Towards a G.O.D. Organization for Organizational Self-Awareness

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Abstract. In this paper we draw on concepts from the Design and Engineering Methodology for Organizations, and also from its theoretical foundations, to discuss our notions of Organizational Self-Awareness and ontological meta model. These are deemed as central notions to understand and present, in a clear and precise manner, solutions for our main research purpose: finding concepts and methods to better handle organizational change caused by unexpected exceptions causing dysfunction in an organization's activity. Based on ontological notions like state base of a world and the ontological parallelogram, we arrive at precise definitions of what we call organizational self and its awareness. These then serve to put in perspective our proposal for the G.O.D Organization, considered to exist in every organization and being responsible for the Generation, Operationalization and Discontinuation of organization artifacts – e.g., actor role *pizza deliverer* – reflecting change of the organizational self. The main contribution of this paper is a discussion and clarification of how one can perceive an organization in a precise and thorough way, as to be able to keep a fact record of its relevant changes and, as a consequence, have a dynamic and "living model" of the organization.

Keywords: organizational engineering, organizational self-awareness, organizational change, model, meta-model.

1 Introduction

Our initial research efforts had the general purpose of understanding and clarifying what the *function perspective of an organization* should be. Normally, the function concept is associated with behavior, *activity* or operation of an organization or of a certain organizational unit like a marketing or IT department, normally responsible for the respective function [1]. In [2] we find that the function perspective means looking at a system from the point of view of the using system, in terms of provided functionality, i.e., kinds of behavior that can be caused. We regarded this to be an incomplete use of the term function. As a result of a review that we undertook on how

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this concept is used in such diverse areas as enterprise engineering, information systems, biology, sociology and philosophy, we found that, besides the aspect of *behavior*, also central to the function concept is the *normative* aspect (e.g., [3]), that is, the existence of certain normally expected values – *norms* – for certain vital properties of a system. In an organization, *deviations* from such norms imply a state of *dysfunction* that can possibly compromise its *viability*. Dysfunctions will have a *cause* which may be *expected* or *unexpected*. If the cause is expected, certain *resilience strategies* may already exist that can be activated to eliminate or circumvent dysfunctions [4], [3]. If the cause is unknown we will be in the presence of an *unexpected exception*. This unexpected exception will have to to be *handled* so that its concrete nature is detected and actions are undertaken that either eliminate or circumvent it, solving the dysfunction. The handling of unexpected exceptions constitutes another central aspect of the function perspective, namely *change* through the *(re)Generation*, *Operationalization* and *Discontinuation* of organizational artifacts which will eliminate or circumvent the determined cause of dysfunction. We consider an *organization artifact* (OA) as a construct of an organization like a business rule (e.g. "if invoice arrives, check list of expected items") or an actor role (e.g. library member). Change of OAs to handle dysfunctions is considered a special kind of dynamics that – inspired in philosophy literature on this subject – we call *microgenesis* [5]. We find that change is also driven by the detection of *opportunities of improvement* which will increase the viability of an organization and place it ahead of *competition* [6]. This is proactive change, as opposed to reactive change in the cases of resilience and microgenesis.

The focus of our research is in reactive change and on modeling the aspects of *resilience* strategies to solve known exceptions causing dysfunctions and (microgenesis) dynamics of handling unexpected exceptions also causing dysfunctions. This paper, focuses on theoretical issues underpinning our solutions for modeling resilience and microgenesis dynamics. In section 2 we develop on our main research problem and related work. Sections 3 and 4, the main contributions of this paper, present our discussion on the issues of organizational self-awareness and ontological meta model, necessary for a precise specification of our solutions. Section 5 provides a summary of or solution proposal – addressed in another report – which serves to consolidate the contributions of our discussion. Section 6 concludes with a short review of our contributions and issues raised for related work.

2 Problem, Motivation and Related Work

Above findings helped us to identify two relevant and closely interrelated more focused problems. On one hand, *a large amount of time is lost, in organizations, in the handling of unknown exceptions causing dysfunctions* as exception handling can sometimes take almost half of the total working time, and the handling of, and recovering from, exceptions is expensive [7]. On another hand, *current OE approaches seem to lack in concepts and method for a continuous update of organizational models, so that they are always up to date and available as a more useful input for the process of continuous change of organizational reality and decision on possible evolution choices*. We focus on these problems in the context of small timely changes, as opposed to large impact changes in the context of IT/IS projects, mergers,

acquisitions and splittings of organizations. It seems that the root problem for the above mentioned interrelated problems is an *absence of concepts and method for explicit capture, and management of information of exceptions and their handling, which includes the design and operationalization of OAs that solve caused dysfunctions*. Not immediately capturing this handling and the consequent resulting changes in reality and the model of reality itself, will result that, *as time passes, the organization will be less aware of itself than it should be*, when facing the need of future change due to other unexpected exceptions.

In terms of related research, the lack of awareness of organizational reality has been addressed in [8], with the coining of the term "Organizational Self-Awareness" (OSA). This construct has been further refined in [9] and [10]. OSA stresses the importance and need of continuously available, coherent, updated and updateable models of organizational reality. A recently proposed research discipline named Organizational Design and Engineering (ODE) [11], also defends this and further raises the importance of capturing and making organizational history and lessons learned available to organizational actors. OSA, and ODE claim that current OE approaches have the shortcoming of lacking in concepts and methods for a continuous update of models of organizational reality, aligned with the continuous change happening in the real terrain. However, both OSA and ODE have, for the most part, only addressed the issues of identification and formulation of this problem and, in terms of solution, mostly the aspect of representation, leaving the change aspect as future work.

This shortcoming of lack of continuous update of models aligned with the continuous change of reality has been addressed, by and large, in research and practice in the context of Workflow Management Systems (WfMS) – see, for example, [12] and [13]. However, current solutions assume that an organization will be using a WfMS, which will not be the case of many organizations. And, even in the case of organizations using WfMS, relevant activities may happen outside of IT context and we may also want to address exceptions related to them.

From our review and proposal of a broader notion of the function perspective and related insights brought from Complex Adaptive Systems (CAS) literature, we find that we may have two main types of change dynamics: *resilience* and *microgenesis.* From CAS [4] (p. 33) and philosophy [3], we find that systems maintain an internal model of the world (of themselves and the environment) so that they can activate specific resilience strategies to react, appropriately and in time, to certain known exceptions or fluctuations in critical norms that guarantee the system's viability. We also find that a system adapts with incremental changes [5], having as a main purpose to survive and evolve among competition, by having credit mechanisms which favor changes (adaptations) that increase the system's viability and constitute criteria of measuring success [4] (p. 34), [14] (p. 5). One of the premises from CAS theory is that, to solve new exceptions, "rule pieces" that constitute current resilience strategies that solve similar exceptions may be re-utilized to build new resilience strategies or new OAs to solve the new exceptions. From unexpected exception handling in WfMS [12] and insights from ODE discipline [11], we find that information on the history of organization change is an essential asset in the moments where change is again needed, i.e., in microgenesis dynamics. Modeling resilience and microgenesis dynamics and keeping a systematic history of their execution is deemed as a solution to our main research problem, so that exception handling and organization change is more

efficient and effective. Microgenesis is the main focus of our main research project. To precisely specify its dynamics we needed to also precisely specify resilience dynamics. Resilience and microgeneis have been the focus of other reports to be published elsewhere. In this paper we present a discussion on essential notions needed for a precise specification of microgenesis dynamics.

We ground our research in a particular Organizational Engineering approach, namely, the Design & Engineering Methodology for Organizations (DEMO) [2]. From several approaches to support OE being proposed, DEMO seems to be one of the most coherent, comprehensive, consistent and concise [2]. It has shown to be useful in a number of applications, from small to large scale organizations – see, for example, [15] and [16] (p. 39). Nevertheless, DEMO suffers from the shortcoming referred above. Namely, DEMO models have been mostly used to devise blueprints to serve as instruments for discussion of broader scale organizational change or development/change of IT systems [16] (p. 58) and does not, yet, provide modeling constructs and a method for a continuous update of its models as reality changes, driven by exceptions (microgenesis) nor for the continuous control (resilience) that we need to exert on organizations to guarantee viability. Contributions of our research – presented in the next sections – are heavily based in DEMO so, while proceeding, the reader which is unfamiliar with this methodology is advised to also consult [2] or [15] or other publications in: www.demo.nl.

3 Organizational Self-Awareness

3.1 Review of DEMO Concepts

We adopt the formal definition of ontological model of a world (from [17]) as: the *specification of its state space and its process space. Both are expressed in business rules*. By *state space* is understood the set of allowed or lawful states. It is specified by means of the state base and the existence laws. The *state base* is the set of fact types of which instances may exist in a state of the world. The existence laws determine the inclusion or exclusion of the coexistence of facts. We adopt also the ontological system definition from [18] (citing [19]) which concerns the construction and operation of a system. The corresponding type of model is the *white-box model*, which is a direct conceptualization of the ontological system definition presented next. Something is a system if and only if it has the next properties: (1) *composition*: a set of elements of some category (physical, biological, social, chemical etc.); (2) *environment*: a set of elements of the same category, where the composition and the environment are disjoint; (3) *structure*: a set of influencing bonds among the elements in the composition and between these and the elements in the environment; (4) *production*: the elements in the composition produce services that are delivered to the elements in the environment. From [18] we find that in the Ψ-theory based DEMO methodology, four aspect models of the complete ontological model of an organization are distinguished. The Construction Model (CM) specifies the construction of the organization: the actor roles in the composition and the environment, as well as the transaction kinds in which they are involved. The Process Model (PM) specifies the state space and the transition space of the C-world. The State Model (SM)

specifies the state space and the transition space of the P-world. The Action Model (AM) consists of the action rules that serve as guidelines for the actor roles in the composition of the organization.

We see that the definition of ontological model of [17], is extended into the more complete definition above. In [2] it is said that, from the AM one can derive all other aspect models, namely that "the AM is in a very literal sense the basis of the other aspect models since it contains all information that is (also) contained in the CM, PM, and SM; but in a different, and not so easily accessible, way". We agree that one can in fact obtain all information for the PM from the AM. But for the SM and CM this claim does not appear to be true. Many fact types and event types – part of the SM – do appear in action rules but one may not be able to consistently derive, for example, unicity and dependency laws from them. In action rules we do find reference to all transactions and P-acts and C-acts that create C-facts and P-facts. If we consider that a set of action rules constitutes and defines an actor role in the AM – just like presented in [2] – we will still be missing relevant information needed to completely obtain the CM namely: (1) which are the external actor roles (2) how internal actor roles are composed or decomposed in other (composite or simple) actor roles and (3) how all these actors interact through transactions. So it appears that, the AM is not sufficient to derive all other aspect models and completely describe an organization. Not only that happens but the AM, in the original DEMO method [2] and in the current [20], is the third one being elicited. On top of that, the only research work we found evaluating application of DEMO in projects – in a 10 year span – verified that the Action Model was not part of any project experience until then [21]. We consider that the AM is in fact an essential aspect to have a precise modeling of an organization, but probably should not be considered as the base from which all other models can be derived.

Before presenting some of our main claims, we present, in Figures 1 and 2, respectively, the meaning triangle and the ontological parallelogram, taken from [22] which explain how (individual) concepts are created in the human mind. We will also base our claims in the model triangle, taken from [2] and presented in Figure 3. We find that the model triangle coherently overlaps the meaning triangle. This happens because a set of symbols – like a set of DEMO representations (signs) that constitute a symbolic system – allows the interpretation of a set of concepts – like a set of DEMO aspect models, part of the ontological model, constituting a conceptual system. This conceptual system, in turn, consists in the conceptualization of the "real" inter-subjective organizational self, i.e., the set of OAs constituting the concrete organization system's composition structure and production. Figure 4 is an adaptation from the model triangle of Figure 3 and depicts our reasoning. We call the set of all DEMO diagrams, tables and lists used to formulate the ontological model as *ontological representation*. Now relating with the meaning triangle, we can verify that a particular sign (e.g., a transaction symbol with label membership fee payment), part of an ontological representation (e.g., actor transaction diagram) designates (i.e., allows the interpretation or is the formulation) of the respective concept of the particular transaction part of the respective ontological model (e.g., construction model). This subjective concept, in turn, refers to a concrete object of the shared inter-subjective reality of the organization's human agents (e.g., the particular OA transaction T02). Figure 5,

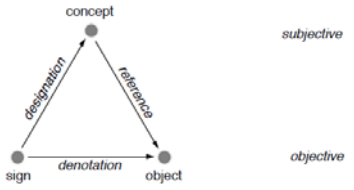

Fig. 1. The meaning triangle

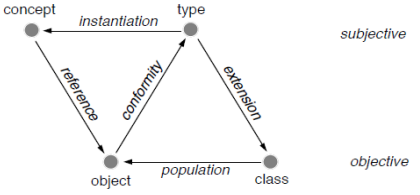

Fig. 2. The ontological parallelogram

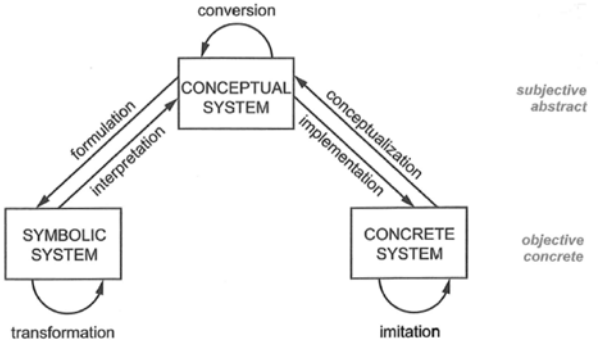

Fig. 3. The model triangle

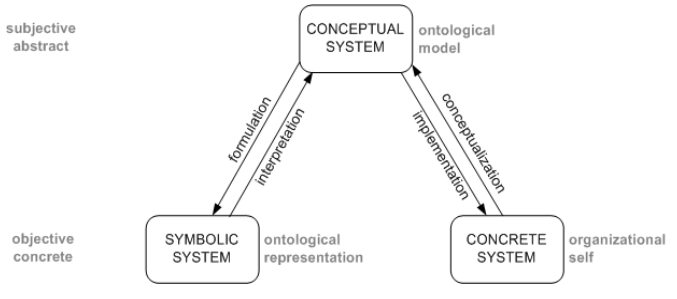

Fig. 4. Model triangle applied to organizations

an adaptation from the meaning triangle depicts this other reasoning. Another example of an OA related with T02 would be the transaction initiation OA, relating T02 with actor role registrar (also designated by A02) and formulated by a line connecting the transaction and actor role symbols of T02 and A02. Actor role registrar is, in turn, another OA of the construction space of the library. Once such role is communicated to all employees of a library, it becomes a "living" abstract object part of the shared inter-subjective reality of the library's human agents. Such object, along with other OAs of the organizational inter-subjective reality, give human agents a way to conceptualize their organizational responsibilities – in this case,

requesting membership fee payments to aspirant members. We name this set of all abstract objects living in the inter-subjective reality of an organization's members as the *organizational self*.

3.2 Devising the Notion of Organizational Self-Awareness

With the previous clarifications and preparation of scope, we now present one major claim of our research which is that *every organization should formally maintain an OAs base which is a clear and coherent specification of the organization system's composition, structure and production. These properties of an organization system can be named as organizational self. The ontological model of an organization consists in the conceptualization of the set of OAs constituting its current organizational self*. OAs are, themselves, inter-subjective concepts existing in the minds of an organization's human agents. But, following the logic of the ontological parallelogram, thoughts in one's mind and, thus, concepts, can be viewed as objects, as we can think about our own thoughts. So we consider OAs as concepts that are objects of the shared inter-subjective reality of an organization's human agents. Such OAs, in turn, specify: (1) the types of facts allowed to exist in the organization world, along with the laws restricting coexistence of facts – i.e., the *state space OAs*; (2) the types of events allowed to occur in the organization world, along with laws restricting the sequencing of occurrence of events – i.e., the *process space OAs*; (3) the action rules which are guidelines for allowed action, grouped in actor roles – i.e., what we suggest to call the *action space OAs*; and (4) the composition of the organization, in terms of allowed elementary (and/or composite) actor roles, how these are composed or decomposed in other (elementary or composite) actor roles, allowed external actor roles and allowed interactions between all such actor roles, through allowed transactions – i.e., what we suggest to call the *construction space OAs*.

An important notion that we point out in this paper is the fact that an organization – besides producing a set of products or services for its environment – also produces itself. That is, enclosed in its day-to-day operation, there will be parts of its operation which change the organization system itself, i.e., change the set of *OAs* that constitute its composition, structure and production. Another important notion is that, in parallel to this process of change, we have what we propose to call the process of *Organizational Self-Awareness* (OSA). We propose to redefine OSA as the continuous synchronization of the "real" organization system – i.e., the "real" and concrete organizational self – with its ontological model – i.e., the conceptual organizational self – and its ontological representation – i.e., a symbolic system which is a formulation of the conceptual organizational self. We can see that communication, the used symbolic system and rules for arranging the OAs play a major role in OSA. Because both the organizational self and its ontological model live in the minds of an organization's human agents and each individual subjective images may differ or be incoherent, a strong effort must be in place to synchronize all minds for the most coherent possible specification of the organizational self.

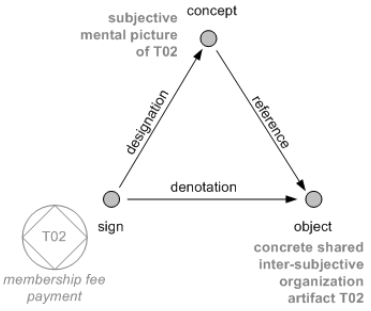

Fig. 5. Meaning triangle applied to a transaction OA

One cannot change what one is not aware of and, because organizational reality is constantly changing, following the tenets of OSA and ODE: if one wants to change the organization in a controlled and precise manner, it is helpful that one (1) has an ontological model of the organizational self and and respective ontological representation as most updated and coherent as possible, as well as (2) keeps a record of the change history of the organizational self. This means that, also enclosed in the day-to-day operation of an organization, there will be parts of its operation which change the organizational self. By formally and explicitly specifying these change acts one keeps a definite and updated record of produced OAs. Such a record – the OAs base – constitutes the means for one to always be able to conceptualize the most current and updated ontological model of the organizational self. This leads to another important claim of this paper which is: *the continuous production of the organizational self should include the synchronized production of the collective and subjective "picture" (awareness) of the organizational self – the conceptualization that constitutes its ontological model – by the synchronized production of the respective symbolic system – an ontological representation that allows the interpretation of the ontological model and the conceptualization (awareness) of the organizational self.*

Awareness means to be aware of the present and have memory of the past and how it shaped the present. Human consciousness is constantly aware of its actions and how they change reality, because reality and actions that are also part of reality, are constantly reflected in its consciousness and memorized. In a similar manner, organizational awareness of an organization O is realized by O constantly "reflecting" and "memorizing" all kinds of relevant acts that change relevant organizational reality, along with the "as-was" and "as-is" states of O's self. To separate concerns, we propose that such acts are performed by a (sub-)organization considered to exist in every organization that we call: G.O.D. Organization (GO). The GO's production world will contain the current state of O's self as well as its relevant state change history. The GO has the role of continuously realizing and capturing changes of organizational reality. Thus, by implementing the GO pattern in a real organization, in an appropriate manner, providing automatic generation of ontological representations derived from the OAs base, one can achieve Organizational Self-Awareness. This is possible because one can implement clear rules that, based on the arrangement of OAs of the organizational self, automatically produce the appropriate ontological

representation which, in turn, allows the appropriate interpretation of the ontological model that is the correct conceptualization of the organizational self. In other words, as another step of devising a solution to our research problem, we claim that *every organization has a G.O.D. Organization (GO) responsible for its microgenesis dynamics and the GO's world state base includes a record of the set of OAs that constitute the organizational self as well a record of its state transitions, up to its most current state, i.e., the set of all facts of Generation, Operationalization and/or Discontinuation of each OA.*

We adopt the formal definition of a world, presented in [17], where B is the set of facts that constitute the state base of a world, and S the set of facts that are current, specifying the current state of the world where $S \subset B$. Therefore, we will refer to the set of facts of the GO that constitute the state base of the organizational self (OS) as GB and to the subset of facts that constitute the current state of the OS as GS where $GS \subset GB$. In other words, every organization has a set GS which constitutes the specification of the OS's current state and a set GB which constitutes the full history of the OS, including its current state. In [2] it is considered that the notion of system state is ambiguous, because changes in the composition or structure of a system may also be considered as state changes. Current notions of coordination and production worlds of an organization O provided in DEMO do not address the issue of changes in the state of the composition and structure and production of the organization system. They only addresses changes in the state of its operation. These worlds focus on what O produces to its environment and coordination dynamics that occur for such production. Following our above claims, this ambiguity issue is solved by modeling state changes of the organization system as state transitions occurring in the production world of the GO, reflecting the Generation, Operationalization and Discontinuation of OAs of O. In other words, the world of O keeps a fact record of its "normal" production and the world of GO keeps a fact record of the production of O's self.

For a precise formulation of our proposal of the G.O.D. organization we needed to address the notion of ontological meta-model, presented next.

4 Ontological Meta Model

OAs constituting the organizational self are arranged in a certain manner as to specify all the spaces (state, process, action and structure) of an organization's world, i.e., they have to obey certain rules of arrangement between them. We will call the specification of these rules as the *ontological meta model*. The ontological meta-model is the conceptualization of the *OA space*. By OA space we understand the set of allowed OAs. It is specified by the *OA base* and *OA laws*. The *OA base* is the set of *OA kinds* of which instances, called *OAs*, may occur in the state base (set GB) of the GO's world. The *OA laws* determine the inclusion or exclusion of the coexistence of OAs.

The definition of the OA space is quite similar to the definition of state space of an organization's production world – specified in World Ontology Specification Language (WOSL) [22] – and, thus, it is appropriate to use WOSL to express the ontological meta-model in, what we propose to call: the *Organization Space Diagram* (OSD). DEMO's OSD is currently called as the *DEMO Meta Model* (DMM), the

chosen name for the specification provided in [23] and consisting, in practice, in the OSD corresponding to the four DEMO aspect models: SM, CM, PM and AM. They are called, respectively: *Meta State Model*, *Meta Construction Model*, *Meta Process Model* and *Meta Action Model*. We argue that, also respectively, *State Organization Space Diagram*, *Construction Organization Space Diagram*, *Process Organization Space Diagram* and *Action Organization Space Diagram* would be more coherent names. We argue this, because each of these are specifying, in WOSL, what we call the OA space of each of DEMO's aspect models. That is, these diagrams formulate, for each aspect model, the OA kinds out of which instances – OAs – can occur in the organizational self and coexistence rules governing how to arrange these instances. Another reason we propose to use the expression Organization Space Diagram is because we're in fact looking at a Space Diagram which, following the model triangle [2], is a symbolic system which is a formulation of the conceptual system of the ontological meta model. So, for coherency reasons, one should not use terms "Meta" and "Model" to name those figures but use, instead, the term Organization Space Diagram. The OSD allows the interpretation, in one's mind, of the ontological meta model. The complete set of organization artifact kinds and laws governing the arrangement of their instances constitutes the organization space. The conceptualization of the organization space consists in the ontological meta model which, in turn, is formulated in what we call the Organization Space Diagram. A depiction of this reasoning is present in Figure 6, another adaptation from the model triangle.

For a particular organization, each of its aspect models consists in the conceptualization of organization artifacts, instances of organization artifact kinds of their respective organization space. Following the adopted philosophical stances for an ontology and the logic of the ontological parallelogram, each aspect model is a set of concepts that refer to "real" organization artifacts. We remind that these artifacts, although being abstract objects, are objects of the inter-subjective reality of the organization's human agents. A certain organization artifact will be a member of an organization artifact class. Continuing our example of the previous section, organization artifact T02 is a member of class TRANSACTION KIND which is a particular organization artifact kind, also living in the inter-subjective reality (but objective in terms of the ontological parallelogram). Class TRANSACTION KIND is an *extension* of the subjective and generic type transaction kind, from which the concept of membership fee payment is an *instance*. Figure 7 depicts this last reasoning and example.

Summarizing, the ontological model of an organization is the set of all concepts that *refer* to the "real" inter-subjective organization artifacts that constitute the "real" inter-subjective organization, i.e., the organizational self. The ontological meta model applies to every organization and is the set of all types that refer to the "real" inter-subjective organization artifact kinds and constitute the "real" inter-subjective *organization space*. All DEMO representations (sets of symbols/signs) are a way to *formulate* the set of concepts that constitute the conceptual system that the ontological model of an organization is. They *denote* the set of organization artifacts that constitute the organizational self. The DEMO OSD is a way to formulate the set of generic types that constitute the organization space.

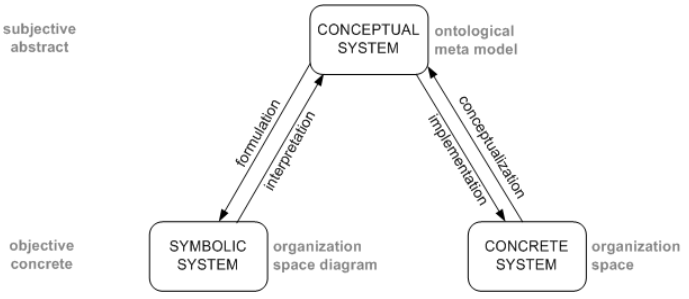

Fig. 6. Model triangle applied to the organization space

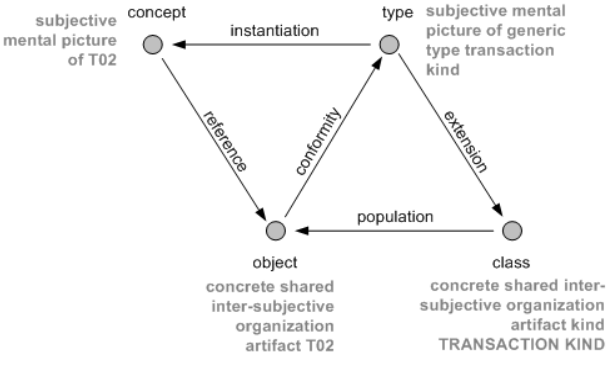

Fig. 7. Ontological parallelogram applied to a transaction organization artifact

An organization's action manifests by its agents following a certain order specified in the organizational self and these same agents constantly change the shape of this same self, as needed, continuously generating, operationalizing and discontinuing organization artifacts that conform with certain types part of the conceptual system that is the ontological meta model. The main business of the G.O.D. Organization of a particular organization O is to formally manage the life cycle of all relevant inter-subjective organization artifacts of O that constitute its self and are instances of organization artifact kinds. Organization artifacts specify the previously mentioned *state space*, *structure space*, *process space* and *action space* of O, shaping, in turn, the operation of O.

The G.O.D. organization is addressed in detail in another report but, in the next section, we present an overview of it, which serves to consolidate our above discussion of notions of organizational self-awareness and ontological meta model.

5 G.O.D. Organization Overview

Figure 8 presents, on the top, the formulation of part of the ontological meta model in the shape of part of the Construction OSD and of the State OSD. On the bottom left we find the formulation of part of the ontological model of the library, namely part of

its Organization Construction Diagram (OCD) and of its State Space Diagram (SSD). Organization artifacts represented in these two diagrams are instances of their respective kinds represented on the respective OSD. On the bottom right we find the formulation of part of the G.O.D. Organization's ontological model, i.e., part of the G.O.D. Organization's OCD and SSD. In the Library's SSD we find a fact type – that we can identify by name FT01 – expressed in the following predicative sentence, also depicted in Figure 8: *copies of [book] are delivered in [shipment]*. To express fact instances and fact types, we're adopting the notation used in the current version (3) of DEMO [20] which makes diagrams much more readable. FT01 itself is an OA (a fact type) of the state space of the library's SM, constituting part of the library's organizational self. FT01 allows the specification of fact instances describing which book instances of external object class BOOK are delivered in a certain instance of SHIPMENT.

Following our claim presented above, although, from the perspective of the ontological model, FT01 belongs to the type level, it happens that, from the point of view of the GO – responsible for change dynamics – FT01 is looked upon as a fact – a particular OA – instance of a certain fact type (from the meta model, thus, a meta type) – which is a particular OA kind. In our example, FT01 is a fact type of the library,

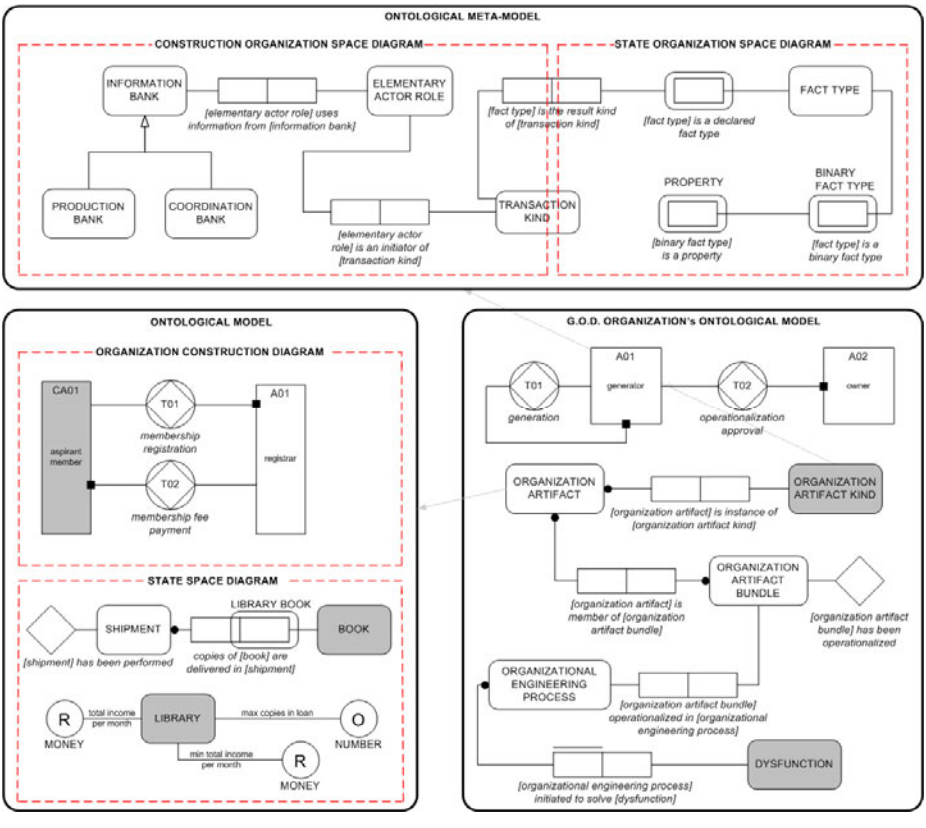

Fig. 8. G.O.D. Organization Overview

which, from the perspective of the GO is an OA, which is an instance of a particular OA kind, namely a fact type. Because FT01 is an OA that is part of the current organizational self of the library, it belongs to the respective set GS. We find object classes ORGANIZATION ARTIFACT and ORGANIZATION ARTIFACT KIND on the (part of the) G.O.D. Organization's ontological model depicted on the right part of Figure 8. The first is the population of all OAs that constitute a particular organizational self – in this case, of the library – while the second is the population of all OA kinds that constitute what we have previously called the organization space.

Changes in the organizational self will occur by state changes of bundles of OAs – whose population is represented by object class ORGANIZATION ARTIFACT BUNDLE – as never an isolated OA will be created. Let's suppose that, for some reason, one needs to specify a new result kind, to be added to the library's SM, affecting shipments, namely: *[shipment] has been returned*. This implies the generation of an associated transaction kind, as well as of an actor role to initiate it. All this, in turn, implies that the GO will produce OAs, instances of (1) OA kinds, that are object classes at meta level: fact type, transaction kind, actor role as well as of (2) OA kinds that are fact types at meta level: *[fact type] is the result kind of [transaction kind]*, *[elementary actor role] is an initiator of [transaction kind]*, etc. All such instances will be part of a bundle that will be operationalized after its generation and approval.

A major contribution of our research is making the aspect of change of the organizational self explicit with the GO. This (sub)organization allows us to make an "operational bridge" between the meta model and model levels so that we can keep a precise and thorough track of the state of the organizational self and its state transitions or, in other words, the life cycle of organization artifacts that constitute the organizational self. The OAs that are current and constitute an organization's current self, will be the ones that are part of bundles whose last result was that they have been operationalized. The conceptualization of this set of OAs constitutes the organization's ontological model.

6 Conclusions

Current notions of coordination and production worlds provided in DEMO do not address the issue of changes in the state of the composition and structure of the organization system which means that one can use DEMO only to take "static pictures" of an organization. Following our claims presented in this paper, this ambiguity issue is solved by modeling such state changes as state transitions occurring in the production world of the G.O.D. Organization, reflecting the Generation, Operationalization and Discontinuation of OAs. OAs are a central concept in this paper which we propose to be abstract objects, existing in the inter-subjective reality of human agents of an organization and constituting the organizational self which, in turn, defines the operation of the organization. The conceptualization of the organizational self constitutes the organization's ontological model. Keeping a precise record of the acts of production of OAs is the way that we propose to realize Organizational Self-Awareness, that we (re)define as the continuous synchronization of the real organizational self with its ontological representation, for a correct conceptualization of the ontological model. This implies that the OAs base should be constantly available to

all relevant human agents of an organization, so that they can always conceptualize the current and correct "version" of the part of the organizational self that they should be aware of.

We have shown how the G.O.D. Organization makes a bridge between the worlds of model and meta model, where the latter contains the set of generic OA (meta level) types out of which a set of (model level) OA instances can be generated that constitute an organization's self. With our proposal of the G.O.D. Organization, DEMO no longer is limited to a "static" picture of an organization and we can now have a full trace of the state of the organization system. The current picture of the organization, or, in other words, its ontological model, simply consists in the conceptualization of the set of OAs that are current, i.e., belonging to a bundle of OAs whose last event was "has been operationalized".

As related research being addressed in other reports, we delve on the specification of the full ontological model of the G.O.D. Organization which ends up being the specification of a method to formally capture microgenesis dynamics and realize Organizational Self-Awareness. We also address the ontological model of what we call the Control Organization, responsible for resilience dynamics, i.e., observing if certain critical properties characterizing an organization's operation – called measures – are respecting the values – called viability norms – that guarantee an organization's viability and activating (and deactivating) bundles of transactions to overcome dysfunctions on such norms and, if unsuccessful, to make a request for the G.O.D. organization to initiate what we call an Organizational Engineering Process to handle the problem and change the organizational self to solve it.

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