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Tangible Business Process Modeling: A New Approach

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ABSTRACT

This paper examines preliminary work applying contemporary design theory and methodology research concepts to Business Process Modeling (BPM). BPM practitioners have expressed difficulty in sharing BPM concepts with clients, and getting salient feedback from clients. Through the application of design prototyping frameworks and methods, the authors developed an extension to BPM, called Tangible Business Process Modeling (TBPM), in order to resolve these difficulties.

Keywords: Business Process Modeling, Structured Interviews, Media-Models, BPMN, TBPM

1 INTRODUCTION

This research attempts to extend and refine design thinking methods by focusing on business processes as design products, in which several stake-holders, with potentially conflicting interests, are involved. Business processes are essential assets of companies, since they reflect how products and services are provided to the market. They have significant business value and can only be enacted successfully, if stake-holders collaborate and if technology is used to support the process. Business process models are the key instruments to successful implementation of business processes.

Practitioners have expressed difficulty in sharing process modeling concepts with clients, and getting salient feedback from them. Domain experts are not confident expressing their knowledge in process modeling sessions. Current scholarship in cognitive science [10], science technology studies [4], and design thinking [2] has reconsidered the role media plays in knowledge gathering and acquisition. The use of low-resolution physical prototypes has been very successful in innovative, user-centered practices in product design [2]. It is our aim to investigate the ways in which this approach could be fruitfully used to model and develop business processes.

BPM deals with the internal processes of a company. The questions that BPM practitioners ask include, "Which steps need to be taken to process the order?" and, "Who is responsible for what?" Business process modeling tries to represent these working procedures as clearly as possible in order to provide a common understanding of the business process. BPMN is the de facto standard [8] for process modeling, a shared language used by IT developers and business users to communicate about business processes. This creates a platform for discussion, process improvement, and eventually, software support to successfully enact the processes.

2 BACKGROUND AND MOTIVATION

In November, 2008 a group of researchers from the United States and Germany met to explore the possibility of bringing design thinking research concepts to BPM. The group decided that experimenting with three dimensional tactile objects as a proxy for BPMN icons would be a viable path for development.

As noted, BPM practitioners have expressed difficulty in sharing BPM concepts with clients, and getting salient input and feedback from clients. In common BPM practice, extensive structured interviews are conducted with clients [1]. BPM experts build process models which have two major components, a business process model, in the form of a flow chart, and a printed narrative, which provides the context and particulars not indicated by the model.

Unfortunately, domain experts who have the required business knowledge are often unable to give meaningful feedback, because they lack expertise in process modeling. In fact, only a small group of method experts can create and read process models. These models range from somewhat simple to quite complex (*Figure 1*).

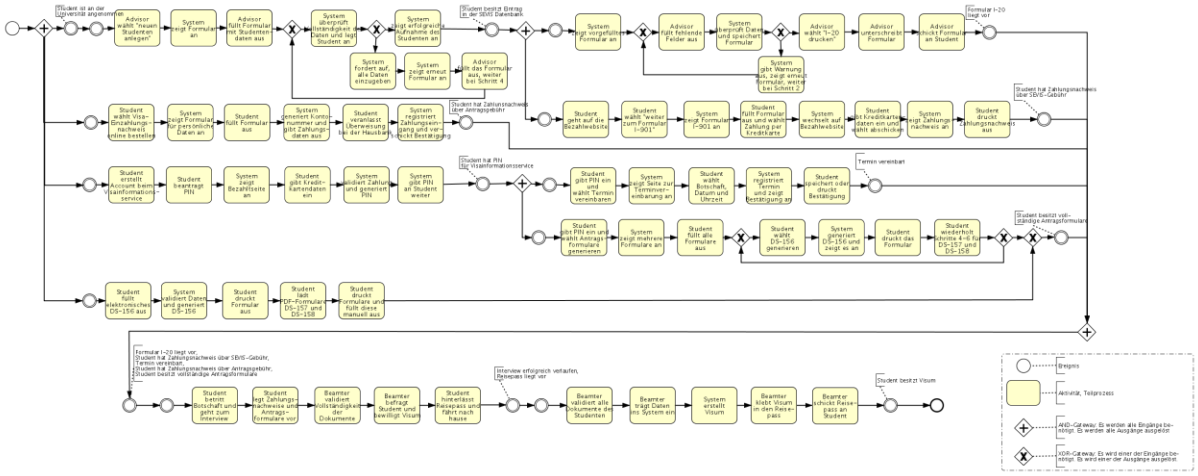

Figure 1: A complex Business Process Model

When faced with a technical flow chart and a disembodied narrative, most clients are at a loss to penetrate BPMN flow charts and connect them to how their business works, and thus are unable to give meaningful feedback to BPM practitioners. This can lead to inaccurate process models, or process models that are simply wrong. Problems are not discovered until software implementation based on the model is complete, at considerable expense. We propose that adapting user-centered product design methods will close the gap between empty models and real business practice.

Our research team is made up of individuals who are practicing designers and BPM professionals, as well as design researchers. It is understandable that our interests would lead us to see this problem as both a design problem and a research problem. The resulting work was always seen as a hybrid, part design intervention and part scientific study. To date, the research team has conducted a series of four preliminary experiments together with four iterations of tangible objects. What follows is an account and analysis of our work thus far.

3 First Iteration: November 2008

In contemporary practice, BPM consultants visit the stake-holders individually. They perform structured interviews in order to uncover how each part of the business works. Questions like, "What do you do when you get an order?" are the stimuli for gathering requisite information to build a model of the business. The BPM consultant visits each stake-holder in each company or department and repeats the interview process. The data is gathered and consolidated by the consulting team, not by the people who actually work in the company. Consultants make a model, and then return to individual stake-holders for feedback.

Our research group began with a role playing exercise based on a fictitious bicycle shop processing orders. This scenario assumed multiple stake holders (customers, sales people, suppliers, fabricators)

simulating the process of ordering and buying a bicycle. The media used included Post-Its, LEGO, and anything on hand with little regard to how it corresponded to BPMN domain iconography.

In our simulation, we posited a "game" in which multiple stake-holders would meet simultaneously to go through the steps of the bicycle ordering process. Players gathered in groups of four to five people: one customer, one supplier, and two/three persons working in the bike shop (sales, construction, and management). Our notion was that by playing the game, we could come up with a general understanding of the process involving all partners.

Figure 2: The first iteration – Lego, paper, and anything ready at hand

We allowed about 1.5 hours to get the people into playing mode, play the game and talk about the findings. In the spirit of the practices of innovative design development, we did not establish too many rules. Instead, we wanted to see what the situation would suggest as a way of moving forward.

First Iteration Observations

We observed some confusion about Lego pieces and what they represented. For example, one player assumed that a Lego piece was a bike part, another player a bicycle, and still another player assumed it was money. Negotiating meaning helped, but painting or tagging the objects with a Post-It would make it far easier to share a common understanding.

Concurrency made the game a challenge. Playing the game with several stake-holders at the same time added complexity to understanding the process. The research team realized the necessity of marking and tracking the chronology of events. One group decided to pass a token around (a small ball), which indicated that a single person could act exclusively when in possession of the ball.

Small whiteboard (dry erase) plates were considered to be of benefit, as they enabled observers to follow a sequence of information exchange, e.g. negotiate a price. The research team considered this use of media beneficial and worthy of further development.

The team found that role playing seemed helpful in understanding stake-holder needs, and that having tangible objects held promise for assessing how actual physical objects (bicycles, paper, packaging, and storage needs) had to be managed. Affordances for judging and manipulating physical objects are largely absent in the current representational methods of BPMN.

4 The Second Iteration: January 2009

This iteration was done in order to explore ways in which people can experience a business process by playing a game together. The guiding question of this iteration was, "Can the overall state of the process be represented in the middle of the table or is it only distributed through the artifacts that are in front of the individual players?"

In this iteration, the participants were asked to model a transaction on EBay, because it presented a process with which everybody was familiar. Another question concerned the issue of concurrency, "How can concurrency be enabled during the game play without making the game too complex for its participants?"

In this iteration we employed five subjects to act as stake-holders: EBay, the post office, bidder 1, bidder 2, and a seller. In addition we included a Game Master / Moderator. The media we employed were simpler than the first iteration, consisting of only Post-Its, pens, and a clock to keep time.

Figure 3: Post-Its and pens

We asked participants to describe their motivation for their role in this process (who wants what from whom and why?), and to define the start and end of their role in the process. In addition we asked them to create a Post-It for every activity that they thought they would perform during the process.

Second Iteration Observations

The preparation phase was helpful for the players to develop empathy for the users. People want the state of the process to be represented on the table. Time must be reliable and the time constraints must be obvious to everybody.

The prepared activities (on Post-Its) were of value in that they allowed subjects to think about their role in the process. People used almost every Post-It and rarely created new ones. Perhaps the prepared Post-Its limit the thinking scope. Only one person had to recreate most of his Post-Its (the post office role) because his assumptions proved wrong during the game play.

The Post-Its that were created during the game's preparation stage were rather restrictive during the actual gaming session, since almost all participants were strongly motivated to fit these anticipated

activities into the game. A better usage of these cards could include an adjustment of the level of abstraction for all participants if, e.g., people write: shipping the goods to the customer and ask for the customer's address. An evaluation of these cards before the start of the game could help all participants to understand the expected level of abstraction.

5 Third Iteration January 2009

As a result of the second iteration we observed that subjects wanted the state of the process to be represented on the table. We posited that interviews would improve if people had physical objects that held the current knowledge. We surmised that it might be easier for both the subject and the interviewer to uncover the actual steps of the process and to look deeper into certain steps of the process if the process itself was physically laid out in front of them.

The third iteration of this series involved fabricating a set of white acrylic tiles based on systems modeling iconography. The motivation for this iteration was to step closer to BPMN iconography. The white acrylic afforded writing with a dry erase marker right on the piece, making the content easily changeable. Furthermore, the pieces were made large enough to require gross motor coordination in order to manipulate them with the hands.

Figure 4: First version of acrylic blocks

Preliminary research with this model included user testing with administrative assistants at HPI, Potsdam. The team asked administrative assistants to describe the process of booking travel and accommodations for faculty conferences. One round was done with standard questionnaire methodology. Another round was done using tangible objects. Our guiding research question for this iteration was: "Do tangible objects help to gather more information in interview situations?"

We interviewed six administrative assistants from different Chairs. For three of the subjects, we performed a structured interview consisting of five questions (below). For the three others we performed the same structured interview, but brought in tangible objects to record the steps noted during the interview.

Structured Interview Questions:

1. Please tell me how you arrange a conference for your professor? (Note: this is usually followed by a general description of the process)
2. Can you tell me more about step X?
3. Is there something you like or dislike about the process?
4. Is there something you'd like to change about the process if you could?
5. Is there anything else?

Third Iteration Observations

We found that in the interviews that included tangible objects, the second question was rendered unnecessary. We assume that the reduction of cognitive load via the object right in front of the subject allowed the subject to delve more deeply into the individual steps of the process. The subject was able to reflect on the process in front of him in such a way that he corrected small details ("usually, this task comes before this one") as the interview continued. This often occurred during the first question. This result is quite unusual for an ordinary interview which is too linear for such a reflection about the words describing what happens in a certain phase of the process.

5 Fourth Iteration

The third iteration led the team to consider fashioning a table suitable for writing on with dry-erase markers, upon which designers and users could write as part of a BPM development system. The table would permit drawing lines, connecting one transaction with another.

For the current iteration, we moved even closer to BPMN, while maintaining the tangible nature of the previous iteration. This iteration used BPMN as a model for the shapes of the acrylic pieces. Care was taken to design the pieces so they were big enough to write on with dry erase markers and comfortably hold in the hand. A complete set was made totaling one hundred and twenty pieces. We called this iteration the TBPM toolkit. In addition, the toolkit included the table that could be written on with dry erase markers. During the course of the interviews using the TBPM toolkit, the interviewer would draw BPMN swim lanes, as well as lines connecting actions representing BPM states.

Figure 5: the TBPM toolkit and table

We interviewed university office assistants for standard processes such as travel planning and conference organization. We used structured interviews and the TBPM toolkit. We wanted to see whether the domain experts would accept the tool and how they would apply it.

Subjects were reluctant to use the TBPM toolkit at first. We found it effective if the interviewer listens and models the first steps of the process, while explaining the concepts behind the tangible objects. After the interviewer has written on several acrylic tiles, subjects started writing on the blocks themselves. The first steps also set the level of granularity for all other discussions.

We did not explicitly introduce the concept of control flow [3] or gateways in BPMN. Intuitively, subjects accepted a logical order if steps were laid out from left to right. Parallelism and alternatives were both captured by putting activities one over another. Only in processes where both concepts occurred together, gateways were introduced. In general, we introduced as few concepts as possible to reduce distraction from the problem (distraction by language overhead has been reported by Stirna []).

Figure 6: Snapshot from two interview situations: process modeling driven by domain experts

Fourth Iteration Observations

The initial mapping was relatively slow because subjects had to find appropriate activity names and write them down on a tangible object. In this iteration we also conducted interviews using Post-Its. We found that mapping with Post-Its is fast and creates a stream of arbitrary information, but does not help to frame the output into the concepts of process modeling. Once the process was modeled, the tangible objects functioned as a map through which subjects could navigate. We observed subjects jumping around in the storyline, adding more details to each of the activities.

Because subjects were apt to point at the represented stages of their process, it was easy for the interviewer to follow their explanations. In post-interview debriefing subjects reported that they enjoyed working with the tool because it was intuitive to use. We believe that they liked being engaged in a creative task that is both tactile and intellectually challenging. Easily erasable whiteboard markers and wipers afforded users the ability to start modeling with an imprecise solution, allowing them to revise and correct the process model.

6 Preliminary Hypotheses

Based on our investigations, we have formed several preliminary hypotheses: 1) higher consensus and adoption, 2) higher self-correction, and 3) a better understanding of the result by complementing structured interviews with our methodology and toolkit. We also hypothesize that 4) interviewers will remember more details based on the additional cognitive dimensions.

1) Higher consensus and adoption: We believe that modeling with the domain expert leads to a consensus about the results. The domain expert may recognize the model that she co-designed as her work and thereby identify with the model.

   A similar effect was reported by Stirna [17] for participative group modeling sessions. They also reported less objections and change requests leading to less iteration cycles and more efficient elicitation. The model serves as a common language which is able to reduce misunderstandings inherent in natural languages [7]. Usually, iterations with the domain expert are needed after the initial interview because of misunderstandings and wrong interpretations by the method expert. A domain expert feeling misunderstood may get distrustful and therefore may question the elicited model as a whole.

2) Self-correction during the interview: We believe that domain experts will change the model during the interview and correct information they claimed beforehand. They correct statements that would otherwise be captured as inconsistent information.

It is not surprising that users may give incorrect or inconsistent information [5]. That might also be a result of misinterpretations by the interviewer. Interview situations that create intermediate artifacts report instant feedback and corrected information. The visual mapping of the process in our case allows subjects to jump around in the storyline and makes self-correction possible at any point in time.

3) Better understanding of process and notation: We believe that the domain experts learn the basics of the notation by the hands-on modeling experience. Knowing the basic concepts and relating them to their process example is already an education in process modeling. Thus we believe that they are not only able to read their own model but also to read modified models or even unknown models because they can distinguish the different concepts in the notation.

   Given that the domain experts have no previous experience in process thinking and modeling, any modeling experience is better than nothing. Stirna also reports [17] that people adopt knowledge quite well by hands-on experience.

4) Interviewers remember more details: We believe that interviewers can remember more details about the process if it is mapped on the table. This helps to better document the interview results. Humans are limited in terms of their ability to remember details [5, 6]. But it was also shown that additional dimensions can help one to remember more details [6]. We believe that the visual mapping is one such dimension which provides a fatter bandwidth data to improve memory.

Related Approaches

Several domain specific techniques are in use today to map knowledge for communication [11]. As an example value stream mapping, a lean technique, provides a framework of seven mapping tools [9] among them, process activity mapping and decision point analysis. BPMN as an Object Management Group (OMG) standard [8], aims to provide a communication vehicle for process documentation, improvement and software support, and is in wide use by experts for these purposes.

However, our approach aims to engage non-BPMN experts in the creation and communication of business process models. Participative modeling was also explored by Persson et.al. [16,17] in the area of enterprise modeling. The work is highly concerned with culture and participant selection. Participative modeling is facilitated by workshops, a software tool operator and a method expert for moderation. TBPM eliminates the software tool and operator in order to lower the barriers for client participation.

Conclusion

Structured interviews have been considered state of the art in process elicitation [1]. In this paper, we discussed the problems that arise with structured interviews for process elicitation. We developed a toolkit and a methodology (TBPM) to introduce tangible objects in process modeling, thereby engaging domain experts in generating a business process model to a greater degree than observed though the use of structured interview alone. We shared our observations from pilot studies and derived a set of hypotheses upon which we plan to design experiments to empirically validate our ideas. It is our desire to understand how the TBPM toolkit changes interview outcomes in order to develop refinements of the method.

In the future we aim to refine this approach for interview situations and we see potential to expand the use of tangible toolkits for process improvement sessions with groups of process modeling experts. We believe that tangible building blocks change the way people think about and address problems.

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