# Phenomenological Ontology Guided Conceptual Modeling for Model Driven Information Systems

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## 1 Introduction

The old dream of semantic consistency between minds, conceptual models and data in executing Information Systems (IS), in accordance with the infological equation [1] $I = i(D, S, t)$ : D = users received data, S = users structure of concepts (knowledge, perception of reality), t = time to interpret data, i = information function, I = conveyed information; may be within reach even for full scale life cycle support of enterprise information systems.

Model driven generation and execution of IS means a paradigm shift for the IS community. In order to facilitate this paradigm shift, methods and tools have to be simplified and refined. Knowledge about them has to be disseminated beyond the academic sphere for model driven development and execution of IS to become a mainstream approach.

One important component to accomplish this paradigm shift, is a suitable ontology. A systematic literature review on Ontology Guided Conceptual Models (ODCM) [2] does however indicate a lack of an ontology for executable conceptual models, with the purpose of modeling perception of reality (S) in such a way that information systems will communicate relevant data (D) in an efficient manner (t), about this reality.

Our research focus on seamless life cycle management of information systems, which are semantically consistent with their users. Part of this research is development of a suitable ontology.

## 2 Ontological Research Issues

How to model the users (actors) conception of a domain, to steer the design of user views of an information system, according to the infological conceptual aspect as introduced by Langefors [1],

The pragmatic feature of a model and choice of an ontology depending on subject and purpose of the model, as well as complexity of ontological modeling

and limited application of ODCM by businesses and professionals as pointed to by Verdonck and Gailly [3].

Complexity reduction is essential to the pragmatic quality of models: to match model and IS to actors conception of enterprise, sustainably and in phase with enterprise life cycle changes. Improvements of ODCM, could be a key instrument to this objective.

**Research Issues to Address at VMBO2019**

– The pragmatic quality of a conceptual model, for meaningful user views of an EIS, assumes that the domain of modeling is *perception of the enterprise* among enterprise actors.
– Complexity of ontology - Limited number of ontological categories and terminology recognizable for business professionals.
– Complexity of model - Limited number of entities and relationship between entities as well as support for organizing model elements in structures consistent with modeled domain.
– Complexity of modeling - Language and Tool design based on ontology and support for navigation of complex models through context zooming, from high level of abstraction down to details.

## 3 Phenomenological Semantic Modeling for Model Enabled Information Systems

Phenomenological Foundational Ontology (PFO) is a novel ODCM approach, different from the most referred-to ontologies [4] Bunge Wand Weber (BWW) and Unified Foundation Ontology (UFO) in that modeled entities are phenomena representing *mind* items, based on comprehension of existence in a metaphysical sense, Lifeworld (Lebenswelt) as in the philosophical school of phenomenology with philosophers such as [5] [6] and [7]. 'Lifeworld' is that which is perceived as existing in reality, perception of phenomena, always there, and the foundation for all shared human experience.

Development of PFO is an attempt to further develop, formalize and disseminate an approach for conceptual models which has been applied for successful and proven model driven EIS life cycle management, in large scale information systems (1500+ users) [8] over a period of 25 years. Lately, it has also been applied for successful design and maintenance of EIS for the social network enterprise Project Lazarus as demonstrated at ER 2018 [9]

Basic components of PFO are entities (the phenomena), properties and relations. In this paper, we describe PFO variants (kinds) of phenomena, ontology for phenomena abstractions, relations and properties are still subjects for research.

## 4 Phenomenon Kinds

PFO phenomenon kinds are grouped in four areas, Fig.1, representing worldview awareness domains, building outwards from the most concrete and primitive

awareness of existence. We use the term *object* to refer to that which exist outside the mind, observable through perception.

**Static physical world**: Phenomena as mind items, representing that which is considered to exist in a static physical world. Physical here means, that which could be observed. However, could be observed, does not mean that something has to exist for observation, it can be just thought of or imagined to exist as observed.

– Things: Predominantly inanimate objects, objects which are not considered to act, have their own will.
– Actors: Predominantly animate objects and groups of such objects. Also automata such as automated machines, robots and information systems could, if they seem to act i.e. take actions.
– Localities: Spatial relations, concepts of location, position, area or volume, coordinates in a coordinate system defining position, area or volume.
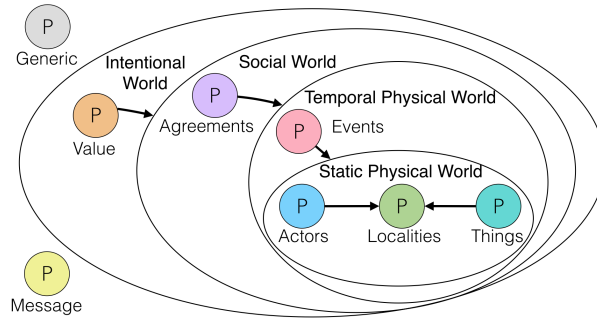


**Fig. 1.** Phenomenon kinds, their world-view awareness domains, combined with a coloring scheme used in modeling tool and runtime environment. (read arrows as "relates to")

**Temporal physical world**: A physical world which changes over time. All phenomena have a past, a present and a future, but when we want to understand and reason about change, change is the phenomenon.

– Events: Phenomena of change. Events can be observed only when they happen, are in progress, but as mind items they can exist as plans before and memories after they are observed.

**Social World**: The social world is regulated, driven, by agreements between actors in relation to the temporal physical world.

– Agreements: Phenomena of relationships between actors, possibly also with relations to other phenomena included in the agreement. Agreements are either informal, undocumented, subconscious or formalized and documented, e.g. legal systems or written contracts.

**Intentional World**: A world of intentionality which motivates, drives, gives purpose for individuals and organizations.

- Value: In the perspective of an actor, related to social and physical world, describing that which is value and possible its measure. For actors as individuals, Maslows hierarchy of needs indicates a starting point for possible values. For profit making enterprises, value is money but also other values are considered, such as customer value.

**Additional Phenomenon Kinds**: The following two kinds of phenomena are not considered to be pre-conceptional mind items from the point of view of phenomenological philosophy. They are conceptual abstractions, which however may play an important role as entities in conceptual modeling for information systems.

- Message: As in the widest sense, generally unstructured (non modeled) information, usually as textual or image data. E.g. email, documents, pictures, books in their non-physical sense i.e. in the digital universe.
- Generic: Should not be used when modeling according to PFO, except when a phenomenon type represents an abstraction of two different phenomenon kinds, e.g. phenomenon sales item can be either something physical (thing) or service (event).

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