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A Box Analogy Technique (BoAT) for Agile-based Modelling of Business Processes

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***Abstract*—This paper reports on our experience on developing the Box Analogy Technique (BoAT) an agile-based approach to extract business process models as part of the requirements elicitation phase. Business processes models have been established as an effective way of capturing and reasoning about organizational operational processes, and although having been used as part of requirements elicitation, their definition is a heavy process not aligned with agile principles. BoAT provides a complement for requirements gathering based on agile practices for process modelling combined with a cognitive-visual analogy focused on business view. The technique has been applied in three public and private organizations in a Brazilian state capital, and its artefacts have been compared against those obtained through a traditional interview technique. Results show that BoAT has indeed improved the communication with stakeholders, increasing the quality of the collected artefacts.**

I. Introduction

It is well-known that the activity of requirements elicitation is subject to various issues [1], [2], [3], such as, inefficient communication with stakeholders; lack of clear boundaries in the problem domain; requirements recorded in a disorganised manner; and requirements collected only based on the vision and needs of users without considering the vision of the business needs. These issues are even more relevant when we consider requirements activities in agile teams [4].

Understanding of business needs during early stages of the software development process provides a comprehensive view of the problem, allowing the identification of what is really relevant to stakeholders considering the real needs of the systems that will support the organisation's operations. In this context, business process models, which can be obtained through the design or redesign of operational processes, are strong candidates to capture such demands [5], [6], providing an alternative for systems analysts to collect requirements that are closer to the reality of an organization [6] [7]. Studies carried out in [8], [9] demonstrate that there was an improvement in the quantity and quality of the requirements collected from business processes.

Although existing work explore the use of business processes to collect requirements and generate software artefacts [10], [11], they do not specify how the business process models are obtained. In general, these works assume that there are already business process models in the organisation, that a dedicated BPM (*Business Process Management*) team is responsible for defining them or that the systems analysts themselves model the business processes without specifying how this occurs. Other work report that the models are built based on high-level requirements already raised before the modelling of business processes [12], [13].

However, designing a business process is a complex and challenging task [14]. Weißbach et al. [15] identified the main challenges in business process modelling, which includes dealing with lack of clear aim and communication between stakeholders with different levels of knowledge; and how agile principles can help. Moreover, when performed in later stages of the software development process, that is, after the requirements have been established, it can result in the creation of systems that do not support the real needs, objectives and expectations of the organization [16]. Thus, seeking mechanisms to improve the design of business processes during the requirements elicitation is a necessary task to deal with the complexities involved in capturing requirements.

In this context, this paper presents BoAT (Box Analogy Technique), an approach that introduces an agile-based cognitive-visual analogy to help teams discover and capture business processes during requirements elicitation. BoAT helps in structuring group interviews through the use of cards for capturing business processes using a subset of the business process model and notation (BPMN) [17].This paper reports on the development and application of BoAT, following the action design research (ADR) methodology [19] as guidance, for extracting business processes during the requirements elicitation phase in three different private and public organisations in a Brazilian state capital. The resulting artefacts were then compared with artefacts obtained through a traditional interview technique, and feedback provided by all three clients allowed us to improve BoAT.

In the remain of this paper section II presents the methodology adopted in the research. Section III describes the context, problem and objectives of the project. Section IV presents the

main elements of BoAT while section V presents the three case studies in which BoAT has been applied. Section VI discusses the experiences and lessons learned. Section VII discuss some related work, and section VIII concludes the paper.

II. Research Design

This section describes the methodology adopted in this research. BoAT was born from a problem faced by practitioners in their day-to-day following an approach based on the Action-Design Research (ADR) methodology [19]. This is a methodological approach that combines aspects of both action-research (AR) and design research (DR) [19].

AR is a research methodology focused in contributing to knowledge by solving a practical problem faced by an organisation [20], being applied in software engineering research in industry context as demonstrated by dos Santos and Travassos [21] and further expanded in the work of Staron [22]. It comprises a number of stages in a cyclical approach, usually presented as the canonical AR method: Diagnosis-Planning-Actions-Evaluation and analysis-Reflections and Learning. On the other hand, it is possible to notice discussions on the use of design research (or design science) for software engineering project, and its similarities with action research, such as the cyclical nature of a number of phases [23], [22]. One conclusion from these authors is that while AR has the learning as the main result of the research conducted, DR has as main goal the design and use of artefacts.

In this context, Action-Design Research (ADR) comes as a systematic combination of both approaches [19] which is being adopted in different projects. For example, Gill and Chew [24] report on the successful use of action design research (ADR) on a large project. According with the authors, DR can be seen as most adequate to software engineering projects due to its strong emphasis on artefact, but suffers with *criticism on methodological rigour*. Thus, they complement their design science approach with elements from action research in terms of intervention and organisational context.

Based on these discussions we have adopted an ADR-based methodology to structure our research, as presented by Sein et al. [19], composed of four main stages: Problem Formulation and Objectives (PFO); Building, intervention and evaluation (BIE); Reflection and Learning (RL); and Formalisation of Learning (FoL).

Our ADR-based methodology is presented in Figure 1. The PFO phase deals with identifying and conceptualising the research. This phase also includes setting-up the research objectives with its theoretical basis and defining roles and responsibilities of the research team. The BIE stage deals with the actual construction of the IT artefact and its intervention in the target organisation, while RL analyses the intervention results to support design and redesign of the project. BIE and RL are repeated in a cycle as many times as needed. In our case BIE and RL cycle was repeated with three different clients between the months of January and June of 2019, constituting three case studies during which BoAT evolved to its current form. The FoL stage concludes the project by abstracting the learning into general concepts that can be shared and reused by other practitioners.

III. Problem Formulation and Objectives

This section presents the context in which this project was inserted, defines the scope of the problem tackled and identifies the main objectives and theoretical basis for the development of BoAT.

A. Context

The team involved in the development of BoAT includes a business system analyst (BSA), a software architect (SA) and a software engineer (SE) of a Brazilian IT outsource company. Both the BSA and SA also provide consulting services to different companies. These three professionals constitute the practitioners that collaborated with a researcher through an intervention in order to solve a practical problem they detected in their day-to-day jobs. The BSA has joined the team in the middle of BoAT development.

We report on BoAT development through its application to three different clients. We choose these clients because they are the ones that better capture the process of developing the technique between the months of January and June of 2019. Client#1 is a Brazilian governmental organ of urban transit control in which all practitioners are part of a team composed of six developers, working on a project for the reengineering of one of their internal systems, together with the addition of new functionalities. Client#1 has a team of nine developers who are responsible for maintaining their existing systems, and usually outsources development of new functionalities. Client#2 is a medical cooperative entity with a team of five developers. They were running an internal software development project, in which the BSA was providing consulting services, and they were interested in getting involved with BoAT after learning of its first results in capturing business processes with Client#1. Client#3 is a franchising company with approximately 100 stores all over Brazil. The IT team is composed of five developers and were engaged on an internal project for automating some of the manual tasks performed by a team of five people related to invoice entry. Similar to Client#2, this client usually engages with the BSA in consulting services, and were interested in the BoAT technique after learning of its initial results with Client#1.

All clients were looking to develop a Web-based system for their respective business processes. While the practitioners were part of the development team of Client#1, being able to directly intervene in the development process, they played the role of external consultants to Client#2 and Client#3, and thus helped with requirement elicitation that would then be developed by their respective client's internal development team. All clients follow agile principles in their respective projects.

B. The Problem

The practitioners experience in dealing with different clients have formed the basis for the *Problem Formulation and*

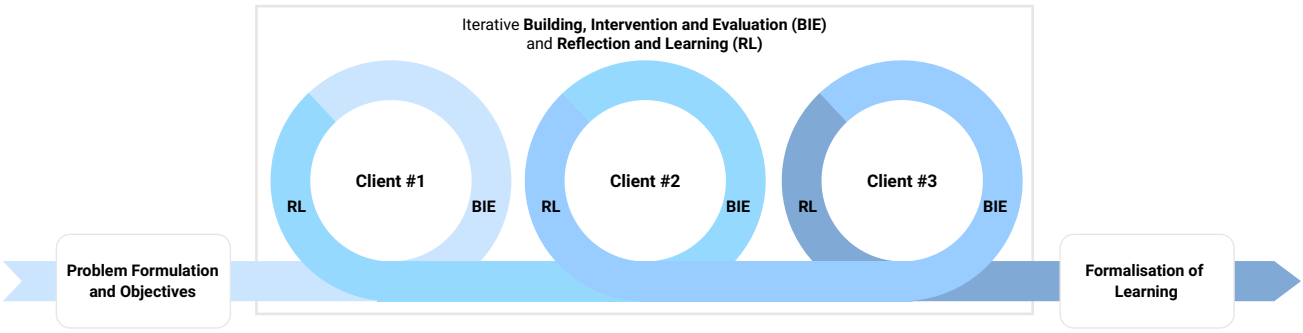

Fig. 1. BoAT construction methodology based on ADR.

Objectives phase of this work. The main problem faced by the practitioners was how to capture business processes in support of other activities commonly conducted during the requirements elicitation phase. The main benefits of such practice is well established in the literature (e.g., [16], [14], [15], [25]) and this provided us with the scope of the project.

As part of the *Problem Formulation and Objectives* phase we conducted individual interviews and a focus group session with the practitioners in order to dive into their practices and experiences, and to understand the challenges faced by them. It was possible to identify a number of recurrent issues: Lack of focus when there is no definition about which business process will be discussed; Low engagement and high dispersion of attention on the part of the participants; Omission of domain information considered obvious for interviewees; Without focus, interviews for surveying business processes take too long, producing confusing data and unsatisfactory results; or Adoption of informal artefacts and annotations without standardisation, making it difficult to understand the elicited flows, causing errors during later modelling stages.

Based on this we analysed the practices adopted by the practitioners, and confirmed that they were indeed following common best practices such as: pre-interview preparation with evaluation of forms, reports, documents, project objective, scope to be discussed and profile of the interviewees; structured interview based on pre-defined topics and questions, but open for users to express freely. In fact, these same practices are also adopted by other development teams consulted after the interviews, and they also report the same difficulties in this phase of the software process. This reinforces the idea that this problem is more common than we think in real software development scenarios as reported in [26].

C. The Objective

Our goal is to develop a technique that can be used during the requirements elicitation stage to help capture business processes. The technique should broaden the participants engagement in the requirements elicitation activities and produce higher quality artefacts for software modelling.

Based on this we have considered existing approaches to capture business process (as discussed in the section VII) and observed agile practices that come from methodologies as SCRUM and eXtreme Programming (XP) with the use of cognitive-visual analogies to increase the perception of linguistic manifestations around a scope [27], such as the use of iterations, the adoption of user stories, the writing of paper cards, as well as working in pairs.

BoAT is based on the use of cards arranged on a table or board so that all participants can interact with the process flow in real time, indicating tasks and events associated with the information captured by the cards. One reason to use cards to model the business process is that the vast majority of users are already familiar with this type of object, as they already use them in their day-to-day lives, unlike BPMN models, which are more restricted to analysts. Using physical elements allows those involved to manipulate activities freely, stimulating the interaction and focus of the participants. In this sense, these cards can be considered within the context of requirements engineering as a *"setting mechanism"* [18].

IV. Building the BoAT

BoAT starts with a targeted group interview guided by pilot and co-pilot with the objective of capturing a business process in BoAT cards. Business specialists report their knowledge of the process, which are captured in BoAT cards that can be freely manipulated by all participants. At the end of the interview the cards are collected and placed in the story box, giving space for the definition of new processes if this is the case. The story box is then used to create a business process diagram (BPMN model) capturing the flow described on the cards.

In the sequence we details BoAT's constituent elements, the participant roles and providing a general guidance on how the technique can be used.

A. Elements

The technique draws on two cognitive visual elements: a *Stories Box* to represent the business process that would be analysed and *Cards* to represent the flow of business process.

The *Story Box* functions as a metaphor to represent a container for the scope of the business process, a bounded context that keeps its logically unified models [28]. The story box is labelled with a short sentence that represents the process to be defined, and visible to all participants throughout the

interview. In doing so, we reinforce the focus on scope that will be explored in the interview. Taking this analogy to the agile process, the box represents a set of system features, the story to be told, and the scope of the product to be developed.

BoAT uses cards to capture information. These are classified into three categories: **Actors**, **Activities** and **Artefacts**. Regarding its handling, the front of the cards is used for immediate identification of the actor, activity or artefact; while the back is intended for relevant details that aid in the description of the respective card. Another quick identification mechanism is the use of different colours[1] for each card.

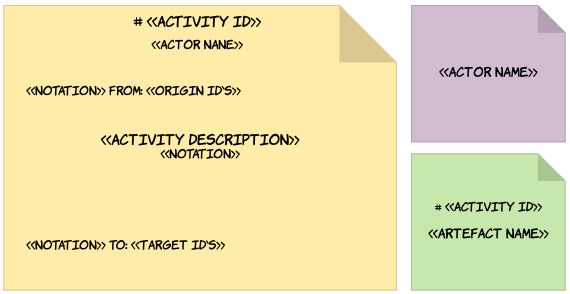

Fig. 2. Structure of BoAT cards (activity, actor and artefact).

As Figure 2 illustrates, the **Actor Card** contains a simple description for an actor that participates in the process. The **Artefact Card**, besides a description, has an field to indicate which activity originated the artefact (*Activity Id*). These cards allow the identification of elements such as data objects, annotation and other events. The **Activity Card** has fields for a unique *Activity Id*, the *Actor Name* and an *Activity Description*. In order to capture a business process sequential flow, activity cards are related to each other through the *Origin ID's* and *Target ID's* fields.

Activity cards adopt some BPMN symbols to help representing the flow of the business process. Table I illustrates the BPMN notation adopted in the *Origin ID's*, *Activity Description* and *Target Id's* fields. The *Origin ID's* field can be annotated with *start* or *end* BPMN events. A *start* event indicates the activity is catching a "signal" that triggers the execution of a new instance of the process. On the other hand, an *end* event indicates the activity is concluding the process instance and "throwing" a signal with the results of the process execution. The *Target ID's* field can be annotated with the *exclusive* or *parallel* BPMN gateways. These are used when the current activity is followed by multiple activities in the process execution flow, indicating whether the next activity is decided based on some condition (*exclusive* gateway) or are all executed in parallel (*parallel* gateway). In this case the *Origin ID's* and *Target ID's* fields may contain a list of activities. An activity can also be identified as a sub-process in its description.

[1]The colours presented here were chosen arbitrarily and should not be limiting for creativity and personalization of each team

TABLE I
SIMPLIFIED BPMN NOTATION USED IN THE ACTIVITY CARDS OF BOAT.

FIELD	NOTATION	DESCRIPTION
⟨⟨Origin id's⟩⟩		**Start event** Acts as a catching event that indicates the triggering of a process instance.
		**End event** Throwing event representing the result of a process instance.
⟨⟨Target id's⟩⟩		**Exclusive** Used to create alternative flows where only one of the paths can be taken.
		**Parallel** Used to create parallel paths without evaluating any conditions.
⟨⟨Activity description⟩⟩		**Sub-process** Used to indicate this activity is a sub-process.

Figure 3 presents an example of written *Activity*, *Actor* and *Artefact* cards. In this example, we can see that an actor named "Purchasing Analyst" (purple card) participates in an activity named "Review Order to Supplier" (yellow card). In addition, it is possible to notice that this activity produces an artefact identified as "Purchasing Capacity Report" (green card). Once the flow has been established, the cards can have their *Origin ID's* and *Target ID's* filled in. In our example, the "Review Order to Supplier" activity follows from activity #1, receiving the id #2. Given its decision nature, this activity card has received a BPMN notation indicating a unique flow that derives the process for activities #3 or #4. All of these cards are exposed and organised to represent the flow of the process, allowing all participants in the interview to intervene more actively, pointing, withdrawing, rewriting, rearranging the activities of the "virtual" process represented by the cards.

At the end of each process definition, the set of cards are removed (from the board or table) and placed in the *Story Box*, opening space for a new process to be surveyed. The interview session ends with all the cards stored in the box.

B. Roles

In applying BoAT, those involved in gathering requirements assume a pre-defined set of roles and responsibilities. The definition of these roles aims to organize the communication process and the activities related to requirements elicitation. They are: **Business specialists:** Responsible for providing information and artefacts about the operational processes that help in understanding the scope of the domain problem; **Pilot:** Responsible for conducting the interview and the annotation of the cards that describe activities; and **Co-pilot:** Responsible

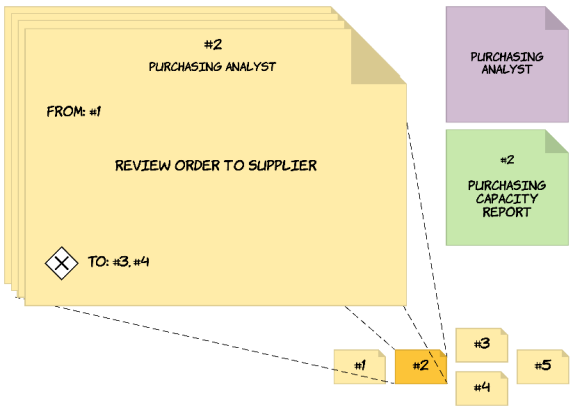

Fig. 3. BoAT cards example usage

for the annotation of cards for the description of actors and artefacts associated with an activity.

Regarding the interaction between those involved in this process, there is no established hierarchical relationship. The terms pilot and co-pilot are based on XP's peer programming technique, representing the collaborative manner that analysts supervise each other's work. In this sense, the terms pilot and co-pilot should not be understood as a mentoring relationship, but rather as two people working in a collaborative way, both responsible for the quality aspects of the artefacts produced.

C. General Application Guidance

BoAT has been designed to complement the requirements gathering process and thus does not prescribe how the created business processes are used in the development process. In the sequence we describe one possible use of BoAT, demonstrating the approach adopted by this team.

Once a BoAT interview is concluded the cards in the story box are used to create a business process diagram (BPMN model), while the annotated details are used to create an use case document. Then a rapid prototype of the business process is built and a review is requested from the business specialist through a validation interview where the produced artefacts are presented. At this point a decision is made whether to perform another iteration of the BoAT interview, or if the collected requirements are of a satisfactory quality that can be sent to the development team.

Once the business process prototype is considered as "approved" all the generated artefacts are made available and used as basis for continuing with the software development process. For example, requirements can be enriched with user stories to describe scenarios and get the user's point of view, which can then be used to create backlog items. In this sense, techniques such as BDD *Behaviour Driven Development* [29] stories and their associated GWT *Given-When-Then* format for describing acceptance criteria scenarios can be employed [30], [31].

V. Navigating the BoAT

This section reports three scenarios where BoAT technique has been applied with real clients. They constitute the three *Building, intervention and evaluation/Reflection and Learning* cycles in which BoAT went through during its development.

Before conducting the BoAT interview, a quick explanation of the elements, roles and flow of the technique is carried out for the participants. This helps to awaken the curiosity of those involved, keeping them interested in how a box and cards will help in capturing the business process.

In all three cases, the practitioners were responsible for conducting the application of BoAT and acted as participant-observers performing the intervention on their respective work environment. The researcher was not directly involved in any of the BoAT sessions, having participated in debrief sessions with the practitioners.

A. Client #1 - Brazilian governmental organ of urban transit control

1) Context: BoAT has been initially designed while the three practitioners were part of the development team of Client #1. As a public organ of urban transit control this client has a number of business processes that have been identified as target for an outsourcing project in which the practitioners were involved.

A team of three business experts have been allocated to work alongside the development team. These business experts are public servants with no knowledge of software development practices or business process management, but deep knowledge of the operational processes of the client.

The application of BoAT has been conducted by two of the practitioners (SA and SE) assuming the roles of pilot and co-pilot respectively. The practitioners have previous experiences of requirements interviews with the business experts, having conducted several traditional interviews with mixed results. In fact, their previous experience with this client was the main motivator for BoAT.

2) Application: The first business process considered was the *Impact Reports of Urban Traffic (IRUrT)*), whose purpose is to analyse traffic projects, considering the impacts of vehicles and people that a new building might bring to a region.

The practitioners carried out the collection, analysis, and validation of the IRUrT process requirements following the steps defined by BoAT: the first step was intended for the capture of the business process, exploring the BoAT cards with details of the process; in the second step BPMN diagrams and use cases were elaborated. These have then been used to create system screen prototypes, which were presented back to the business experts during the validation interview.

As a result, this first application of BoAT in the *IRUrT* process lasted approximately one hour and it was possible to identify one box with one start event, two end events, five activities, one subprocess, six actors, six artefacts and one business rule. From the BPMN diagram, five actors were identified that interact with the system through eight use cases. Eight screens were prototyped to represent the system view of the business process. After presenting the produced artefacts to the business experts, they have been considered as approved and continued in the development process.

3) Discussion: Reflecting on the first experience with BoAT we have considered that our technique has managed to successfully capture a business process and collect its requirements in a single iteration.

The total time from first interview to approval was around seven hours, including one hour for the first interview, one hour for designing the BPMN model, four hours for designing use cases and screen prototypes, and another one hour for the validation meeting. This was a very substantial result when compared with the previous experience of the practitioners with this client (without BoAT). For example, one attempt to collect requirements lasted six hours, two hours for the interview and four hours to understand the notes collected. However, the results were not satisfactory, as many business processes emerged in the discussion and there were no clear boundaries on them. The system analysts tried to focus the participants in a single process, but the participants kept drifting to activity flows and software requirements that were not relevant to the process being captured.

This first experience provided us with some valuable lessons together with feedback from the participants, which have been valuable in improving BoAT. The most noticeable thing was the increased *level of engagement of the business experts*. They felt motivated to express their view points, with the captured knowledge about the business process clearly visible and organized in a structured way.

Another lesson is related to *maintaining the focus on specific flows and domain information*. In an attempt to avoid the drift to non-related processes and information we initially adopted the practice of storing directly in the box parts of the business process that were captured in BoAT cards. In fact, this has been quickly pointed out by the participants and we noticed the need to leave the process cards visible on the table, and organizing them in the order which the activities were carried out.

BoAT has been applied in two other opportunities with this client, achieving very positive results. The lessons from our first interview were implemented in the next application of BoAT, allowing those involved to participate more actively in the dynamic, through their interaction with the cards that represent the stages of the process discussed.

B. Client #2 - Medical Cooperative Entity

1) Context: Upon learning about the first experience of BoAT, Client #2 has brought our team in to capture a *Medical Schedule Management Process* (MSMP). In this case, we have been directly involved in conducting the BoAT interview and modelling the resulting business process using BPMN, as the client's objective was to experiment with the technique and capture the business process that would then be further developed by its internal team.

Client #2 allocated four members to participate in the BoAT interview. Two business experts and two software analysts of the internal development team. The two business experts are administrative assistants, without prior knowledge about software development or business process management. The two system analysts of the internal team had knowledge in requirements engineering, but without experience with business process management.

Two of the practitioners conducted the interview in the roles of pilot (the SA) and co-pilot (the SE). We also had one of the practitioners (the BSA) act as an observer. Since the BSA was in the process of joining the practitioners team at that point he was not familiar with BoAT, thus could provide an external view of the technique in practice. It is important to mention that the observer has substantial practical experience in conducting requirements elicitation interviews and working with business process management in the context of ERP systems. The observer was given free reign on how to conduct the observation and capture the requirements.

2) Application: After a brief explanation of the BoAT approach to all participants, pilot and co-pilot started the BoAT interview.

Based on feedback from client #1 application, during this BoAT interview all cards were left on the table. This allowed those involved to interact with the stages of the process, even suggesting their re-ordering according to the real flow of the business process. All participants pointed and interacted with the cards, as they discussed the process step in question, demonstrating that the visual resources of the technique stimulate collaboration between those involved, allowing the extraction of more information about the domain problem.

The observer followed the application of the technique, capturing the details of the business process through traditional forms of interview, such as notes on sheets of paper, to allow a comparison with the artefacts produced by BoAT.

The application of BoAT for the MSMP lasted approximately one hour and it was possible to identify two boxes: **box A**, represented the *Initial Schedule Generation Process* in which we have identified one start event, two end events, nine activities, one subprocess, four actors and four artefacts; while **box B** represented the *Schedule Management Process* in which we have identified one start event, two end events, six activities, one subprocess, three actors, six artefacts and one business rule.

In the sequence we have produced the BPMN model diagrams, which have then been passed to the client's internal development team.

3) Discussion: The use of an observer provided us an outside view of the BoAT interviews. After the interview we debriefed the observer, collecting the produced artefacts and its impressions on the use of BoAT. According to him while the business process was being explained the conversation evolved and new process elements emerged, it became increasingly difficult to note such details in an organized fashion. Often it was necessary to discard bits of wrong notes or that changed after explanations. In the end, his results were two pages of unstructured annotations. The overall impression of the observer over its own notes was a feeling of uncertainty regarding the modelled process, as it was not clear whether all activities were actually captured and the defined flow was correct. Comparing BoAT cards arranged on the table with the

external observer recorded set of notes, it was clear that BoAT provides concrete and manageable elements for the capture and modelling of business processes.

It is important to mention that the observer was not actively involved in the interview and this might have affected the quality of its produced artefacts as he was not able to pursue follow-up questions, which would have happened in a traditional interview. In fact, this can not be seen as a proper comparison between BoAT and traditional interview techniques, but as initial impressions of an observer for one session of BoAT interview.

The main learning aspect from this experience relates to the *roles of pilot and co-pilot*. The observer noticed that the scope of the process had ended, that is, the current process was finalized and a new process began to be discussed. Being highly involved in identifying the activities and their flows, the pilot did not notice the end of the process, registering more activities than were necessary for the context in question. The observer suggested that this assignment should be allocated to the co-pilot, since it has a lower workload.

We have also obtained feedback from Client #2 after the production of the modelling artefacts. Overall the client was very satisfied with the application of BoAT. The speed and objectivity with which the process was captured allowed the meeting to be efficient in relation to the *participants' focus, understanding of the business flow and the set of clear information that was recorded*. The client conducted other BoAT sessions to detail the subprocesses identified in this case, and intent to adopt BoAT as default method in their project.

This case demonstrates that the technique was efficient in keeping domain experts focused on the business process discussed, with a high level of involvement and interaction.

C. Client #3 - Franchising Company

1) Context: Similar to client #2, this client approached us after learning about BoAT experience with client #1. Client #3 development team started to suspect that traditional interviewing techniques were generating models that did not reflect the operational reality. Thus, they approached the practitioners with the objective of capturing an existing business process, whilst the development of the solution would be conducted by their internal IT team.

The client allocated five people to participate in the BoAT interview. All of them performed the role of business experts and have previous experience of participating in process elicitation interviews. Three were domain specialists with knowledge of the client operations, while the other two were members of their development team: one software developer and one system analyst.

The practitioners adopted the role of pilot and co-pilot, conducting the interview while taking onboard the experiences with client #2. This was the first time that the BSA was actively involved in applying BoAT, having previously seated as observer.

2) Application: In this session the participants have been seated on the same side of a large table, and the cards arranged in a way that everyone had the same vision, observing the flow of the process from left to right. After the explanation of BoAT by the pilot and co-pilot, we reserved 10 minutes for the participants to speak freely about the process to be discussed, eliminating the initial timidity in the presentation of ideas.

In the sequence, the participants quickly quoted several actions, requiring the pilot to moderate the pace of the conversation, trying to stay focused on the activity identified. As the activities were recorded on the cards, it was noticed that the participants quickly identified, pointed and interacted with related activities.

As a result, the BoAT interview in *Invoice Entry* lasted approximately one hour, having identified one box, five start events, two end events, seven activities, seven subprocesses, seven actors, five artefacts and one business rule. In the second step the BPMN model of the business process has been produced and delivered to the company. Other BoAT sessions have been performed by client #3 to detail the seven subprocesses identified in this application.

3) Discussion: After application of BoAT we have received very positive feedback from client #3. This is very relevant to us as it was the first time we received feedback from people with previous experience in the identification of business processes. It was with this client that we have identified the *need for a visual element to represent the decision or parallelism points* on the table, improving the visual reference for participants.

In fact, after the BoAT interview we learned that this client had previously conducted process capture interviews for the same process in which BoAT has been applied to. Based on the information provided by them, these interviews left business experts free to present their own point of view about the process under discussion, generating doubts about which flow was really compatible with the real process. BoAT provided a collaborative environment for discussion, with a *structured set of elements and an explicit flow between activities*. Participants reported that BoAT allowed an explicit visualisation of the process, in contract to the traditional method of interview used previously by the company to capture business processes.

The feedback provided by client #3 indeed demonstrates that BoAT provides a concrete way to involve and stimulate the participants, facilitating the capture of business process. While their previous experience and knowledge raises questions about BoAT effectiveness, it provides us a first opportunity to compare the artefacts obtained with BoAT with artefacts generated by traditional interview techniques. We started by looking at the business process models for this client. Figure 4 presents the BPMN model obtained through BoAT interview, while Figure 5 presents the BPMN model obtained through traditional interview techniques. It is important to mention that this is not a formal comparison between the BPMN models (.e.g, [32]), but used to guide a discussion with members of client #3 in order to get some feedback about BoAT. Nevertheless, according to them, the BPMN model captured with BoAT indeed presents a more realistic representation of the same business process.

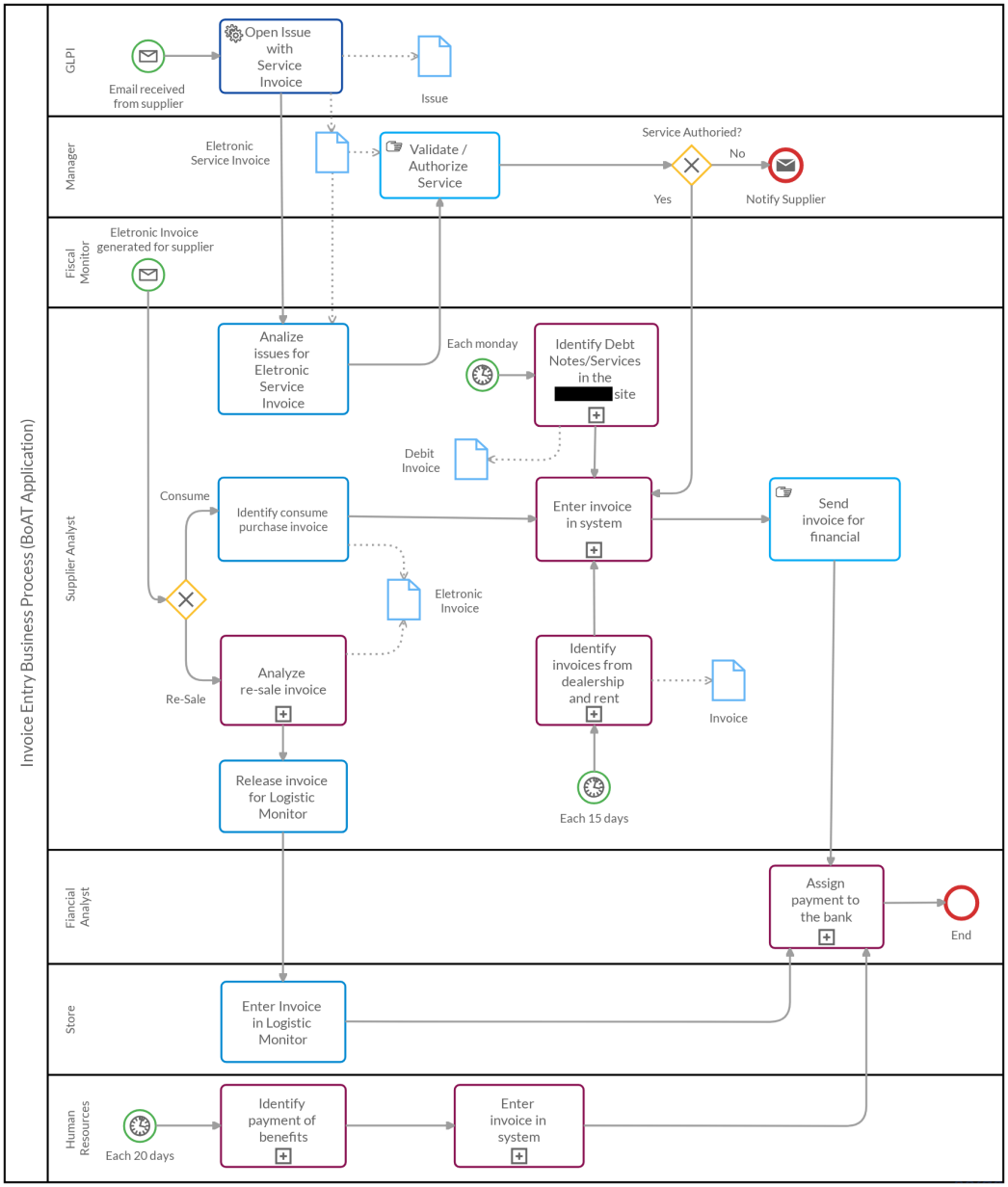

Fig. 4. BPMN model of case study #3 extracted through BoAT interview.

A summary of the number of elements in both BPMN models is presented in Table II. In both approaches business specialists have been interviewed only once. BoAT provided the opportunity of reflecting on the activities of a process, and while the number of activities identified with traditional techniques (17) is greater than the number of activities identified by BoAT (7), BoAT was able to perceive the existence of seven sub-processes. After discussion with the client we attribute this difference to the omission of domain information that is considered obvious for interviewees. The same can be said about the different in the number of actors. BoAT was able to clearly identify important roles in the business process that went under the radar when using the traditional technique previously adopted. Finally, BoAT was able to identify one business rule while their attempt identified three business rules.

Several activities identified with BoAT did not appear in the main process elaborated by the company's business analysts. Additionally, some system actions have been recorded as business process activities. This indicates a tendency of traditional techniques to lose information during the interviews and to capture the view of the system instead the view of the process, reinforcing the idea that business processes modelled after establishment of requirements may not mirror the organization's operational reality.

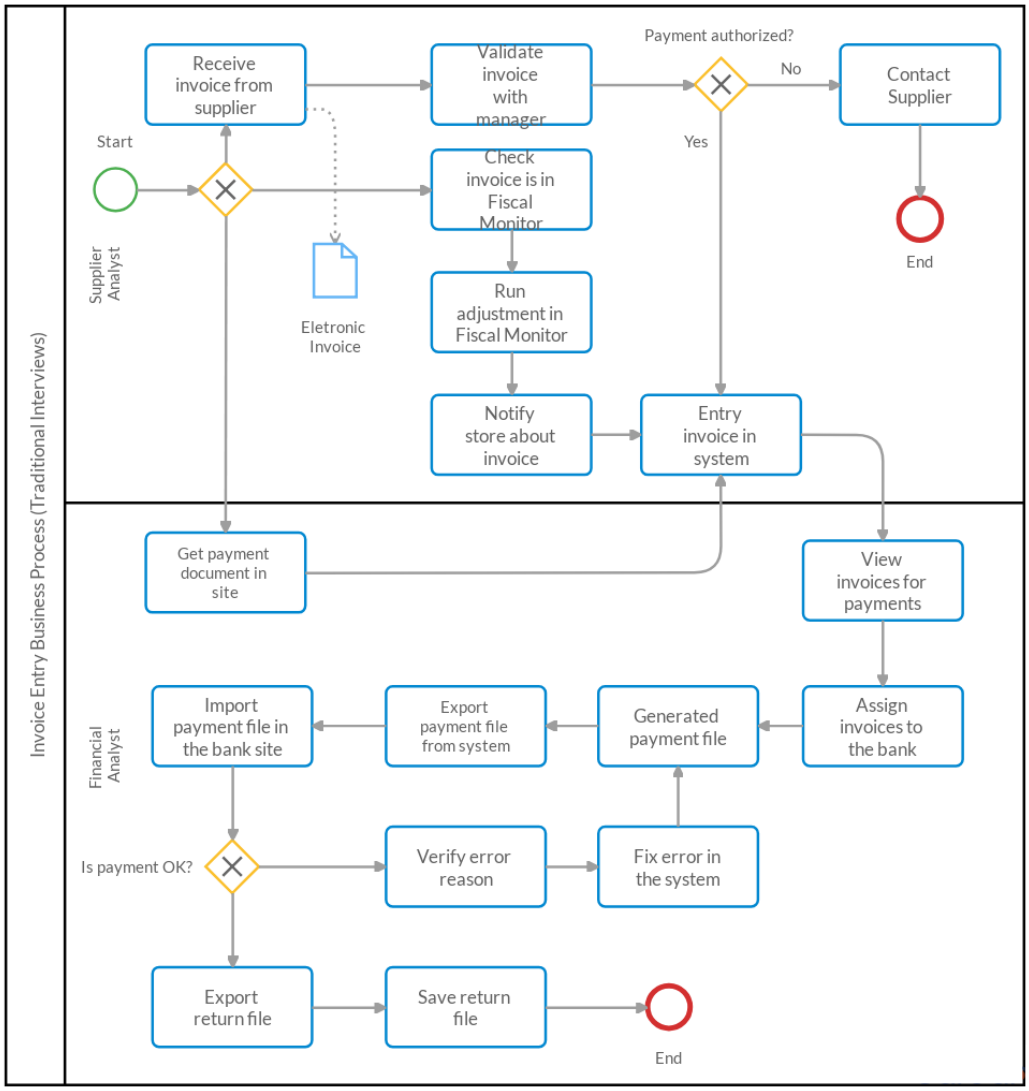

Fig. 5. BPMN model of case study #3 obtained through traditional interviews.

TABLE II
NUMBER OF ELEMENTS IDENTIFIED IN THE BUSINESS PROCESS OF CLIENT #3 WITH AND WITHOUT BOAT.

Technique	Traditional Interviews	BoAT
#Iterations	1	1
#Start Event	1	5
#End Event	2	2
#Activites	17	7
#Sub-Process	0	7
#Actors	2	7
#artefacts	1	5
#B. Rules	3	1

VI. DELIVERING THE BOAT

This section presents a discussion over the three clients, followed by a brief description of the lessons learned and then discuss some limitations and threats to validity.

A. *Reflection on clients*

We have reported the application of BoAT in three different clients. Client #1 is a public organisation while the other two clients are private entities in the domains of healthcare and retail/franchising, respectively. This was not planned at the beginning of the project, and only happened by initiative of clients #2 and #3. A summary of the main characteristics of these three clients is presented in Table III. Reflecting on the clients we had the opportunity to apply the technique involving participants with varied levels of knowledge and experience with requirements elicitation and business process management.

Another interesting aspect was the fact that the most knowledgeable client (client #3) was only involved in the last cycle,

TABLE III
SUMMARY OF MAIN CHARACTERISTICS OF THE THREE CLIENTS AND RESULTS FOR BOAT APPLICATION.

	Client #1	**Client #2**	**Client #3**
Domain	Government	Healthcare	Franchising
BPM experience	no	no	yes
#Part. dev/total	0/3	2/4	2/5
BoAT team	Internal	External	External
#Processes	1	2	1
#Start event	1	2	5
#End event	2	4	2
#Activities	5	15	7
#sub-proc	1	2	7
#Actors	6	7	7
#Artefacts	6	10	5
#B.Rules	1	1	1

thus the lessons learned at the first applications were not biased by the perception of experienced participants. This indicates that the technique can be applied with business experts without prior knowledge of business processes, although pilot and co-pilot must have some knowledge in order to guide the technique application. Due to this we are not able to establish whether the client domain has any impact in the results obtained. In fact, the different clients all contributed to BoAT construction by being involved in different stages.

Table III also summarised the number of elements identified in each process modelled for all three clients. While this is not an indication for the quality of one process over the other, it gives an idea of the magnitude of the business processes involved. It also provides some insights over the impact of participant experience in the approach, in which the most experienced participants produced business processes with more elements and complexity. In fact, client #3 raised the point that BoAT captured an elevated amount of elements as a worrying aspect, although in a more structured way than their previous practices. This was quickly overcome when the produced artefacts were presented in the validation meeting.

In general, BoAT was well received by all participants, with and without experience of business processes. In all clients there was a perception of greater focus in the discussion about the process.

B. Lessons Learned

In a more general sense, and limited by the low number of applications, BoAT helps in dealing with the different issues identified in the introduction. Some of the lessons learned in this process are presented below.

Higher engagement by adopting a cognitive approach: BoAT brings a visual representation of the business process with noticeable increase in participants engagement during the interview, effectively improving the communication with interested parties, in contrast with the previous interviews with business specialists. Practitioners and interviewees themselves were very surprised with the change of behaviour brought about by BoAT. Another lesson related to improving engagement was the need of some sort of "ice-breaking" activity at the beginning of the interview, but that is still relevant to the business process being captured.

Standardization of artefacts: By adopting cards together with a sub-set of BPMN, BoAT provides a structured way of recording requirements with a high level of details. This helped the interviewees to interact better with the elements of the process, while eliminating the problem of implicit knowledge. The cards were placed on the table providing an overview of the process being discussed to all participants, although we noticed a few issues with the positioning of the participants around the table, which meant some of them would be looking at the process upside-down.

Business-driven interviews: BoAT reinforces the adoption of the business process as the main focus for conducting the interview, with the box providing a clear boundary to the process at hand. Participants reported that being able to visualise all steps of the process allowed them to clearly identify the scope under consideration. This also contributed to the identification of sub-processes.

Pre-defined roles and responsibilities: BoAT encourages the adoption of roles, Pilot and Co-pilot, by analysts. Given that each of these roles assumes specific responsibilities during the interview, this causes each analyst to focus on the set of elements of his or her responsibility, preventing loss of information.

C. Limitation and Threats to Validity

Although we have obtained very positive feedback from the three clients, it is necessary to perform a thorough evaluation of BoAT with its application with different teams. In particular, it is necessary to investigate how much impact previous knowledge and experience of participants influence in the business processes obtained. The business experts from client #1 were already involved with the development team, having participated of previous "traditional" interviews, while client #3 had previous experience of designing business processes. This raises the question of whether BoAT has indeed improved the business process elicitation or if our impression of improvement was not caused by the prior knowledge these business experts gained through those previous interactions. BoAT, and the practitioners experience with it, was evolving as we engaged with the three clients. In fact, some aspects of BoAT have been incorporated based on feedback of client #3.

Another aspect that we could not explore is the impact of BoAT on the full software development life-cycle. Although BoAT-based artefacts and software have been developed by client #1, we don't have information about the extent in which it has been developed by clients #2 and #3, nor how it compares to their previous developed software.

We also noticed that BoAT was not able to capture many business rules. This is verified in case #3, where the number of identified business rules (Table II) using traditional interview techniques (3) was greater than the number of rules captured by BoAT (1). This is because the focus during the application

of BoAT is to identify what is *executed*, what the *execution sequence* is and *who* does it. Business rules eventually appears during the interview, but analysts are focused on understanding what activities are involved and what is the process flow. We understand that trying to capture all details about a business process in a single iteration can extend the interview time, change the focus of the participants and compromise the final results.

VII. Related Work

There is a movement today to bring agility to the business process management discipline. Badakshshan et al. [33] conducted a systematic literature review on the topic providing a framework for integrating different agile practices into the BPM discipline. However, different from BoAT, this movement is concerned with bringing agility as the means for dealing with changes in business processes.

Curcio et al. [4] conducted a systematic literature review in the topics of requirements engineering in agile. They have identified a gap in the requirements elicitation phase, with only two works mentioning the use of business processes to help in the elicitation phases of agile software projects. Unger et al. [34] conducted a systematic literature review identifying how business process models can be used to inform the development of enterprise information systems, evidencing the importance of such models early in the software development process. They have also identified a number of works that employ BPMN to formalise software requirements. The main problem with these approaches (e.g., [10], [11], [9]) is that they do not consider how the business process has been obtained or assume that business process models already exists.

Closer to BoAT, others works show approaches to business process modelling as part of the requirements elicitation phase. Lai et al. [8] propose an approach for acquisition and refinement of requirements, creating business process models as formal representation during requirements elicitation. It combines collaborative and communication methods, among them: group narrative, dialogue game and narrative network model. Carvalho, et al. [5] presents a method of defining requirements oriented to business processes, also contemplating the analysis, identification of problems and redesign of the processes. However, those methods are *"heavy"*, as recognised by the authors, and part of a larger macro-process, requiring additional time and knowledge to execute.

Some works are closer to BoAT in regards to the use of visual aides. Grosskopf, et al. [27] proposes the use of a visual toolkit and methodology to engage domain experts, exploring BPMN shape objects that will be used by participants to model the business process. The methodology requires participants to know BPMN elements minimally. In BoAT, the task of creating and organizing the process is executed by the pilot and co-pilot, leaving stakeholders free to focus on the details of their activities without requiring additional knowledge about the BPMN.

Another similar work explores an adapted version of CUTA *(Collaborative User's Task Analysis)* as an alternative approach to identify business processes [35]. This has evolved into the CUTA4BPM [36] where different semi-structured cards are used to capture details about business process activities and control flow. Although the cards capture a substantial amount of information, which can be confusing to participants, there is no information to represent card sequences once they have been collected, making it difficult to re-organize during the interviews and modelling business process. A metamodel and prototype graphical editor has been proposed in order to support automatic transformation of cards into BPMN models [37] through the use of model-driven engineering [38] techniques. However, there is no information about the state and use of such software as the different applications of the approach all focused on the card-based aspect.

VIII. Conclusion

This paper presented BoAT (Box Analogy Technique), a method based on agile practices for process modelling through a cognitive-visual analogy focused on business view. BoAT has been developed from a problem faced by practitioners in their day-to-day following an approach based on the Action-Design Research (ADR) methodology. We reported the application of BoAT in three different clients involving public and private organizations of a Brazilian state capital, showing how ADR can contribute to the development of software methodologies.

BoAT has demonstrated itself as a facilitator improving the perception of the processes and allowing system analysts themselves to model the business process along with stakeholders. One of the case studies allowed us to perform an initial comparison between artefacts created with BoAT against models created using traditional interviews.

BoAT is being used by other development teams, and although we observed good practical results with the application of BoAT, these applications are not being closely monitored by us. Feedback received from these teams indicated a higher perceived quality of the artefacts produced with BoAT, but no formal rigorous comparison has been performed with those applications.

As future work we identify the need for a rigorous comparison of BoAT against traditional interview techniques for requirements elicitation and other approaches for business process modelling, with closer observation of its application by different teams in varied scenarios. Although the technique is based on agile principles, there is nothing preventing its use in a more traditional development model. We are currently working on the creation of shapes templates as to allow the use of the technique through online collaborative tools, providing an alternative primarily for teams working remotely. In addition, we realised the need to improve the structure of the cards, facilitating the work of the pilot and co-pilot in the capture of the information during the interviews. These could in the future be used for automatic conversion of the cards into BPMN models.

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