# 'The *Clock* has *Fallen Off* the *Wall*' - Emergence of BPM-relevant Knowledge based on Cascading Stakeholder Perspectives

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**Abstract.** In this contribution, Shchedrovitsky's work on the engineering nature of managing today's enterprises is taken as input to challenge S-BPM as organizational instrument. It structures analyzing how stakeholders can utilize S-BPM's modeling capability to represent how they act in a specific situation in business operation. Stakeholders distinguish (i) technical entities, focusing on which activities need to be performed referring to tasks (establishing some functional role), (ii) communication acts identifying which entity needs to be interacted with, and (iii) the mutually adjusted encapsulation of behavior specifications, as it plays a crucial role not only for acting as a collective in a specific situation but also to complete work processes, and thus, achieve business objectives. A reference model taking into account these elements is probed. It could help stakeholders to structure their articulation process of situation-relevant activities, and successively generate context-sensitive subject-oriented process representations.

**Keywords:** Situation pragmatics, process semantics, viewpoints, behavior encapsulation, elicitation, articulation support, modeling.

## 1 Introduction

In Business Process Management (BPM) one of the most crucial tasks is to capture all relevant information that enables involved actors (human individuals or technological systems) to accomplish their tasks in a context-aware and thus, situation-sensitive way (cf. [18, 19]). In this way the actual work practice of stakeholders (rather than engineered business processes - cf. [10]) could be supported effectively, and some business advantage through adaptive process design could be achieved (cf. [12]). Shchedrovitsky [13] in his analysis on the engineering nature of organization, leadership and management of work pinpointed to conveying a specific meaning according to a situation and thus, grasping situations according to semantics (p. 42 ff):

"*What is 'meaning'? It is a tricky question. Really, there isn't any meaning. Meaning is a phantom. But here's the trick. I* can *say a sentence, like 'The clock has fallen off the wall' in two situations with two completely different meanings: 'The clock fell' and 'The clock fell.' The change of accent corresponds to two fundamentally different situations. Imagine this: when I am lecturing, I have got used to the fact that there is a*

*clock here on the wall. At some point, I turn, I see an empty space, and someone in the audience says, 'The clock fell off the wall.' They might simply have said 'it fell' because, in this instance, the word 'clock' carries no new information. I look at the clock, I have got used to it and everyone in the lecture hall has got used to it. We look at that place and someone says 'it fell off the wall', and that phrase provides new information*."

"*But now imagine a different situation. I am giving a lecture and all of a sudden there is a crash behind me. What has made it? I am told, 'The clock fell off the wall.' The situation is entirely different because what is new in this instance is the message about the clock. I heard something fall – that is a given – and I am told that it is the clock that fell. We pin this down in terms of* 'subject' *and 'predicate' in their functional relationships: in the first case, the clock is the subject, and in the second case the subject is the falling. We carry out syntactical analysis and highlight a difference between the two oppositions 'noun–adjective' and 'subject–predicate'. The distinction between subject and predicate is this: when we have a text, the subject is what we are talking about and the predicate is the characteristic that we ascribe to it. So when I hear any text, I understand it through an analysis: I work out what is the subject. Why do I work it out? I relate it to the situation".*

"*The subject might be an action. In an algorithm I always treat actions as items, to which characteristics are ascribed. So I am always doing a particular sort of work: I parse the text syntactically, identify its syntactical organisation, its predicate structure, and map this onto the situation. This is a process of scanning, of relating the text to the situation. When you understand my text now, you carry out this complex relational work. You are constantly identifying what is being talked about and what I am saying about it. This is the standard work that goes on automatically, you understand what is being said to the extent that you can find these objects and relate the text to them*."

These paragraphs reveal several insights that are not only relevant when trying to capture a situation at hand, but also when aiming to represent or modelling it. Providing information, i.e. giving meaning to perceived data, needs to be considered a context-dependent process itself. Simply by focusing on a specific part of a sentence, like shown above for 'The clock has fallen off the wall' different meanings can be conveyed, and thus, different situations and adjacent work practices could be revealed. Shchedrovitsky considers ascribing meaning to a situation as relational work. It requires an active entity identifying elements of concern (perceived) information can be assigned to.

This work reflects on S-BPM concepts [1] to describe a perceived situation from various perspectives in section 2. In section 3 snippets from Shchedrovitsky's text on organizational management are discussed. They provide triggers to rethink how developers elicit and represent work knowledge. In section 4 a model of eliciting and structuring perceptual knowledge of stakeholders in a specific situation is proposed. It has been applied in stakeholder settings. 5 persons were asked to describe how they construct meaning when 'The clock has fallen off the wall' in a classroom situation. The model could help them structuring individually perceived situational information for further acting. Key was the cascading of perspectives. It enabled them to enrich a small set of information entities successively, finally leading to a subject-oriented representation of how to handle the situation as a collective. Section 5 concludes the paper suggesting some future work on stakeholder perspectives and cascaded model structures.

# 2 S-BPM Modeling & its Information Categories

This section analyzes S-BPM in terms of its information categories provided for modeling, intended to capture the semantics of a situation, and moving to action or implementing models. The latter refers to the pragmatic aspects of a situation. They concern all practically relevant information which finally influences the pragmatic quality of a model. "Pragmatic quality is the correspondence between the model and the audience's interpretation of the model and has one goal, comprehension, meaning that the model has been understood. Means to increase pragmatic quality include not only executability, animation, and simulation but also more advanced techniques like model transformations, model filtering to present model abstractions from several viewpoints, model translation, and explanation generation" (in [8], p. 94, according to [14]). In case S-BPM should deliver models of such pragmatic quality as well as means to improve it, a closer look to its constituents and representational capabilities is required. In section 2.1, the world view created by taking the S-BPM perspective is detailed. In section 2.2, S-BPM's capabilities to represent semantic situation information are discussed, followed by those for pragmatic information in section 2.3. The final section 2.4 provides some principles of S-BPM guiding its application in development projects.

## 2.1 The World as Network of Subjects

Entering the world of S-BPM means trying to represent each observation in terms of networked active elements, termed subjects, assumed to act in parallel (cf. [1]). Since each of those actors or subjects can be described in terms of its behavior and has the capability to exchange messages, a federated choreographic ecosystem is established:

- Federation means a form or single unit, within which each actor or subject or organization keeps some internal autonomy (cf. [3]).
  - This form or single unit identifies the perceived part of world that is considered relevant to describe a specific situation. It sets up the universe of discourse or context space for representation and action.
  - Keeping some internal autonomy at some point requires to be more concrete: The 'some' is dedicated to the level of abstraction considered representative for the stakeholders or modelers, both, with respect to functional or technical activities, and interaction or communication with other subjects.
- Choreographic ecosystem refers to recognizing concurrent, however, synchronized processes and activities
  - in a community of interacting elements and their environment,
  - when considered as networked or interconnected system.

According to this perspective, ecosystems operate as autonomous, concurrent behaviors of distributed sub systems or actors. A subject is a behavioral role assumed by some entity that is capable of performing actions. The entity can be a human, a piece of software, a machine (e.g., a robot), a device (e.g., a sensor), or a combination of these, such as intelligent sensor systems (cf. [2,11]).

Since subjects represent systems with a uniform structure, they can be used to define federated systems or System-of-Systems (SoS) [9]. SoS have as essential properties 'autonomy, coherence, permanence, and organization' (ibid, p.1) and are constituted 'by many components interacting in a network structure', with most often physically and functionally heterogeneous components [16,17]. For instance, education support systems comprise social media and content management systems for learning support. SoS subjects can execute local actions that do not involve interacting with other subjects (e.g., a clock providing the time in a classroom) and communicative actions that are concerned with exchanging messages between subjects, i.e. sending and receiving messages, e.g., triggering ringing a tone. Figure 1 shows a set of federated systems or subjects, Clock, Facility Management, and Clock Producer that could be considered of relevance for 'The clock has fallen off the wall.' The directed links denote the interaction pattern for message exchange.

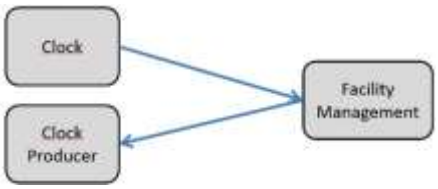


**Fig. 1.** Sample universe of discourse for 'The clock has fallen off the wall.'

## 2.2 Capturing Semantics

Any setting or situation can be structured in S-BPM as set of individual actors or systems (cf. [3,11])), such as facility devices, encoded in subject diagrams according to their communicating with each other. When these systems need to communicate directly with another system, as required in case of maintenance, a Subject-Behavior Diagram also encodes this link. It is executed during runtime (after technical implementation). On the modeling layer, the corresponding activity is a request sent to another subject. The sending subject waits until it receives an answer. Then, it processes the received answer - see Figure 2 for that pattern. The rectangles denote the messages that the systems exchange.

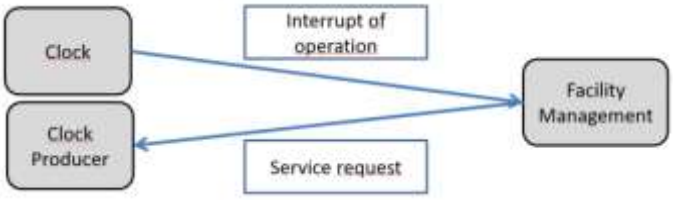


**Fig. 2.** Sample interaction pattern for 'The clock has fallen off the wall.'

Figure 2 shows a Subject Interaction Diagram (SID). SIDs provide a global view of a SoS, comprising the subjects involved and the messages they exchange. The SID contains a maintenance support process in Figure 2. It comprises several actors (subjects) involved in communication: Facility Management coordinating all maintenance activities, a Clock Producer taking care of providing a working clock, and the Clock providing scheduling support in classroom management. They exchange messages in case of operational problems as shown along the links between the subjects (rectangles).

Subject Behavior Diagrams (SBDs) provide a local view of the process from the perspective of individual actors (subjects). They include sequences of states representing local actions and communicative actions including sending messages and receiving messages. Arrows represent state transitions, with labels indicating the outcome of the preceding state (see Figure 3). The part shown in the Figure represents a service request to the Clock Producer subject from the Facility Management subject.

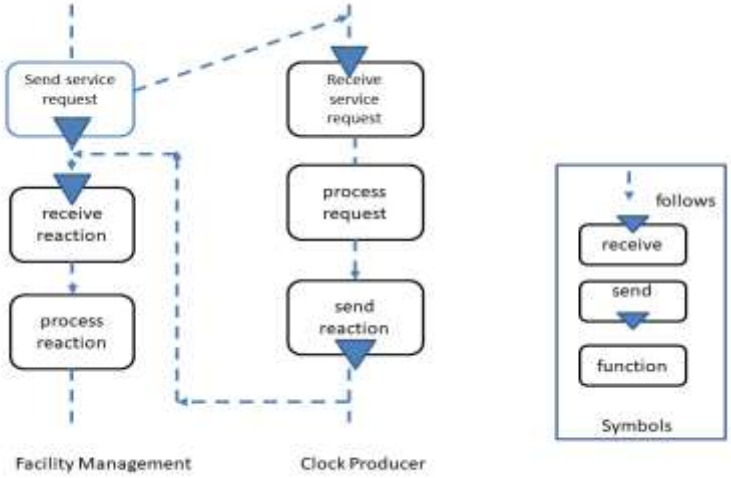


**Fig. 3.** Sample Behavior Synchronization (SBD)

Given these capabilities, representations are characterized by (i) a simple communication protocol (using SIDs for an overview) and thus, (ii) standardized behavior structures (enabled by send-receive pairs between SBDs), which (iii) scale in terms of complexity and scope.

### 2.3 Capturing Situation Pragmatics

S-BPM is designed to probe representations for operation (cf. 2,7]): Once a SBD, e.g., the Facility Management subject is instantiated, it has to be decided (i) whether a human or a digital system (organizational implementation) and (ii) which actual device is assigned to the subject, acting as technical subject carrier (technical implementation). Typical subjects are devices and their process-specific services, including smart phones, tablets, laptops, etc. Subjects can also be role carriers controlling or executing

tasks. Both types of instantiations can be supported by subject-oriented runtime engines [6]. These engines provide services linked to some ICT infrastructure. The infrastructure itself could be modeled as subject-oriented SoS (cf. [17]).

Once the runtime engine is tightly coupled to model representations, ad-hoc and domain-specific requirements can be met dynamically. The situation-sensitive formation of systems and their behavior architecture need to be validated before being executed without further transformation. Hence, stakeholders can adapt model representations and proceed to implementation according to the SoS their models are part of. In case of re-occurring patterns, e.g., for routine tasks, they could be integrated to improve the overall process performance, e.g., including the processing of complex events (cf. [2]).

### 2.4 Application Assets

When applying S-BPM to picture reality and model situations according to inherent aspects, some essentials can be identified which finally guide the utilization of semantic and pragmatic elements (i.e. related to activities) of a situation:

- *Being in the World*: Identifying a subject means bringing a self-contained entity to life - it is a behavior encapsulation of an active entity, and also subject to the 'world' (i.e. identified universe of discourse). The latter results from the fact, that a subject can be addressed (only) by other, existing subjects of the world. Consequently, being a subject *in* the world also means being subject *to* the world.
- *Subjects are social and private at the same time* - exchanging messages is interaction via send and receive pairs. Hence, subjects are open for message passing, either for being informed or for further handling and delivering a business object. However, how they process incoming messages and produce output remains encapsulated in the (internal) behavior description. In this way, subjects align individuals with communities - they allow stakeholders having a cognitive identity while behaving as a social being.
- *Subjects themselves are dynamic entities while keeping the outer structure stable* – they can change their internal behavior while remaining a stable communication partner. In this way, self-organizing communities can be represented. It increases flexibility of structures, even when changing their manifest form. New gadgets can take over new responsibilities, such as calendar, meeting, cinema proposal, or sensor systems, just to name a few, replacing or encapsulating existing behavior patterns.
- *Subjects make the world more concrete* due to their nature of being *boundary objects*. This type of objects can be communicated among stakeholders and thus, understood by people with different backgrounds. Subject representations can be read in natural language using active sentences [1]. This property ensures some understanding and allows active participation of all stakeholders, even when requiring some self-discipline of stakeholders to use active sentence and complete natural-language expressions to describe situations. It brings the approach to integrated thinking and acting, as proposed by Heidegger (see [4], p. 53).

- *The approach scales*, due to the decentralized management mechanism. It enables setting up and configuring a large number of actors or systems. The latter is of particular importance in networked settings. Thereby, subjects correspond to autonomous entities, not only being capable to implement certain task behaviors, but also to monitor the status of other elements or systems (cf. [2]). For instance, in health-critical settings such services may be a requirement.
- *Subjects are part of a choreography*. Subjects encapsulate behavior and interact with other subjects through asynchronous messaging. They may change their internal behavior while keeping their interaction interface. In this way, lifecycle activities of certain systems or elements can become part of continuous development without endangering ongoing operation (cf. [3]). Internal subject behavior can be replaced and modified, as long as the communication interface is preserved.
- *Subject-oriented representations allow for problem- and domain-specific abstraction.* This feature provides uniform addressable interfaces for resource control and management (cf. [11]).

Overall, a subject-oriented representation of any setting can come close to the 'reality' as perceived and pictured by humans, both in terms of its elements as behavioral entities including their set of activities and interactions, and in terms of its description, as natural language can directly be used conveying the content of subject-oriented representations. However, as recent field studies reveal (cf. [11]), stakeholders cannot easily apply the concepts and make effective use of their capabilities when developing socio-technical systems. In the following section, S-BPM is reframed by a management approach looking for development activities featuring the exploration of meaningful stakeholder operation and organizational structures.

## 3 Rethinking the Management of Perceived Information and Work Knowledge

Going back to the roots of expressing perceived information we could try to make use of some fundamental insights of Shchedrovitsky on context-sensitive and systemic organizational management. Mindful organizations practicing this type of management rely on stakeholders looking for meaning when perceiving situations and developing a sense-making practice of work (cf. [15]). The following look beyond technocratic engineering is made to reflect on S-BPM concepts and the ontological assumptions listed in the previous section. The analysis includes the identification of elements relevant for technical operation, such as stakeholder roles and tasks, and their alignment as required for ensuring organizational performance. The section starts with the identification of meaningful entities (section 3.1), proceeds with interactions of identified entities (section 3.2), and ends with the alignment of interactions recognizing systemic operations (sub section 3.3).

### 3.1 Identifying Meaningful Entities

When stakeholders perceive situations they start with spotting relevant elements according to their current perspective: "*Now imagine the following device. I project a ray of light from my consciousness as I compare things – first, second, third thing – all the time extracting information and drawing it to myself. And there is a little paint brush with black paint attached to this ray and every time I send out the ray the brush leaves a mark. When I jump to something else the brush leaves a mark again; when I go back it makes another mark. In this way the brush leaves a kind of grid behind it. Then we look at the grid and we say that it is* ***meaning****. So meaning is a particular structural representation – a sort of freezeframe – of the process of understanding. We can look at this another way, by asking a trick question: does movement have parts or not? I make a movement what parts can there be in it? And, generally, how can you stop it and capture it temporally? You cannot do any such thing because in order to obtain parts, you have to cut it up. But my movement isn't capable of being cut up!*

*But see what we actually do. Here is a movement. For example, something falls. It leaves a trail. Now we begin to slice this trail into sections, we get parts of the trail and we transfer it to the movement.*

*So the movement obtains parts secondarily, by transfer onto it of the parts of its trail. Otherwise, we cannot work with movements in thought. In order to cut them up, transform them, or do something else with them, we have to stop them – to represent some 'frozen' part of the movement structurally. This is how we work with any process – whether of understanding, work or something else. We divide it into stages and phases, but in order to do this we have to find and register the traces (the trail) of this process*." ([13], p.43)

The 'trail' may range from realizing the trigger event for the clock's falling off the wall to watching how the broken glass spreads over the floor in the class room. Evaluating this trail allows scoping the entire scene in terms of all relevant elements involved, e.g., the holder went off the wall, the clock fell down, and the clock fell apart when touching the floor. Hence, meaning could be action-triggered which in turn is relevant for the stakeholder in the room. Assuming that nobody got hurt through the event, for the students in the room it may be an event of low complexity, as they do not have to care about the time and are able to watch their steps when avoiding to step in the clock's broken parts. For the teacher it is a major event, as he/she needs to take care about the time and the safety of the students.

As we can see, each stakeholder constructs meaning through some role-specific glass. It may require immediate action or reaction to an event. The teacher may take action through interrupting the process of teaching, and switching to the role of caretaker of classroom safety, in case of warning the students when leaving the classroom. From the teacher's perspective, in a second step the time problem needs to be addressed, assuming classes are structured along time slots. The teacher needs to interact with somebody from the class or facility management to ensure correct timing, in case he/she relies on an external source of information w.r.t. time. Finally, the facility management needs to be informed to take care of all the damage. Hence, from a representational perspective, several entities are involved to make meaning out of a situation:

- The event itself – being an action itself (falling off the wall ending another operation namely the time ticking), or 'sliced', a set of small actions or events,
- The role – student, teacher, care taker, facility management
- Actions and interactions, such as teaching and warning the students
- Concerned objects, i.e. the clock, and the classroom

Each of these elements is constitutional to S-BPM representations. Subjects denote roles, encapsulate behavior in terms of doing, sending and receiving messages. Finally, the concerned objects are addressed in or passed through messages exchanged between subjects.

### 3.2 Conveying Meaning to Others

Situations trigger not only specific behavior, but also need to be documented and transferred to others, e.g., to guide further behavior. "*We ought to speak in such a way that those listening cannot fail to understand. How they understand is a very complex question. We all understand through the prism of our own peculiarities. And very often understanding is richer than what the* speaker *or writer of the text intended. The text always contains much that the speaker, the author of the text, did not personally put into it. This is due, first of all, to the fact that the author uses the tools of language. It is fair to say that language is always smarter than us, because all the experience of humankind is stored and accumulated in it. Language is the principal battery for storing experience. Second, the person who understands carries their own situation with them and always understands in the light of that situation, and often sees something more or something else in the text than its author*." ([13], p.44)

It could happen that communication is not documented, and very likely, reduced to technical behavior. S-BPM goes beyond that – it enforces to think in terms of communication and interaction of stakeholders or systems, as behavior specifications cannot exist without interaction. For instance, the teacher subject (i.e. a role) activates the care taker which in turn activates the facility management.

### 3.3 Individual Alignment with Others (rather than Engineering Interactions) through Goal-oriented Behavior Abstraction

In order to run an organization, it may not be sufficient to develop a chain of interactions from a single perspective. For instance, administration, technically not involved into the clock falling off the wall, needs to be activated to ensure the classroom can be utilized by students of the next class. "*Everything starts with engineers who master the principles. They do not discover what was already in nature, but create a structure, something fundamentally new something that was not there in nature. They collect the elements and create – by assembling, joining together, 'bootstrapping' – completely new things not made by nature, and in doing this they are supported by creative – bold, 'crazy' – thought. All this is bound together in a unity, which does not follow the laws of nature, discovered by science: there was nothing to 'discover' until an engineer created something.*

*The work of organisers, leaders and managers has the character of engineering work: it is structural and technical. Organisers*, *leaders or managers must always be one step ahead; they have to come up with something new*."

**"*Technical knowledge*.** *Suppose that you have to lead or manage people. You must determine their future actions, make a decision concerning their actions. As a result you have a goal in advance, and you consider this person as a means or tool to achieve this goal. This how things always are if you are an organiser, leader or manager. But people might resist, 'break loose', or act in some unforeseen way. You say one thing to them, and they – perhaps they are* creative *individuals – do something else. And you do not know whether you need to regulate their manner of execution or if you only need to set the goal. In short, each time you need to have knowledge about the individuals and their actions, but this knowledge must be oriented from the very outset to your goals. You have to achieve a certain goal through these people. And so your knowledge answers the question: how can you achieve your goal through these people, and adjust their actions and your relations with them as a function of your goals? Such knowledge is what we call technical knowledge*." ([13], p. 7f)

Shchedrovitsky, in the statement above, indicates that the matter of including or recognizing perspective can be a matter of goal setting and in this way, scoping responsibilities. "*Technical knowledge gives us the answer to a question about an object, its mechanism and its action. However, this knowledge does not have a general nature: it is specifically geared to the achievement by us of our goals. It shows how adequate the object is for achieving these goals, and what we must do with it, how we must act on it in order to achieve our goals*."

*"Technical knowledge is very complex. It is actually much harder than scientific knowledge. And the work of an engineer is actually much more difficult than the work of a scientist. The work of a practical worker is even more complex. ... Technical knowledge is not just a matter of goals, it is also about your means of influence. You are not interested in the object in itself, but in the achievement of the goal using your existing tools and methods of action. And you see this object in this context. ... Necessary and sufficient information is needed. You need to have adequate knowledge*." ([13], p.8ff)

Fig. 4 shows the scheme for individual and organizational activity alignment according to Shchedrovitsky ([13], p.11). A stakeholder needs to pursue a specific goal and to know whom to involve in which way for further operation. As we will see in the following, the goal can help identifying intentional actor performing self-contained tasks according to the perception of a situation. In addition, the means of organizing work could be subject-oriented business process modeling. These means determine, as shown in the figure, how the stakeholders operate and interact when organizing their work, based on their knowledge to accomplish tasks.

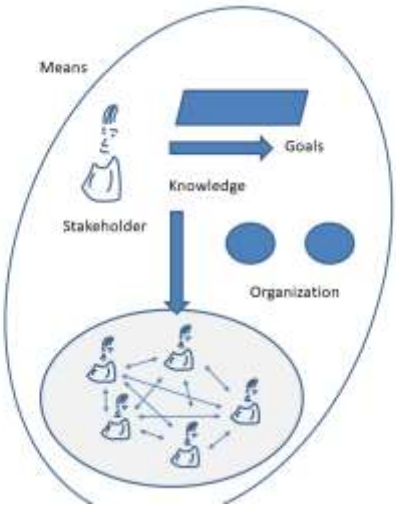


**Fig. 4.** Organizational management scheme simplified from Shchedrovitsky ([13], p.11)

# 4 Structuring Articulated Stakeholder Information

In this section, the insights of Shchedrovitsky presented above are used along the presented structure for developing a model supporting the articulation of process-relevant stakeholder work knowledge. It is introduced in section 4.1, before the report on a small field test is detailed in section 4.2. In this test, interviews were conducted with 5 stakeholders. Their perception of a situation when a clock has fallen off the wall in a classroom has been captured and structured. The interviews reveal some empirical evidence on plausibility, also in terms of utilizing subject-oriented models for representing operational work performance involving goal-oriented actors (represented by subjects).

## 4.1 Cascading Stakeholder Perspectives

The model takes into account stepwise several perspectives on a situation:

1. *technical entities* encapsulating behavior by focusing on activities that need to be performed to achieve an objective or implement an intention (usually referring to some task), and thereby, establishing some functional role
2. *communication acts* identifying which entity needs to be interacted with
3. the *mutually adjustment of encapsulated behavior specifications*, as it plays a crucial role not only for acting as a collective in a specific situation but also to complete work processes or reach intended goals

Accordingly, the model contains several perspectives helping to structure individually perceived situational information for further operation. Once started with an individual perspective, stakeholders can enrich its result with another one, and so on, thus leading

to a cascade of perspectives. Since this cascade contains behavior encapsulations and interactions, it finally allows developers creating subject-oriented process models.

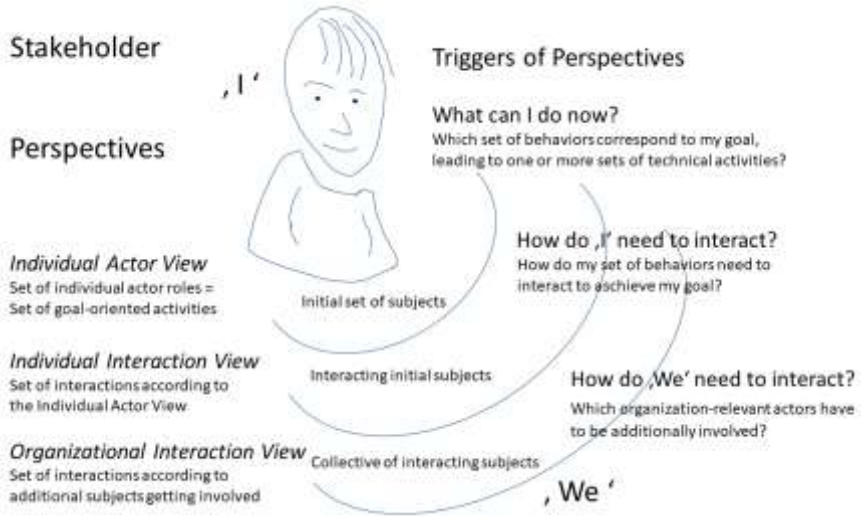


**Fig. 5.** Cascading perspectives

Fig. 5 shows the model serving as frame of reference of building organizational capacity based on individually perceived situations. It instantiates Shchedrovitzky's approach as shown Fig. 4 in terms of structuring behavior in a goal-oriented way. The left part shows the cascade of perspectives that finally captures the evidence of a specific stakeholder when perceiving and reflecting on a situation:

- ***Perspective 1 – Individual Actor View***: This perspective captures a set of individual roles in which a specific stakeholder can act and thinks about in a specific situation. For instance, assuming the clock has fallen off the wall in a classroom with a teacher and students, the teaching role of the teacher addresses all duties related to classroom teaching, whereas the safety-responsibility role of the teacher concerns the physical safety of students in the classroom. Since humans are intentional beings we can assume that each stakeholder has at least one role or objective to (inter)act that constitutes an actor view. This role or a set of roles corresponds to the individual (task) profile a person. Each role refers to a specific behavior that has a driver, namely an intention. For instance, the driver of the teaching role is increasing the level of competence of students, whereas the driver of the safety-responsibility role is ensuring the safety of all student in the classroom. Since each role has an intention, each stakeholder can pursue a set of specific goals in a situation, depending on the set of roles.
- ***Perspective 2 – Individual Interaction View***: This perspective looks on the same situation, but builds upon the results from taking perspective 1 and the identified roles. It keeps the considered role/objective/intention at the center of interest, but additionally captures a set of individual interactions based on that previously defined

intentional behavior set(s). Hence, the set of interactions also depends on the roles in which this stakeholder can act and thinks about in a specific situation. For instance, we assume the stakeholder identifies the role of the teacher (addressing all duties related to classroom teaching) and the safety-responsibility role (ensuring the physical safety of students in the classroom). Then, from this perspective, the stakeholder needs to think about interactions between these two roles. In case the teacher interrupts the class due to the clock's falling off the wall, the safety-responsibility role takes over to ensure the safety of the students in the room. It may lead to ending the class, once the teacher cannot guarantee the safety of the students in this situation, as perceived by this stakeholder. In case the safety-responsibility role does not identify safety risks, the safety-responsibility role informs the teaching role to continue teaching. In each case, the stakeholder can provide and specify a set of interactions, for sending and receiving information on a specific topic, involving relevant objects, such as safety measures.

- ***Perspective 3 – Organizational Interaction View***: This perspective analogously builds upon existing results, this time from taking the previously described perspectives 1 and 2. They already include roles and interactions, however both from an individual perspective. This perspective captures a set of roles this stakeholder perceives to be relevant for a specific situation in addition to the ones he/she can act him/herself, e.g., taking a community or network perspective. It concerns a set of roles the stakeholder having perspective 1 and 2 cannot take or has no privilege to take. For instance, assuming the clock has fallen off the wall in a classroom with a teacher and students, and has been damaging some interior, neither the teaching nor the safety-responsible role is sufficient to continue with giving a lecture in this classroom. Like from perspective 1, another individual actor view is driven by an intention. In the sample case, the goal could be to keep the classes running that are assigned to this room. Then, the interior needs to be restored, which brings in facility management. Its specific behavior needs to be coupled to the safety-responsible role, in order to accomplish the respective tasks. Finally, there may be several perspectives related to the 'We', e.g., evolving from an internal community of practice to formal department, networks, regions, and global connections.

Since each perspective builds upon a previous one, a cascade of perspectives evolves in the course of specifying work- and process-relevant information. The middle part of Fig. 5 reveals the evolving complexity according to refined and networked behavior specifications. The generation of actors and their interaction relations is based on a set of questions that trigger the definition of subjects and their interactions.

- *Initial set of subjects*: The Individual Actor View leads to a set of intentional actor roles that allow stakeholders performing goal-oriented activities. The stakeholder at hand identifies the initial set of behavior abstractions (subjects) by dealing with the question 'What can I do now?' This question targets behavior abstractions a stakeholder can name, once a goal to be achieved in this situation becomes evident. For instance, in case the clock falls off the wall of the classroom, the ultimate goal of a teacher is to ensure the students' safety before proceeding with the lecture. In order to achieve that goal, the stakeholder can perform a set of technical activities.

- *Interacting initial subjects*: The Individual Interaction View leads to a set of intentional actor roles that synchronize their behavior. The stakeholder at hand identifies all those interactions between the initial set of behavior abstractions (subjects) by dealing with the question 'How do 'I' interact?' when having identified more than one role for handlings a specific situation. For instance, in case the clock falls off the wall of the classroom, the safety-responsible interrupts the teacher to ensure the students' safety before signaling him/her to proceed with the lecture. Hence, the interactions are defined, in order to achieve the stakeholder goal determined upfront.
- *Collective of interacting subjects*: The Organizational Interaction Views leads to a set of intentional actor roles and synchronization of their behavior beyond the stakeholder at hand. This time he/she needs to answer the question 'How do 'We' need to interact?' when embedding further actor roles for handlings a specific situation. For instance, in case the clock falls off the wall of the classroom, the safety-responsible informs facility management, in case he/she cannot ensure the students' safety. Every interaction with facility management needs to be defined, in order to achieve the upfront determined stakeholder goal.

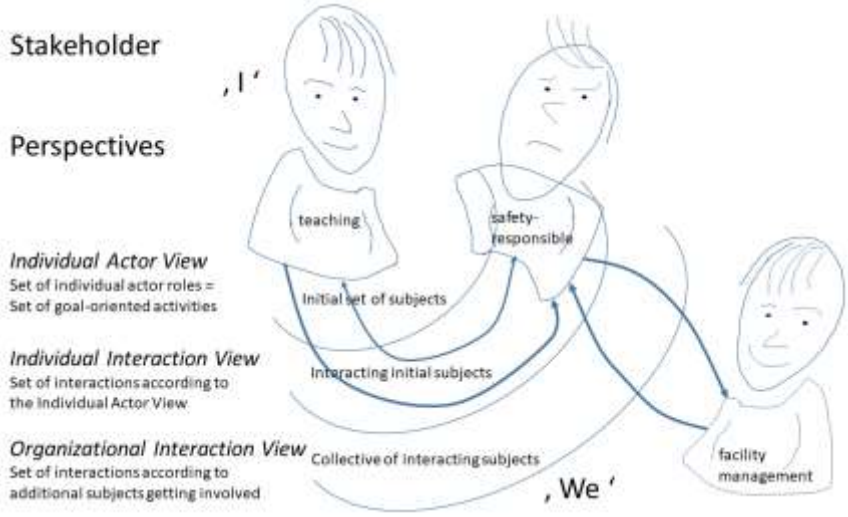


**Fig. 6.** Sample interactions across cascaded perspectives

Fig. 6 exemplifies the cascaded perspective. In this case, the stakeholder has identified 'teaching' and 'safety responsible' as role representatives for perspective 1 and 2 which need to interact sensitive to the safety of the students. For the repair of the clock and classroom restoring this stakeholder activates facility management through respective interactions.

The 'We' perspective can be extended to bring in additional stakeholders, e.g., authorities managing school infrastructures, that are contacted in case needed, e.g., by facility management to improve the interior. Hence, the number of cascaded perspectives depends on the intention and goal of the stakeholder, and results in a systemic view. On one hand, the schema allows focusing on a perceived part of a situation, while

on the other hand extending perspectives limiting contextual or systemic thinking by enabling interaction links to actor roles valid from other perspectives.

Both elements are essential, as they allow handling complex situations or events without reducing the complexity itself, but rather offering a multi-partite structure. This structure facilitates handling complexity

1. by starting with familiar, since ego-centric behavior encapsulations (roles), and then
2. stepwise enriching this set of roles by
   a. sets of interactions between ego-centric behavior encapsulations
   b. including non-familiar behavior encapsulations (roles), and
   c. coupling them through sets of interactions to all other behavior encapsulations

Hence, without pre-determining the number of perspectives and the number of modeling elements (behavior encapsulations, interactions), a stakeholder is encouraged to express his/her perception of a situation based on interacting behavior elements. These elements represent subjects as known from S-BPM allowing stakeholders to detail pragmatic information in terms of role-specific (internal) behavior in a specific situation. The latter is represented in S-BPM in SBDs. Given the interaction between the subjects, a SID and thus, a stakeholder can create a coherent model of a collective in a specific situation.

### 4.2 Snippets from the Field

This section contains a report on several field tests. They have been performed to validate the approach. The model has been probed with 5 persons, between the age 39 and 67, 3 of them females, 3 of them instructors or teachers, the others a service provider and a consultant, however both with teaching experience. 3 of the persons had leadership and organizational management experience. The guide aimed to reveal whether the cascaded perspectives can be used by stakeholders as proposed by the scheme presented in the previous section. It contained the following items:

- Consider a setting in a classroom and you are teaching a couple of students. Suddenly, you recognize the clock has fallen off the wall.
  - *Individual Actor View*: What is your first concern?
    - Which role(s) can you identify when you consider yourself acting in this situation?
    - What is your (set of) intention(s) allowing to encapsulate your behavior by the time of the event?
  - *Individual Interaction View*: What does that mean in terms of interaction and communication?
    - Briefly indicate direction and exchange of information or goods for each of the identified roles representing intentional activities.
- What are your further concerns?
  - *Individual Actor View:* Which role(s) can you take by yourself in addition to the previously identified ones?

  - *Individual Interaction View*: What does the inclusion of these role(s) mean in terms of interaction and communication?
    - Briefly indicate direction and exchange of information or goods for each of the additionally identified roles.
- *Organizational Interaction View*: Whom else do you think you should also involve in the situation and address due to the event?
  - Which further role(s) do you consider relevant to meet your objectives in that situation and should become part of handling the event?
  - What does the inclusion of these role(s) mean in terms of interaction and communication with your (existing) ones?
    - Briefly indicate direction and exchange of information or goods for each of the external roles.

The interviews lasted about 15 minutes each. They included laddering, in case some context appeared to be relevant for fully grasping some of the answers. For instance, the interview with a teacher, who also has extensive experience in managing schools, has led to the following insights – the collected information is structured according to the items of the interview guide:

- Considering the situation where the clock has fallen off the wall,
  - first concern of person A:
    - Role(s):
      - Role being responsible for safety - since the clock has fallen off the wall I need to interrupt teaching and deal with the new situation immediately.
    - Interaction and communication:
      - Look at students whether somebody is in danger. In case there is danger, I need to help.
  - further concerns of person A:
    - Ego-centric role(s): none
  - further concerns external to own role of person A:
    - Role(s):
      - Role being responsible for facility management - I need to inform about the event and whether additional action needs to be taken.
    - Interaction and communication:
      - Look at the damage and situation of students – inform facility management accordingly, e.g., to address cleaning staff, to order a new clock, to adjust schedule.

The acquired knowledge can be conveyed as depicted in Fig 7. Person A has taken the 3 perspectives as guided by the interview items, and intended by the scheme.

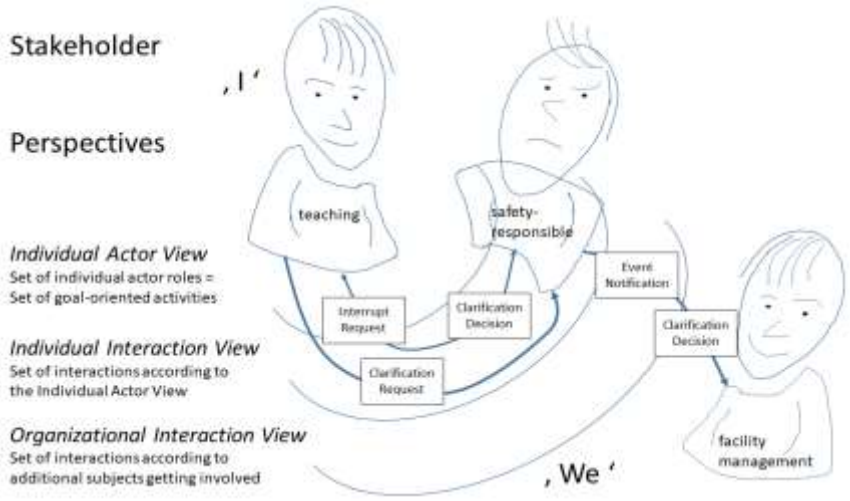


**Fig. 7.** Sample of elicited knowledge in subject-oriented representation style

Fig 7 also shows how we could enrich the cascaded representation to specify role behavior in terms of subject-oriented models. The short description person A has provided indicates a set of subjects – teaching, safety-responsible, facility management – relevant for handling that situation. Person A was able to refine the interaction and communication relationships between the subjects and assign the remaining activities to one of the roles she had identified. The refinements allow creating SIDs, as indicated in Fig. 7 by the message exchanged between the actors. The assignments allow generating SBDs, and capture sequences of activities.

In contrast to person A, person B, being a consultant, is teaching only occasionally. He identified a single actor for handling the situation. When being asked for the initial concern, it turns out he manages the situation by delegation – a student will be assigned the task to handle the unforeseen event. Person B perceives the situation as to be responsible for teaching exclusively, which excludes any other responsible action in case of disturbance. Fig. 8 shows the cascade involving ‘teaching’ and ‘student’ and the interaction representing the task delegation.

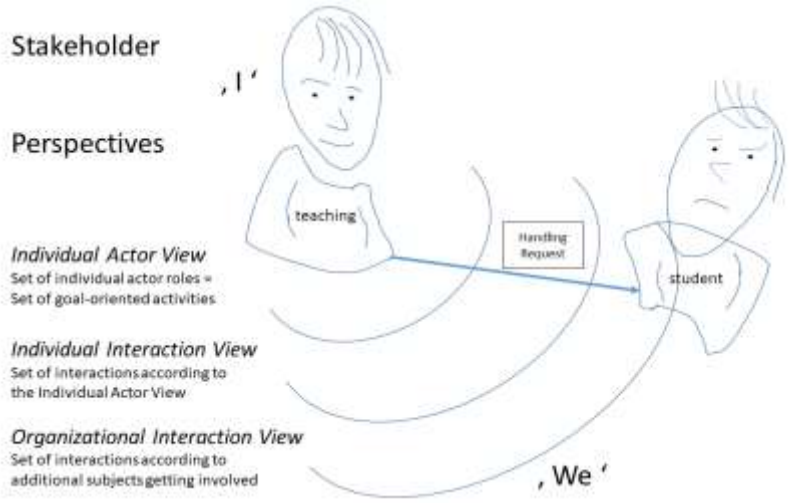


**Fig. 8.** Person's B 'management-by-delegation'

Person C considers involving responsible actors to be essential. We could term that approach another form of 'management-by-delegation', but have to acknowledge that not only a student will be involved but rather a decision-making process is instantiated by activating the head of school. Fig. 9 shows the resulting SID-like representation, the subject 'teaching' providing the 'event report' (business object) which becomes part of the event notification by the subject 'student' to the subject 'principal'.

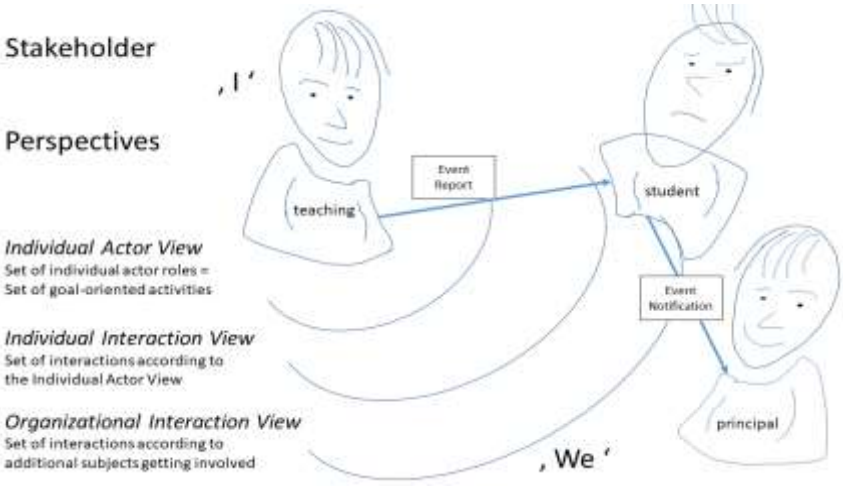


**Fig. 9.** Person C – getting responsible actors involved

These small examples indicate how situations or events can be captured by individual stakeholders giving them the freedom to cascade several perspectives as they consider relevant according to their perception, and knowledge. The last case could be valid for

all persons not trained as school teachers who have to inform responsible actors about unforeseen events immediately. It could become part of a behavior guide of the organization for handling unforeseen events to be studied by external teachers.

The snippets also indicate modeling by construction for specification (cf. [1]) as proper means to create valid models of complex systems for stakeholders. Each of the participants managed to follow the proposed sequence of steps and reflected on the resulting SID-like models in line with their perception of the addressed situation.

## 5 Conclusion

This contribution explored an orthogonal concept based on cascaded actor behavior for capturing stakeholder pragmatic perceptions of situations, comprising individual and collective perspectives. We started out with Shchedrovitsky's work on the engineering nature of managing today's enterprises which allowed challenging S-BPM as contextual organizational instrument. The results reveal its capability to represent the pragmatic qualities of business operations in a way stakeholder can articulate work knowledge. Cascading is based on technical entities identified by intentional objectives, and interaction of identified entities. It starts with familiar behavior encapsulations (roles), and proceeds with enriching this set of roles by sets of interactions between individual behavior encapsulations. The latter include non-familiar behavior encapsulations (roles), finally leading to complete business operations from a stakeholder perspective.

The empirical field tests show, without pre-determining the number of perspectives and the number of modeling elements (behavior encapsulations, interactions), stakeholders can be encouraged to express their perception of a situation based on interacting behavior elements. These elements represent subjects as known from S-BPM allowing stakeholders to detail pragmatic information in terms of role-specific (internal) behavior. The latter is represented in S-BPM in SBDs. Given the interaction between the subjects, a SID and thus, a stakeholder can create a coherent pragmatic model of a situation. Further exploration are under way, focusing on dynamically changing and complex situations, including complex event processing. Thereby, additional frameworks, e.g., stemming from work sciences will be addressed.

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