonstrating the advantages of the first. Schafer et al. [34] applied Group Storytelling to create team awareness. Acosta et al. [35] used the Group Storytelling approach to support the externalization of tacit knowledge. Methods and tools have been developed to support stories capturing, registering and retrieving [13][24]. In this paper we use the TellStory tool [36] that was originally developed for the purpose of collective knowledge recall. This version is described in detail in Section 4.1.

Since a process can be considered a sequence of work steps, performed by agents in an Organization, in order to achieve a business goal, then an as-is business process model should capture and represent the way people actually work daily. It is also important to characterize interfaces and interaction among all participants of a process.

Process instances are specific items going through those steps. There can be any number of instances traversing a business process and every instance has a specific history and properties. Each instance has a beginning and end, as defined in the business process. As the instance advances in the process, it will be worked on by diverse participants. Business process instances can be seen as stories which are performed by groups of individuals who carry out specific roles depending on the context. Thus, we propose a method based on Group Storytelling [36][37] to gather information about work processes.

The main component of our proposal is a knowledge management environment to support the acquisition of information during the process elicitation phase. Our approach promotes and supports knowledge exchange among processes stakeholders. Unlike most traditional approaches in which analysts try to extract knowledge from users, we propose an environment where all stakeholders report and clarify their activities. The components of this environment are: a knowledge representation model, an elicitation method and a tool supporting the interaction and the persistence of the exchanged information. In this environment, users should be able to make explicit their activities, the related difficulties when executing them and their needs.

However, in order to comply with the needs for a formal specification, we start with free style stories and progressively evolve to an increasingly formal representation by means of context descriptions and process models. Thus, the second step of our method is to extract context from the stories. These contexts

are extracted from the stories by a facilitator with the help of all stakeholders. They differ from the initial stories as they focus on activities that can be consolidated into processes.

The third step converts the context descriptions into process models. Again, this is done collaboratively by all stakeholders involved, but led by the system analysts since they have the necessary knowledge about the generation of process models. An important aspect of our approach is the traceability of the processes that will be used to express the Organization's environment. We can always perform the inverse path starting from processes and reaching the stories that inspired or justified them. A similar approach has been followed for elicitation and negotiation of system requirements [20].

4. The method and its usage

The proposed method includes steps starting from concrete facts told by participants, continuing through abstractions and classification of those facts, and finishing up with a conceptual model. The ultimate goal is to obtain a process graphical workflow model.

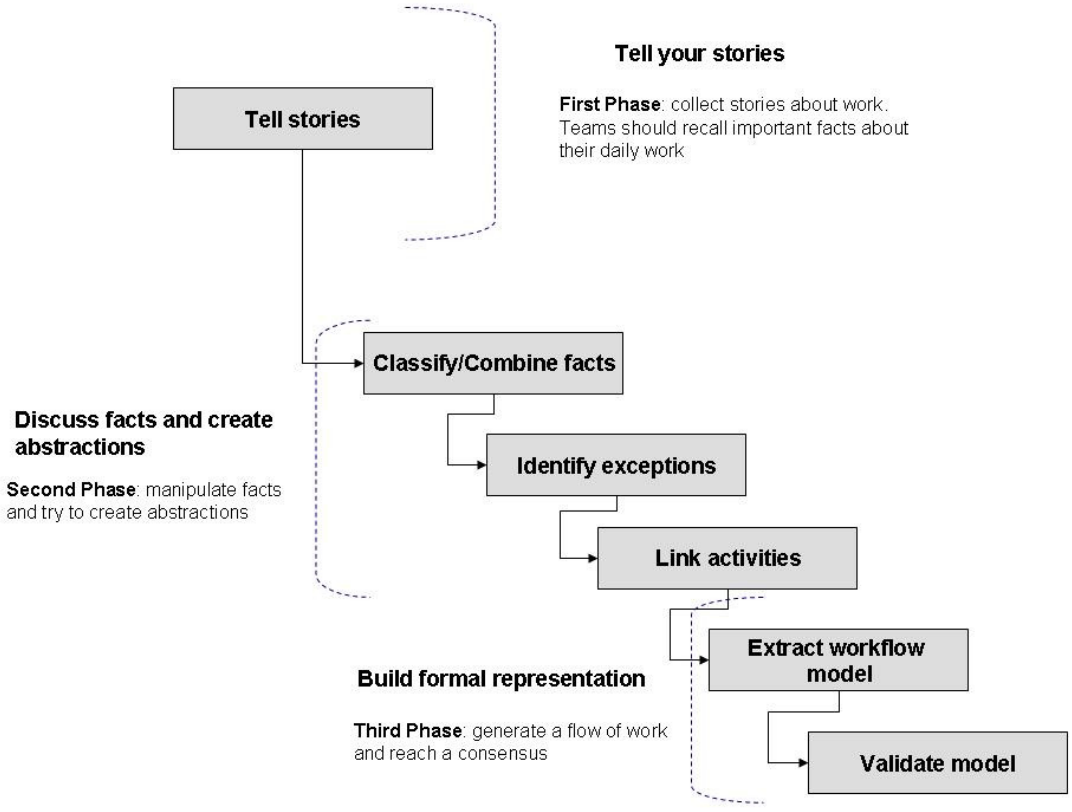

Figure 1 – Method for BP Elicitation based on Group Storytelling

There are three essential roles to carry out tasks proposed for the method: teller, facilitator and modeler. The teller role is assigned to individuals who participate in the process to be learned, and

therefore, they can let their activities be known through a story. The facilitator is an experienced professional who mediates the practice of telling the story, linking the facts and helping the production of the first abstraction. The modeler role is allocated to one or more process analyst(s) who have the ability to develop the graphical model based on the abstractions extracted from stories.

There can be as many participants as required, depending upon the complexity of the processes. It is important to highlight that all participants have to work as a team. They should bear in mind the goals to be reached at each phase. Thus, it is necessary to previously train participants on the method and the tools, making clear for them the products of each phase. The method is summarized in Figure 1 and detailed as follows.

4.1. First Phase: Tell Your Stories

We assume that, at first moment, people are able to talk about current tasks, problems and the way they usually solve them. The concept of process, or more specifically, the model of a process is not straightforward understandable, and therefore, not easy to describe. On the other hand, concrete facts tend to be simple to remember; even the details could be evoked.

In the first phase ("Tell your stories"), participants (**tellers**) are encouraged to tell stories representing their day-by-day. Those stories work as samples, since by telling a few real facts about the daily work, groups show a picture of the processes they perform and provide scenarios that will help building the process model. For example, participants could choose to tell stories about: yesterday; one week ago; or any atypical day where exceptions occurred.

It is important to define what the context of the story to be told is, in order to guide the story tellers (the story has a beginning, central part and end). This could be achieved by establishing frames in time. Besides, the story should not be very long in order to avoid participants abandoning the task due to time constraints.

Each story should be told by a different group of tellers consistent with the complexity of the process. The objective is to register stories from as many people as possible. At least three participants in each story are required; otherwise the group will not work as such. Groups of tellers should be chosen due to a few criteria: include individuals that participate in different parts of the process (play complementary roles); include representation of all the roles in process; include diverse hierarchical roles. Those criteria should guarantee that stories will include most facets of the processes. Choosing the right participants is

also one way to work towards the completeness of the elicitation.

People should be encouraged to describe the events of the story in detail. A **facilitator** can support the groups by checking the provided information with questions asked to the group.

Finally, there must be a deadline for telling the stories. Groups should plan and agree about how long it will take to finish the story and complete this phase.

The computer tool supporting this phase of the method is called Tellstory. Tellstory [36] is a groupware system intended to support collaborative stories construction. It is a web application where a teller can start a story and invite new participants to join in, recollect and link important facts about a situation they have accomplished together.

In Tellstory, a story is a sequence of events tied to each other by a full conducive thread of meaning, built by a causality relationship between a fact and its successor. Tellstory uses that definition to model the construction of the story in group. Each user can insert one or more events which are facts that happened throughout the story, and which he remembers. These events should be linked in a temporal or logical flow just as most structured business processes. The actions along the construction of the story are: inclusion, edition, exclusion, union and fragmentation of events. The union happens when two events can be considered as a single one, yet the fragmentation of the event divides it in two, when necessary. This configures the tool as a flexible environment, where people can express themselves freely.

Tellstory's main interface is shown in Figure 2. A map of events indicating event sequence and a description of each event are highlighted.

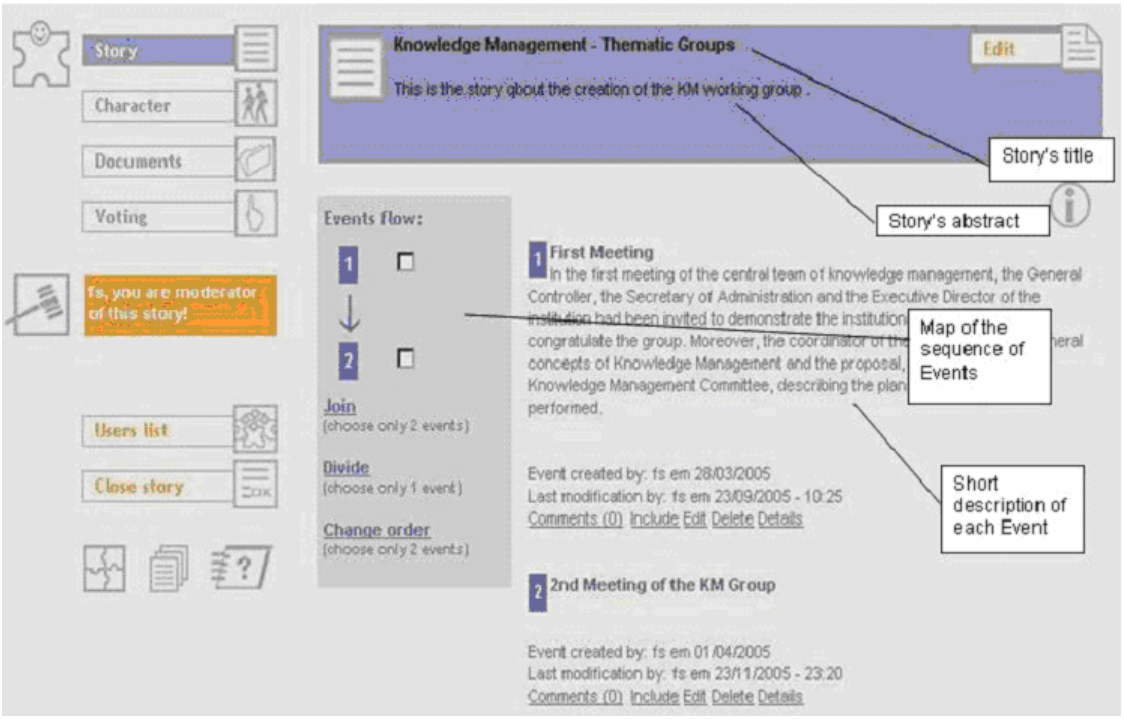

Figure 2 – Tellstory main interface

Once the users include the events, they can discuss, through comments in a forum format, and, eventually, to decide certain subjects through voting organized by the moderator. The unstructured comments may complement the presented information, as well as generate conflicts. One example of subject discussion is event truthfulness. In case there is no consensus about the existence of a certain fact, the tool allows the story to have two versions, each one considering the hypothesis of the event to have happened or not. The final product of this phase is a collection of events from at least three stories by means of texts.

4.2. Second Phase: Discuss Facts and Create Abstractions

The second phase of the method is one of analysis and specification. The inputs are the stories generated in the previous phase. The output is an identified collection of coherent process elements obtained from the stories. The process element types are described below.

- **Activities**: these are the procedures which are obtained from the stories. There may be some activities which appear in several stories, and there may be some which appear as "exceptions" to the storytellers. In any case, these captured activities are given names (tags) for later reference.

- **Roles**: these are the actors' parts played by human or machine resources while performing an activity.
- **Triggers**: conditions or points in time in which the activities are enabled to be initiated.
- **Transferred information**: activities need information to be executed and they produce data as a result of the execution.
- **Rules**: there are rules governing the activities' sequence of execution. Typical rules are of this type: "activity A must be performed after activity B".

The identification of process elements may be done by following one of four alternative approaches. These approaches are:

- **Automatic**: a computer program finds the process elements directly from the stories. This is a difficult approach because it involves natural language understanding.
- **Manual**: human beings do this identification without any IT involvement.
- **Combined**: part of the process is done manually while the rest is done automatically.
- **Supported**: human beings are responsible for the identification with some computer support. This support may include tools to order elements already found, visualization facilities, etc. This is the approach we have chosen.

The first task of the analyst is the separation of the available information about each process. The story tellers are given instructions to avoid, as much as possible, mixing reports of different processes. Our experience shows this is seldom achieved. Thus, the analyst should have an initial list of processes, from which he can start building a tentative association with story fragments. The goal is to identify the context (the process) the storyteller is referring to.

Process activities can be extracted from actions reported by story tellers. Actions are expressed in a story in the form of sentences with a execution verb, such as "I do", "I analyze" or "we decide". Each identified action is described in a list of candidate activities. The tool helps the analyst by providing search facilities, keeping the list and linking list elements to story fragments. The analyst can then try to match the actions described by storytellers who play the same role in the process.

The roles, i.e., the function responsible for some activity can be obtained from two sources. Whenever an activity is described, the person may add a description of his/her function in the process. Otherwise, the role can be deduced from the position occupied by this person in the organization.

The events that trigger the processes or activities are identified in the fragments through the analysis of temporal adverbs, such as “when”, “whenever” and temporal descriptions, such as “every morning”, “at the end of the month”, etc. When these terms do not appear in the narratives, the facilitator should add comments, asking the storyteller to specify when the event takes place.

The rules governing a process description are related to the order or the conditions that govern the flow of activities. Precedence or subsequence, parallelism and conditional flows are examples of these rules. Their discovery constitutes the main challenge for an accurate description of the process flow, particularly when concerning exceptions to the main rules. The narrative may provide some hints, but the analyst should count on additional information given by storytellers in response to his comments. The tool may support the analyst by offering a comprehensive search by key terms such as: “in parallel”, “following”, “alternatively”, “after” and “before”.

Finally, the identification of data and information flows from activities to activities is very important. This is useful for defining precedence in the activity flow, as mentioned above, but also for describing the activity details. Flows can be inferred in a fragment when the storyteller refers to documents and data in his narrative. When the fragments describe some need for communication with other people in the organization, they may be also referring to information needs.

This process of abstraction and analysis is not simple. It requires an analyst’s high level of expertise, but in any case, no more than when he tries to obtain the same knowledge by means of interviews with process players. However, there are two relevant issues in our approach. First, much of the work can be done by the storytellers themselves who are expected to be checking each other’s fragments and adding information relevant to the process definition. Second, the work in this phase does not pretend to be complete. It should be seen as a starting point for knowledge acquisition in substitution or in addition to the traditional approach based on interviews.

Consider, for example, the three story fragments (E1, E2, and E3) input by three different storytellers:

E1 (Story A): “*This morning I received a purchase order through the STD System. Its content was two computers for Engineering Department, according to the attached specification. As usual, I started to contact the most suitable suppliers registered in our system*. (…)”

E2 (Story B): “*Last week, I received four purchase orders to run. They were all very simple*. (…)”

E3 (Story C): "*I remember that on April 4th, there was that crazy order made by Human Resources Department. They asked 1.000 red balloons. I found it very, very strange and didn't know how to run it. Immediately I called my manager and he advised me to …*"

Participants can learn from those texts that there is a usual activity related to daily receiving purchase orders. They should classify them as Basic Activity.

Besides, group members should identify process elements within the description of the activity they performed: events that trigger the activity, time spent, place where the activity was performed, inputs and outputs (documents and data); roles performed; rules that guide the execution of the activity, problems and their causes and effects. That information should be detached and structured.

In the given example, it is possible to observe that some purchase orders cannot be treated in a simple way. They are exceptions and a different procedure is followed to deal with them. Besides, it is possible to identify management roles, which may perform part of the procedures intended to cope with these exceptions.

All participants should discuss the information and try to reach a consensus about it. Even when such consensus is not achievable, the discussion and all points of view are registered. The **facilitator** is responsible for establishing new links among activities based on the given information and to stimulate the identification of tags within the text.

The **modeler** contributes in this phase helping to analyze the material of the stories, logically linking the activities. It means stating a sequence, which is also a requirement of this phase.

As a result, abstractions (or the types or classes of activities in the process) are identified from the real facts told by groups of participants. Moreover, the flow is organized, i.e. the sequence between these types of activities. These activities shall be named as well as the other elements of the process.

Tellstory also supports this phase. Many times, a fact description is naturally mixed with its context thus some structuring would be required, in case further interpretation of the situation might be necessary to retrieve a specific facet. Tellstory provides users with a Complementary Information Framework to stimulate externalizing specific contextual information related to each event of the story. The contextual information surrounding an event in a story should explain it.

The framework draws the users' attention to the typical characteristics of a narrative structure; in fact, working as a guide for the tellers, stimulating their memories and helping them to better structure their thoughts and expand contribution, giving more details about the event. The topics listed in Table 1

comprise the Framework for asking the tellers to cover in their narrative, i.e., they should try to report as much as possible the answers to the six questions described there.

Table 1. Subjects on the Context Framework

Subject	Asks the teller to:	Addresses:
Character	Detail the players and their roles on the story **(General Description, Professional background, Technical abilities, Interpersonal relationship with the group, Task involvement)**	"Who?"
Period	Write date or period when this event occurred.	"When?"
Classification	Indicate to what part of the story this event belongs **(Exposition, Complication, Climax or Outcome)**	"When?"
Place	Describe the place and scenario where this event occurred.	"Where?"
Causes	Discuss what caused this event (events might be related to the previous events)	"Why?"
Effects	Type the consequences of this event (events might be related to the coming events)	"What?"
Emotions	Describe perceived feelings while this event had occurred and associate them to each participant of the story	"How?"

The product of this phase is the collection of activities - since now they can be so called - provided with some details about their execution.

4.3. Third Phase: Build Formal Representations

Since the stories have been studied by the participants, and significant information about processes (activities, roles, rules, sequence, triggers) was identified, it is time to convert all of those issues into another abstraction, using an appropriate process language. An expertise in a specific notation is called for.

In the third phase, the graphical workflow model should be generated. Activities (linked to each other) compose a first version of this model. Basic activities are sequenced, and the exceptions are exposed together with the rules that make them accomplished. Other information about activities (roles, exchanged data) should also be part of the model.

A graphical notation should be used at this point. The input consists of all identified activities and the details associated to them, the output is the information organized in a diagram like the one shown in Figure 3. It depicts the example described in Phase 2 using the ARIS notation [38]. Basic activities such as "Receive order" identified in Phase 2 are represented by rounded rectangles. Decision points determining exceptions are represented by circles where the corresponding rules are the labels.

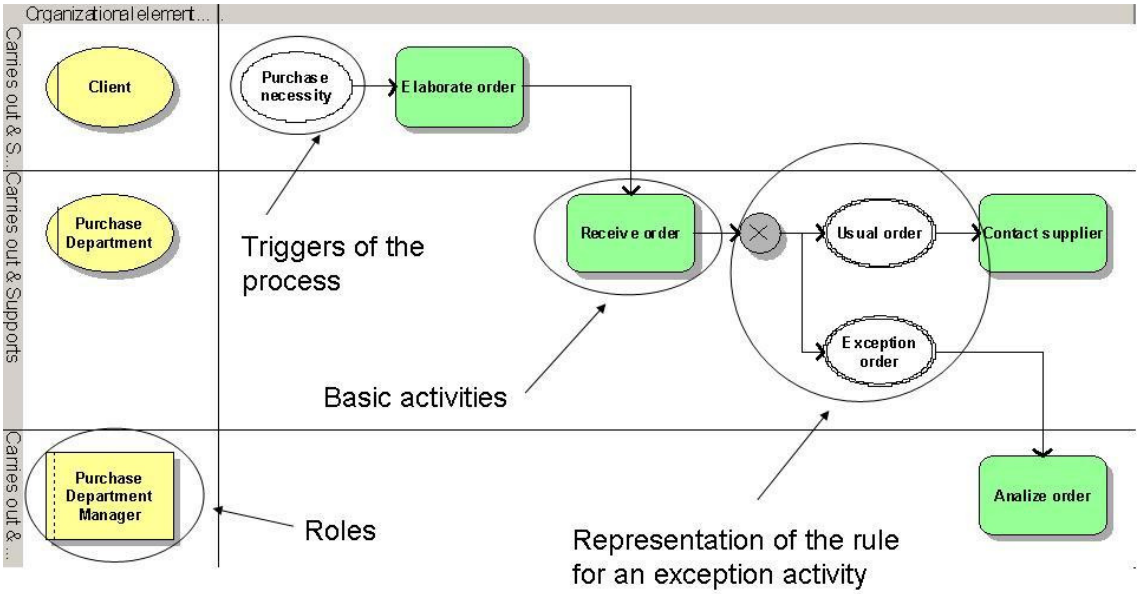

Figure 3 – Example of Graphical Workflow Model to be generated

The conversion of items from the story to the graphical language could be manually done by the modeler. He could choose any language and graphical tool, read the product of Phase 2, and generate the model. Otherwise, Tellstory could be used to automate the conversion by exporting such information in a readable format (XML) to any Business Process Modeling tool able to read it. The types of elements identified in the story are part of the Business Process Modeling Notation pattern [39]. After that, the **modeler** works on the model making adjustments and refinement related to the names of the activities, the flow and the elements associated to them.

Some difficulty may arise because not all parts of the story will probably be classified as process elements in Phase 2, as well as, not all classified parts are clear and easy to understand. The modeler should carefully access all the material and discuss the doubts with the **tellers** in an iterative progression. The discussion should be registered within Tellstory.

When the first version of the graphical model is ready, the **modeler** submits it to the **tellers** in order to validate it. It could be done in a face-to-face meeting where the model is explained by the modelers; the other participants point out problems and suggest improvements. The **facilitator** should also mediate the dialogue. When the group agrees on the model, Phase 3 can be considered finished.

5. An example to illustrate the advantages of the method

The method has several advantages over the traditional approach for process elicitation based solely on interviews. It promotes a wider participation of the operational people involved in the process modeling; it reveals hidden working practices, particularly those related to exceptions; and it sets the basis for a continuous participatory approach to process elicitation. To illustrate some of the advantages we describe three simple processes borrowed from a video rental shop case. We show and compare the process obtained by interviews and those refined using the Group Storytelling approach.

We selected three most common processes in a video rental shop: i) the enrollment of a client (register client), ii) the rental of a movie, and iii) the payment of a debt. Each of these three processes are depicted in the way they were interpreted by the BPA after interviewing shop attendants and after analyzing the stories told by them, following the approach proposed in this paper. The models were generated by the Savvion Process Modeler tool [40].

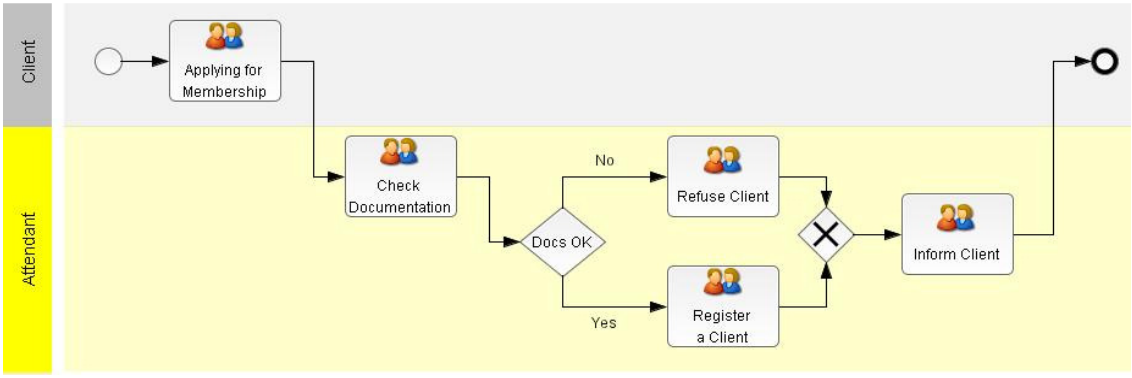

Figure 4a: Modeling the registration process as a result of the interviewing method

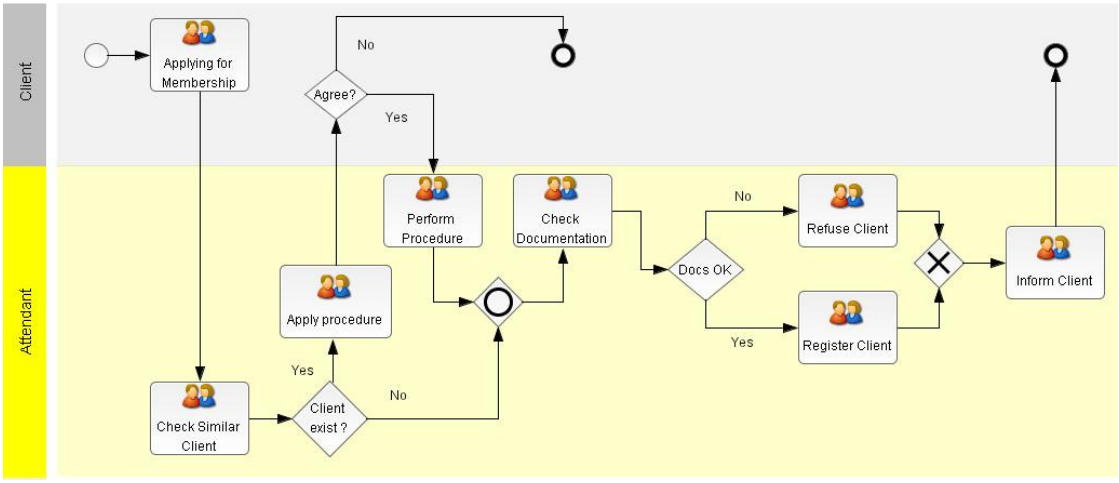

Figure 4b: Modeling the registration process as a result of the group storytelling method

In Figure 4, we show the resulting processes for the registration of a client. At first, we noticed nothing unusual in the process shown in Figure 4a. However, after analyzing a story told by an attendant and

confirmed by two others, we generated the process shown in Figure 4b. The attendant was reporting a story about a client who failed to return a DVD and was trying to register with a different name but at the same address. The attendant recalled seeing that client in the shop before, and she decided to check the address in the "bad clients" file used to register information about clients in debt for more than two months. She then informed the client that he had to pay his debt and continue with his old registration. She could not accept his new registration because he was already a client. This procedure was found adequate and it was incorporated in the model for the new registration process with some changes. Another attendant told a story about a client who forgot that she had registered in the past, but she had no pending debts.

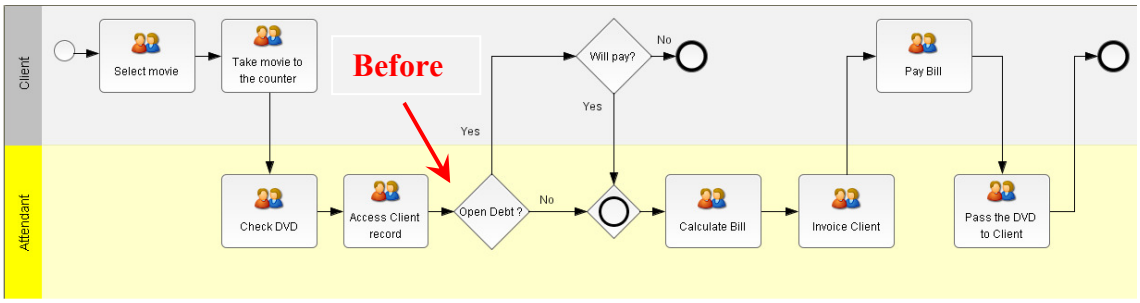

Figure 5a: Modeling the rent_a_movie process as a result of the interviewing method

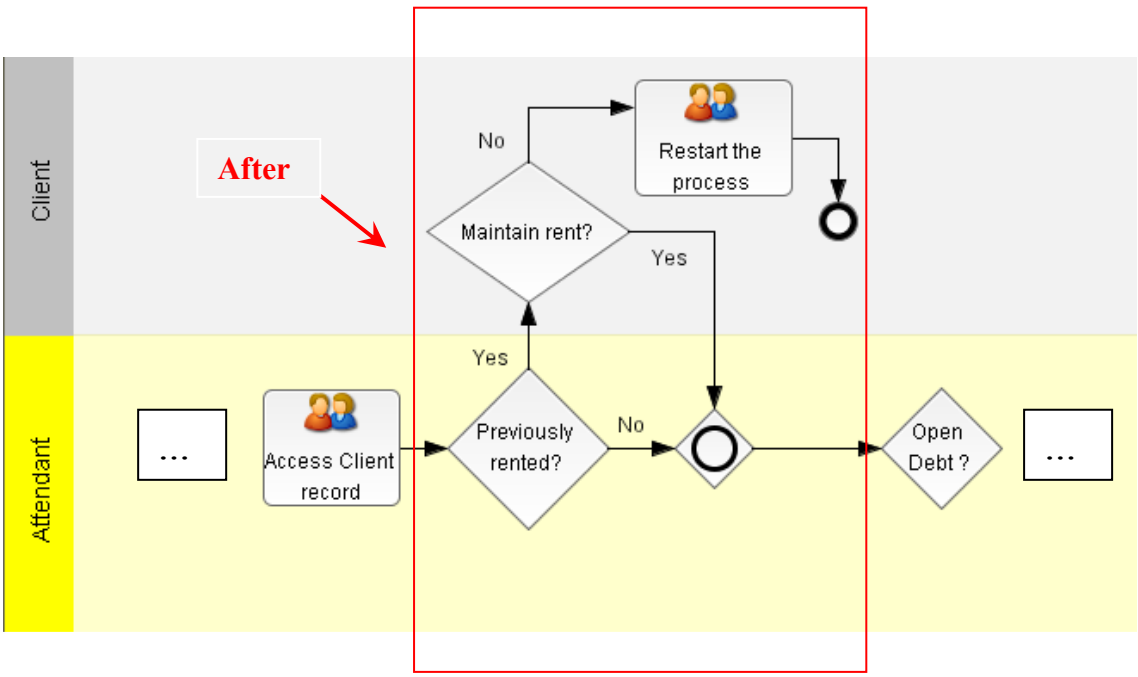

Figure 5b: Changes introduced in the rent_a_movie process as a result of the group storytelling method

The second example illustrates a similar situation. Again, the movie rental process was modeled after interviewing some attendants. The check about open debts was included in the model after the analyst interviewed an attendant. However, after generating the process depicted in Figure 5a, the BPA read the stories told by attendants in the shop related to another process. They reported a case in which a client wanted to return a movie without being charged because he had already rented and watched that same movie in a previous occasion. He argued that the attendant should have informed him about this previous rental. The shop manager decided the client was right and allowed him to choose another movie. Moreover, the manager decided to include a one hour grace period for returning movies.

These reports and decisions changed the model for the *movie return* process (Figure 6a,b), but it also motivated a change in the movie rental process. The analyst decided to include a check to find out whether a movie has been rented to the same client before. If yes, the client should be informed to decide if s(he) wanted or not to rent the same movie again. If the client decides to do it, then the process would continue as modeled, otherwise the process would be interrupted. These changes in the rent-a-movie process are illustrated in Figure 5a,b.

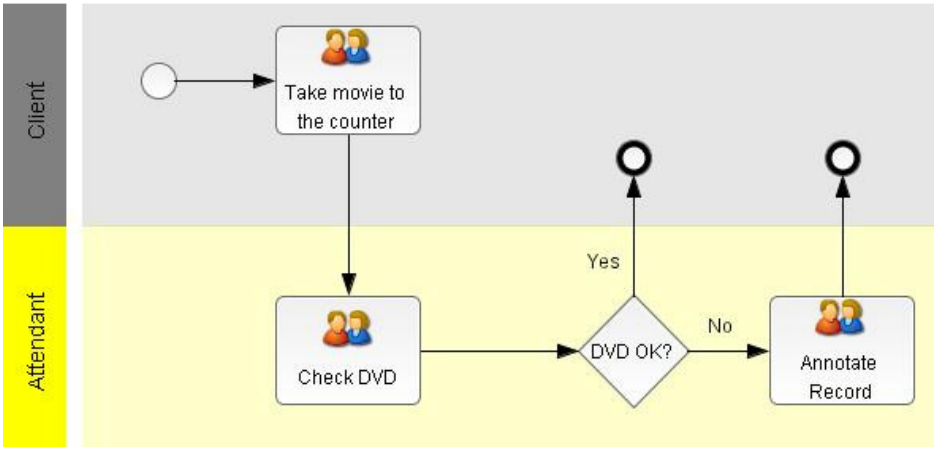

Figure 6a: Modeling the return_movie process as a result of the interviewing method

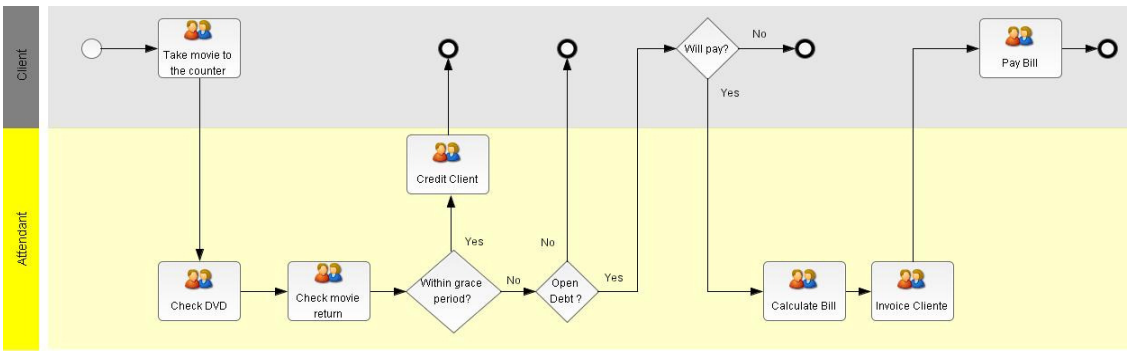

Figure 6b: Modeling the return_movie process as a result of the group storytelling method

As we mentioned above, the changes in the *return_movie* process illustrated in Figure 6a,b were motivated by a client who wanted to return a movie because he was not informed by the attendant that he had already rented that movie. However, with the changes introduced in the *rent_a_movie* process, there is no need to implement a change in the *return_movie* process. On the other hand, the stories told by the attendants reported a number of other situations in which a client asked to return a movie without charge, such as a defected DVD, and a movie that was programmed to be shown in the open TV on the same day. Based on these reports, the manager decided to keep the changes in the return-movie process, assuming the one hour grace period would cover most situations. In any other situation, the manager would decide on a case basis.

Another change was motivated by a story told by an attendant who reported a client who insisted in paying his/her debt at the time of the movie return. Usually, the attendant would annotate the debt on the client's account and bill the client in the next rental, but this client wanted to pay the debt at the time of return. This option was then added to the *return_movie* process model.

6. Use in Engineering systems development cycle

The method can also be useful in the development of information systems intended for the Engineering area. We provide here two examples in which the method could be applicable to developments reported in the literature.

The first example is the production planning system described by McKay and Black [41]. The system evolved during ten years. It first started as a Gantt chart sequencing tool. It was then converted to a scheduler's information system. The system was then enlarged to be integrated with SAP. A final stage of evolution involved small continuous improvements driven by management reporting requirements. McKay and Black discuss this evolution with detail. In particular, they ask whether or not all changes could have been anticipated at the beginning. The answer is no, because many contextual elements have changed from the start of the system. However, the approach described in this paper might have helped to somehow reduce the number of iterations needed. That could have occurred because many requirements and processes could have appeared when the users would have told their stories related to their everyday activities.

The second example is from the architecture, engineering and construction industry. Hartmann et al. present a methodology based on ethnography and action research to understand specific requirements and

later improvements for information systems in this area [42]. They propose four aspects to be considered for the development of these information systems:

- System developers need to gain an enhanced understanding of the complex project routines managing the product and project at the same time.
- System developers should develop an understanding about the unique work routines on specific projects.
- System developers need to gain an in-depth understanding of the different viewpoints of practitioners.
- System developers should anticipate that practitioners will change existing routines after they start using a new system.

These issues match very closely our own assumptions for the storytelling approach. Hartmann et al. [42] propose a large scale effort to understand the processes in this complex area of application, with many cycles. In this context, the storytelling method could be part of this larger project, accelerating or reducing the number of iterations required to reach the good understandings listed above.

7. Conclusions

A knowledge-sharing story offers a surrogate experience. The narrative layout offers the reader an opportunity to experience in a replacement fashion the situation that was experienced by the story tellers. The listener can acquire understanding of the situation key concepts and their context, and although the listener did not directly experience the story circumstances, he could experience a similar situation. Therefore, we believe that reading a story makes the process modeler (process analyst) even more able to understand the process as it is, interpret it correctly and create a representative abstraction to capture both the general view, and also the details.

The method presented in this paper shows how the elicitation of processes is basically done by the tellers; the facilitator's job is to support them, not to *guide* them in the way interviews are conducted. We observe in the presented examples some aspects are simply not reported on interviews. There are many reasons for that. Machado et al. [26] reported that stakeholders may not describe their activities entirely during interviews or focus groups, either due to lack of time, low recall capability, fear, omission, or because it is burdensome to articulate their routines, skills, abilities and tacit knowledge. An omission

may occur because the interviewed person thinks details or *special cases* are not important. As a major and critical concern, sometimes stakeholders say what they should do instead of what they really do. They propose an ethnography approach, which has advantages and disadvantages vs. the Group Storytelling approach that need to be investigated.

The method also should help with another interviews shortcoming we mentioned above, namely, biased selection of interviewed persons. Although the selection of storytellers presents the same problem, the parallel nature of the group storytelling approach allows the increment on the number of participants without a significant additional effort. The rise on the number of interviewees, on the other hand, requires an increment on the interviewing effort in the same proportion. In comparison with traditional interviews, we expect the concurrent group storytelling will require less total time, as the storytelling can happen in parallel while interviews have to be sequential, considering the process modelers do not work in parallel. A group interview is an option but it requires additional logistics, which is not always available. Of course, these tentative advantages of the group storytelling strategy should be scientifically demonstrated by experiments, which we intend to perform in the near future.

The preliminary experiments carried out with the TellStory tool demonstrated some of the benefits of the approach. Participants were able not only to input their stories but also to contribute to others' stories with additional information and comments that helped the fragments' authors to complement them. Participants have reported some usability problems and asked for some additional functionality, for instance, the possibility of linking grouping fragments under one activity or one process. Awareness functionality has been requested by the facilitators in order to promote participation. The modeler however, is the role that requires more support. The tool does not help him/her in the activity of transforming stories into changes in the model. Many of these suggestions are being incorporated into a new version of the StoryTeller tool that is under construction [43].

Another aspect to discuss is the completeness of the elicitation process. A high number of story tellers has the potential to provide several different viewpoints and, hopefully, to capture all special cases and process exceptions. Of course, no fixed number of story tellers can guarantee elicitation completeness. However, after obtaining a version of the process model through the proposed method, we can complement it with other details or clarify issues that may still exist. This can be done by using traditional interviews and the selection of interviewees can be oriented towards those people who can provide the answers to specific questions taking the reference model as a base.

Finally, it is important to mention the process model obtained by the method proposed in this paper is the first phase of a business process project. The process model results from an elicitation process aimed to identify operational problems and possible improvements. Our approach does not cover the incorporation of strategic issues and new activities. For these, the interviewing technique is preferable.

Acknowledgments

This work was partially supported by grants No. 479374/2007-4 and 567220/2008-7 from CNPq (Brazil), No. 1080352 from FONDECYT (Chile) and No. R0308LAC004 from LACCIR.

References

[1] Eriksson, H.E., Penker, M.. "Business Modeling with UML: Business Patterns at work", J. Wiley & Sons, 1999.

[2] Shen, H., Wall, B., Zaremba, M., Chen, Y., Browne, J. "Integration of business modelling methods for enterprise information system analysis and user requirements gathering". Computers in Industry 54 (2004) 307–323, 2004.

[3] Okawa, T.; Hirabayashi, S.; Kaminishi, T.; Koizumi, H.; Sawamoto, J., "A Method of Linking Business Process Modeling with Information System Design Using UML and its Evaluation by Prototyping", *The 2nd IEEE Asia-Pacific Service Computing Conference* (APSCC 2007), pp.458-465, 2007.

[4] Fraser, M., Stanton, D., Ng, M., Benford, S. D., O'Malley, C., Bowers, J., Taxn, G., Ferris, K., Hindmarsh, J.: Assembling History: Achieving Coherent Experiences with Diverse Technologies. ECSCW 2003 Helsinki, Finland, Kluwer, 2003.

[5] Snowden, D.: The Art and science of Story or 'Are you sitting uncomfortably? *Business Information Review* 17(4), 215-226, 2000.

[6] Stanton, D., Bayon, V., Neale, H., Ghali, H., Benford, S., Cobb, S., Ingram, R., O'Malley, C., Wilson J., Pridmore, T.: Classroom Collaboration in the Design of Tangible Interfaces for Storytelling. ACM Conf. on Computer-Human Interaction, Minneapolis, USA, 2001.

[7] Viegas, F., Boyd, D., Nguyen, D., Potter, J., Donath, J.: Digital Artifacts for Remembering and Storytelling: *PostHistory* and *Social Network Fragments*, Hawaii International Conference on

System Sciences (HICSS-37), Persistent Conversation Track. Big Island, HI. IEEE Computer Society Press, 2002.

[8] Hickey, A., Davis, A.: A unified model of Requirements Elicitation. Journal of Management Information Systems 20 (4), 65-84, 2004.

[9] Lin, F.R., Yang, M.C. and Pai, Y.H.: A Generic Structure for Business Process Model. Business Process Management Journal 8 (1), 19-41, 2002.

[10] Dennis, A.R., Carte, T.A. and Kelly, G.G.: Breaking the rules: success and failure in groupware-supported business process reengineering. Decision Support Systems 36 (1), 31-47, 2003.

[11] Borges, M. and Pino, J.A. PAWS: Towards a Participatory Approach to Business Process Reengineering. V Int. Workshop on Groupware (CRIWG). IEEE CS Press, 262-268, 1999.

[12] Ochoa, S., Pino, J., Guerrero, L., Collazos, C.: SSP: A Simple Software Process for Small-Size Software Development Projects. First IFIP International Workshop on Advanced Software Engineering, Santiago, Chile. Springer Vol. 219. pp. 94-107, 2006.

[13] den Hengst, M., de Vreede, G.J.: Collaborative Business Engineering: A Decade of Lessons from the field". Journal of Management Information Systems 20 (4), 85-113, 2004.

[14] Castano, S., De Antonellis, V., Melchiori, M.: A methodology and tool environment for process analysis and reengineering. Data & Knowledge Engineering 31 (3), 253-278, 1999.

[15] Valiris, G. and Glykas, M. Critical review of existing BPR methodologies. Business Process Management Journal 5 (1), 65-86, 1999.

[16] Larsen, M.A., Myers, M.D.: BPR success or failure? A BPR project in the financial services industry. 18th International Conference on Information Systems (ICIS), 367-382, 1997.

[17] Hickey, A., Davis, A., Kaiser, D.: "Requirements elicitation techniques: Analyzing the gap between technology availability and technology use". Comparative Technology Transfer and Society 1(3), 279-302, 2003.

[18] Zowghi, D., Coulin, C.: "Requirements Elicitation: A Survey of Techniques, Approaches, and Tools", in Engineering and Managing Software Requirements, edited by A. Aurum and C. Wohlin, Springer, 2005.

[19] Goguen, J., Linde, C.: "Techniques for requirements elicitation", in Proceedings of RE 93: International Symposium on Requirements Engineering, Jan 4-6, 1993, San Diego: IEEE Press.

[20] Laporti, V., Borges, M. R. S. and Braganholo, V. ATHENA: A Collaborative Approach to Requirements Elicitation. Computers in Industry 60(6), 367-380, 2009.

[21] Maiden, N.A.M., Rugg, G.: "ACRE: Selecting methods for Requirements Acquisition". Software Engineering Journal 11(3), 183-192, 1996.

[22] Gottesdiener, E.: Requirements by Collaboration. Addison-Wesley: New York, USA, 2002.

[23] Weston, R.H., Chatha, K.A., Ajaefobi, J.O.: "Process thinking in support of system specification and selection". Advanced Engineering Informatics 18(4), 2004, 217-229.

[24] Keil, M., Carmel, M.: "Customer- Developer Links in Software Development". Communications of the ACM 38(5), 33-44, 1995.

[25] Iqbal, R., James, A., Gatward, R.: "Design with ethnography: an integrative approach to CSCW design". Advanced Engineering Informatics 19(2), 2005, 81-92.

[26] Machado, R.G., Borges, M.R.S., Gomes, J.O., Guerlain, S.: An Observation Model for the Collaborative Analysis of Real Workplaces In: Proceedings of the 11th International Conference on Computer Supported Cooperative Work in Design. Melbourne, Australia: Swinburne Press, v.1. p.292–297, 2007.

[27] Kozima, A., Kiguchi, T., Kinoshita, D., Hayashi, Y., Hashiura, H., Komiya, S.: "A system to guide interview-driven requirements elicitation work: domain-specific navigation using the transition pattern of topics". Transactions of the Society for Design and Process Science 9(4), 27-39, 2005.

[28] McDermid, J.A.: "Requirements Analysis: Problems and the STARTS approach". IEEE Colloquium on Requirements Capture and Specification for Critical Systems (Digest No. 138), 4/1 – 4/4. IEEE, 1989.

[29] Santoro, F. M ; Brézillon, P. The Role of Shared Context in Group Storytelling. Computing and Informatics 25 (6), 497-522, 2006.

[30] Freitas, R. M., Borges, M. R. S., Santoro, F. M., Pino, J. A. Groupware Support for Cooperative Process Elicitation. IX International Workshop on Groupware (CRIWG), Lecture Notes in Computer Science 2806, 232-246, 2003.

[31] Shen, C., Lesh, N.B., Vernier, F., Forlines, C., Frost, J.: Sharing and Building Digital Group Histories. ACM CSCW'2002, New Orleans, USA, 2002.

[32] Valle, C., Prinz, W., Borges, M.R.S.: Generation of Group Storytelling in Post-decision Implementation Process. 7th International Conference on Computer Supported Cooperative Work in Design, Rio de Janeiro, Brazil, 361-367, 2002.

[33] Carminatti, N., Borges, M.R.S., Gomes, J.O.: Analyzing Approaches to Collective Knowledge Recall. Computing and Informatics 25 (6), 547-570, 2006.

[34] Schäfer, L., Valle, C., Prinz, W.: Group Storytelling for Team Awareness and Entertainment. 3rd Nordic Conference on Human-computer Interaction, Tampere, Finland, 441-444, 2004.

[35] Acosta, C.E., Collazos, C.A., Guerrero, L.A., Pino, J.A., Neyem, H.A., Motelet, O.: StoryMapper: A Multimedia Tool to Externalize Knowledge, 24th Int. Conference of the Chilean Computer Science Society, Chile. IEEE CS Press, 133-140, 2004.

[36] Leal, R. P., Borges, M.R.S., Santoro, F. M.: Applying Group Storytelling in Knowledge Management. IX International Workshop on Groupware (CRIWG), Lecture Notes in Computer Science 3198, 34-41, 2004.

[37] Santoro, F.M., Borges, M.R.S., Pino, J.A.: CEPE: Cooperative Editor for Processes Elicitation, 33rd Hawaii International Conference on Systems Sciences, IEEE Computer Society Press, 2000.

[38] Scheer, A. W. ARIS – Business Process Frameworks, 2nd ed., Springer, 1999.

[39] BPMN – Business Process Modeling Notation, available from: http://www.bpmn.org/Documents. Last accessed on June 2008.

[40] Savvion Inc.: Process Modeler, available from http://www.savvion.com. Last accessed on June 2008.

[41] McKay, K.N., Black, G.W.: The evolution of a production planning system: a 10-year case study. Computers in Industry 58, 756-771, 2007.

[42] Hartmann, T., Fischer, M., Haymaker, J.: Implementing information systems with project teams using ethnographic-action research. Advanced Engineering Informatics 23, 57-67, 2009.

[43] Luz, C.M., Borges, M.R.S. Campos, M.L.M.: Sofia – A framework for the Development of Group Storytelling Tools, ACM Workshop on Story Representation, Mechanism and Context (SRMC), ACM Press, Vancouver, Canada, 41-47, 2008.