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Abstract

Dynamic Semantic Web (DSW) is based at first on the techniques, methods and paradigms of the emerging Semantic Web movement and its applications. DSW is advancing one fundamental step further from a static to a dynamic concept of the Semantic Web with extended flexibility in the navigation between ontologies and more profound transparency of the informational system. Web Services are now re-definded by Semantic Web. To proof the advantages of DSW, it is the main aim of this project to develop the tools and methods necessary to develop a DSW based Web Service (DSW business application). The existing framework of the Semantic Web has only very limited possibilities of realizing dynamism. It´s dynamism is reduced to inter-ontological transactions (translations, mappings, navigation) between different local taxonomies and ontologies. DSW is based on the genuinely dynamic first-order ontologies and logics founded in kenogrammatics of the theory of polycontexturality allowing evolution and metamorphosis to create complex interactivity and new domains of interaction.

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2004

Dynamic Semantic Web

Rudolf Kaehr

DYNAMIC SEMANTIC WEB

ULTRA-DRAFT

DERRIDA´S MACHINES PART II

The TransComputation Institute
ThinkArt Lab Glasgow
Dr. Rudolf Kaehr
April 1 2004

Wozu Dynamic Semantic Web?

Towards a Dynamic Semantic Web

Cybernetic Ontology and Web Semantics

Dynamic Semantic Web

Dynamics in Ontologies and Polysemy

From Metapattern to Ontoprise

Interactions in a meanigful world

On Deconstructing the Hype

SHOE Ontology Example "CS Department"

CNLPA-Ontology Modelling

www.thinkartlab.com

Wozu Dynamic Semantic Web?*

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SAP INFO 10/2003

20.10.2003 / Interview mit Prof. Dr. Jürgen Angele, ontoprise GmbH

Werden Computer uns einmal verstehen?

**Schaffen Sie mit semantischen Technologien den Sprung von der Verarbeitung von Daten zur Verarbeitung von Wissen?*

Angele: Ja, denn semantische Applikationen "verstehen" Informationen. "Verstehen" setzt eine gemeinsame Sprache voraus, um konzeptuelle und terminologische Verwirrungen, Unklarheiten und Mehrdeutigkeiten auszuschließen. Und genau das lässt sich mit semantischen Technologien erreichen. In einer Ontologie werden die für einen Anwendungsbereich relevanten Begriffe und deren Zusammenhänge exakt definiert. Die Ontologie beschreibt ein allgemein anerkanntes Verständnis dieses Anwendungsbereichs, das alle Personen und Anwendungen gemeinsam teilen und verwenden.

Ist es das, was wir mit dem DSW wollen?

1 Ziel: Was soll erreicht werden?

Es soll ein *Framework für ein Dynamic Semantic Web* entwickelt werden, das den Charakteristika des WWW entspricht und nicht bloss auf die Exteriorisierung von Datenbank Systemen aus ist.

Das WWW wird hier nicht nur als ein offenes System mit den Eigenschaften distribuiert, dynamisch und quantitativ massiv verstanden (Hendler), sondern zusätzlich als ein global-kulturelles, komplexes sich selbst organisierendes und selbst-modifizierendes Medium artifizieller Natur. D.h. auch, dass das WWW nicht vorgegeben (vorhanden) ist, sondern sich nur einer Interpretation in seiner Zuhandenheit erschliesst.

Die bestehenden Methoden konzentrieren sich auf die Vorhandenheit der Daten im WWW, DSW hat sich der Herausforderung der prinzipiellen Deutbarkeit des WWW, d.h. seiner Zuhandenheit zu stellen.

Daher ist Wissen (knowledge) und Bedeutung (meaning) in einem WWW als kulturellem System grundsätzlich nicht auf Eindeutigkeit, Disambiguität und Dekontextualisierung zu reduzieren. Dies ist möglich einzig für sehr spezielle Erfordernisse.

DSW hat somit zum Ziel, Mechanismen zur Handhabung, Implementierung, Formalisierung und Realisierung von ambiguen, kontextbezogenem und vieldeutigem Wissen, das nichtsdestotrotz einer machinalen Verarbeitung zugänglich ist, anzubieten.

Einige konkretere Ziele

Es sollen Methoden zur Erstellung komplexer evolutiver Ontologien entwickelt werden, die den Erfordernissen etwa der folgenden Kriterien gerecht werden können.

1. Ontology Engineering

Aus der komplexen Datenvielfalt, realisiert in heterogenen Ontologien, einer Organisation, eine vertikal strukturierte einheitliche Ontologie zu generieren, die dann mit den Methoden des Semantic Web verarbeitet werden können, stellt ein grosses und weitgehend ungelöstes Problem dar. Die Effektivität einer Implementierung misst sich jedoch auch an der Effektivität der Aquisition ihrer Daten.

Eine zusätzliche horizontale Organistionsform kann hier aus Engpässen einer aufgezwungenen Hierarchisierung entgegen wirken.

2. Distributed inferencing, architectonic parallelity

Distribuierte Inferenzmechanismen lassen sich aufgrund der polykontexturalen Logik ohne Komplikationen direkt realisieren. Je Kontextur bzw. je Modul, lässt sich eine eigene und autonome Deduktionsregel einführen. Dies geht weit hinaus über klassische Ansätze der Parallelisierung und der durch Mehr-Sorten-Logiken fundierten Distributionen.

3. Meta-Reasoning, Reflektionalität

Reflektionalität ist der polykontexturalen Architektonik, sowohl auf logischer wie ontologischer Ebene, inhärent. Entstammt sie doch dem Bestreben, eine Theorie und einen Apparat der Reflexionsformen zu realisieren.

4. Reusability

Wiederverwendbarkeit erhält durch die tabulare Anordnung der Module eine neue Dimension, die durch die vertikale Konzeption allein nicht realisiert werden kann.

2 Einschränkung: Was soll nicht erreicht werden?

Es geht bei dem DSW Projekt, trotz des fundamental neuen Ansatzes, nicht darum, Bestehendes in seiner konkreten Definition und Funktionalität zu kritisieren. Oder gar als falsch aufzuweisen. Einfach deswegen nicht, weil der PKL-Ansatz einzig und allein versucht, von anderen, eventuell allgemeineren Voraussetzungen, jedoch mit weit weniger ausgereiften Technologien, an eine gemeinsame Problematik heranzugehen.

Es geht aber auch nicht darum, mit den bestehenden Ansätzen, die sich auf spezifische Fragestellungen spezialisiert haben, wie etwa ontoprise, in Wettlauf oder gar Konkurrenz zu treten.

3 Methode: Wie und womit soll DSW erreicht werden?

Web Ontologien bestehen aus Modulen, die *vertikal* organisiert werden und somit eine Dynamik der Evolution, Adaption und Erweiterung im Rahmen einer systematischen Hierarchie ermöglichen.

DSW erweitert dieses Konzept der Modularität dahingehend, dass alle, auch die Basis-Module, *horizontal* organisiert werden können. Damit entsteht ein System ontologischer und logischer Parallelität und Nebenläufigkeit, das vertikale Interaktion zwischen den Ontologien und deren Modulen ermöglicht.

Die horizontale Organisation ontologischer Module soll mit den Methoden der polykontexturalen Logik realisiert werden. Die Polykontexturalitätstheorie stellt logische und ontologische Methoden der Vermittlung und Distribution modularer Systeme bereit.

Dabei kann jeder Modul innerhalb einer horizontalen Organisation selbst wiederum vertikal hierarchisch strukturiert sein. Damit ist ein flexibler und kontextbezogener Wechsel zwischen der horizontalen und der vertikalen Funktionalität gewährleistet.

Die Möglichkeit des Wechsels zwischen horizontaler und vertikaler Organisiertheit, oder in a.W. zwischen Hierarchie und Heterarchie, stellt die Grundstruktur der Dynamik des DSW dar. Dieses Verständnis von Dynamik stellt ein Novum in der Konzeptionalisierung und Implementierung von logischen und ontologischen Systemen dar.

Die konkrete Realisierung einer Implementierung von DSW hat sich mit den sich entwickelnden Methoden und Programmiersprachen des Semantic Web produktiv kritisch auseinander zu setzen und Strategien der Erweiterung, geleitet durch die Ergebnisse der polykontexturalen Logik- und Ontologie-Forschung, zu entwickeln.

Vererbbarkeit und Verwendbarkeit von Methoden

Damit ist, trotz der Novität des Ansatzes des DSW, Anschluss und Vergleichbarkeit, aber auch Verwertbarkeit des Bestehenden gewährleistet. Denn wenn Module, die in sich vertikal organisiert sind, in eine Distribution und Vermittlung horizontaler Art gebracht werden, lassen sich die Konzeptionen, Methoden, Formalismen und Techniken übertragen. Die vertikalen Methoden vererben sich, wenn auch ev. in modifizierter Form, in die horizontale Struktur. Insofern braucht nicht alles neu erfunden zu werden, um das Projekt des DSW zu realisieren.

4 Nutzen: Wozu soll DSW erreicht werden?

Eine tabulare Organisation ontologischer und logischer Module eröffnet automatisch strukturelle Vorteile einer linear organisierten Struktur gegenüber.

Transparenz

Horizontal verteilte Module und Ontologien unterstützen Transparenz aufgrund ihrer relativ autonomen Modularität, die eine Komplexitätsreduktion darstellt.

Flexibilität

Horizontal verteilte ontologische und logische Module unterstützen Flexibilität aufgrund ihrer Möglichkeit zwischen vertikaler und horizontaler Organisation zu wählen.

Disponibilität

Horizontal verteilte Module und Ontologien unterstützen durch ihre Verteilung über die zwei Dimensionen ihrer Positionierung.

Effektivität

Horizontal verteilte Module und Ontologien unterstützen die Effektivität sowohl ihrer Etablierung wie auch der Abläufe ihrer Prozesse, dank ihrer architektionalen Parallelistät.

Insbesondere werden die Prozesse der *Navigation, Negotation und Mediation* von und zwischen vertikal und horizontal verteilten Ontologien aufgrund der polykontextural verteilten Organisation unterstützt.

Navigation

Navigation zwischen Modulen erhält eine neue Dimension, wenn diese in ihrem Spielraum nicht mehr eingeschränkt wird durch eine übergeordnete, allen gemeinsame Basis-Ontologie.

Mediation

Mediation von Modulen ist in vertikalen Organisationsformen äusserst beschränkt und setzt eine allen Modulen gemeinsame Basis-Ontologie voraus. In diesem Sinne handelt es sich bei der vertikalen Mediation letztlich um eine Form der Subsumtion, die nicht in der Lage ist, Fremdes zu akzeptieren und mit Fremdem zu interagieren.

Negotation

Wenn auch DSW auf machinelle Assistenz setzt, ist immer noch genug Raum für Verhandlung zwischen menschlichen Subjekten. Diese Negotationen können sich nun aber auch auf formale Modelle der Vermittlung stützen und sind nicht der reinen Willkür bzw. dem blinden Vertrauen (Trust) ausgeliefert.

Evolution

DSW soll Grundprobleme der Evolution des WWW und der Semantic Web Ontologien aufweisen und zu polykontexturalen Lösungen verhelfen. Die bestehenden Methoden der Handhabung von Evolution von Ontologien sind auf die vertikale Organisation ihrer Methoden beschränkt.

5 Institutionen: Wo und mit wem soll DSW erreicht werden?

Zusätzlich zu Wiesbaden, Daniel Inc. und CNLPA ist involviert ThinkArt Lab Glasgow in Zusammenarbeit mit dem Computer Departement und dem Center of Critical Media Studies des Goldsmiths College, University of London.

In Planung: Gründung von Creative Industries Lab, London, Singapore und Kontakt zu McLuhan Institute, Maastricht, NL.

Die Manpower hängt von den Kontakten und den möglichen Finanzierungen ab.

6 Zeitrahmen: Wann soll DSW erreicht werden?

In einer ersten 3 Jahresplanung soll im ersten Jahr eine Konsolidierung der bestehenden Forschungsarbeiten geleistet werden, die in den folgenden zwei Jahren zu einem ausgereiften Prototypen führen sollen.

Die Emanzipation von den Methoden und Formalismen des Semantic Web in Richtung auf ein polykontextural fundiertes DSW kann nur Schrittweise geschehen.

Ein erster Schritt ist die kritische Aufarbeitung der bestehenden Tendenzen der Implementierung des Semantic Web bezogen auf Ontologiebildung, Web-Logiken und Impelementierungssprachen.

Ein weiterer Schritt ist die Abgrenzung von diesen Methoden und die Entwicklung von Erweiterungen der bestehenden Konzeptionen und Methoden des Semantic Web.

Dies soll in einem vorläufig letzten Schritt zur Entwicklung eines Prototypes einer DSW Implementierung führen.

7 Abgrenzungen: Wogegen soll DSW erreicht werden?

Angesichts der wachsenden globalen kulturellen Dominanz des WWW soll gegen einen reduktionistischen und technizistisch verstandenen und staatlich implementierten Begriff von Bedeutung und Wissen angegangen werden. Damit soll die relative Adäquatheit reduktionistischer Methoden für beschränkte industrielle, administrative und militärische Zwecke nicht geleugnet werden.

Das WWW ist hier jedoch als ein kulturelles und globales Medium verstanden. DSW versteht sich daher als ein nicht durch den Eurozentrismus reduzierte und auf Aristotelischer Metaphysik basierende Strategie der Eröffnung eines globalen kulturellen WWW.

Es soll mit dem DSW Denkmodelle und Verhaltensstrategien im Umgang mit dem WWW zur Hand gegeben werden, die eine Verabschiedung vom Aristotelismus in der Ontologie und Logik wie auch der Fixierung des Machinalen auf das Turingmodell zu unterstützen in der Lage sind.

Es kann nicht übersehen werden, dass nach dem Sieg der technizistischen Denkweise in der und durch die Computertechnologien nun eine entsprechende Vereinnahmung von kulturellen Schichten des Wissens durch das internationale Semantic Web Projekt in Gang gesetzt wurde. Dagegen sind die Bildungseinrichtungen noch gänzlich mit der Adaption an den Digitalismus und seiner Multimedia-Kultur beschäftigt. Die Hilflosigkeit dem Phänomen gegenüber zeigt sich leider auch in der sonst hervorragenden kritischen Arbeit zum Semantic Web des McLuhan Institute, Maastricht.

**Die vorliegende Arbeit ist ein Bericht zur Zielfindungsphase eines Joint Venture Projects mit der Firma DANIEL, Inc., Wiesbaden, Deutschland*

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Towards a Dynamic Semantic Web

Dynamic Semantic Web (DSW) is based at first on the techniques, methods and paradigms of the emerging *Semantic Web* movement and its applications. DSW is advancing one fundamental step further from a static to a dynamic concept of the Semantic Web with extended flexibility in the navigation between ontologies and more profound transparency of the informational system. Web Services are now redefinded by Semantic Web. To proof the advantages of DSW, it is the main aim of this project to developed the tools and methods necessary to develop a DSW based Web Service (DSW business application).

The existing framework of the Semantic Web has only very limited possibilities of realizing dynamism. It´s dynamism is reduced to inter-ontological transactions (translations, mappings, navigation) between different local taxonomies and ontologies.

DSW is based on the genuinely dynamic first order ontologies and logics founded in kenogrammatics of the theory of polycontexturality allowing evolution and metamorphosis to create complex interactivity and new domains of interaction.

A General Metaphor

Peter van Dijcks overview

Themes and metaphors in the semantic web discussion.

http://poorbuthappy.com/ease/semantic/

http://petervandijck.net/

Joseph Goguen’s help to not to be lost in the chaos of bricolage and the hype:

http://www.cs.ucsd.edu/users/goguen/projs/onto.html

http://www.cs.ucsd.edu/users/goguen/pps/lisbon04.pdf

http://www.cs.ucsd.edu/groups/tatami/seek/

1 The Semantic Web

“Semantic Web: a machine-processable web of smart data.” Daconta

Today, the Semantic Web is becoming an important reality. Not only in research centres but also in industrial, business and governmental organizations, Semantic Web applications are advancing. Semantic Web is understood as the “Next Web”.

“There´s a revolution occurring and it´s all about making the Web meaningful, understandable, and machine-processable, wether it´s based in an intranet, extranet, or Internet. This is called the Semantic Web, and it will transition us toward a knowledge-centric viewpoint of éverything´.” Stephen Ibaraki

As the WWW is based on HTML, the Semantic Web is based on *XML* as its frame language mediated by ontologies. *Ontologies* are the new key to meaning in information processing. Also deriving from philosophy where ontology is representing the most general theory about being and the formal structure of everything, in the Semantic Web, ontologies are of a very pragmatical value. *"Ontologies are about vocabularies and their meanings, with explicit, expressive, and well-defined semantics–possibly machine-interpretable."* Daconta

XML is the corner stone of the Semantic Web. "XML is the syntactic foundation layer of the Semantic Web." It is not a programming language; it is "actually a set of syntax rules for creating semantically rich markup languages in a particular domain. In other words, you apply XML to to create new languages."
"Why is XML so succesful? XML has four primary accomplishments, (...):
XML creates application-independent documents and data.
It has a standard syntax for meta data.
It has a standard structure for both documents and data.
XML is not a new technology (not a 1.0 release)."
More explicit, XML is characterised by following principles:
First: "Markup is separate from content."
Second: "A document is classified as a member of a type by dividing its parts, or elements, into a hierarchical structure known as a tree." Daconta

The Semantic Web is possible today and in reality it is a natural consequence of the fact of the Internet, the WWW, the knowledge about databases and the ubiquity of powerful computing facilities.

Two years ago the Gartner Group has given a marketing projection that *“By 2005 lightweight ontologies will be part of 75 percent of application integration projects”*.

International Investments

DERI-Centres: Ireland and Insbruck (Austria)
Leibzig
Dortmund
Edinburgh

Semantic Web and AI

The merits of the Semantic Web is that it is in its concepts and in its vision very pragmatically oriented. It is in sharp contrast to the sometimes very speculative aims of Artificial Intelligence.

A sharp distinction between Semantic Web and AI can be made between the relevance and understanding of *data* and *programs*. AI is concerned with highly complex programs being at the end able to understand data, e.g. texts and common sense. Semantic Web is more concerned in making its data “smart” and giving them some machine-readable semantics. AI tends to replace human intelligence, Semantic Web asks for human intelligence.

On the other side it seems that Semantic Web is lacking, at least today, strong and complex logics, automated deduction systems and inference machines. Topics which are well developed in AI research and applications.

Semantic Web inferencing machines are mostly based on F-Logic, which is a subsystem of First-Order Logic (FOL).

It is well known that AI has produced a lot of knowledge about Knowledge Representation systems, Concept Analysis and many other semantic based endeavours. Nevertheless, Semantic Web takes a new start on a more pragmatic level, with a more business oriented vision and from an other angle of the whole spectre of “mechanizing” knowledge and interactivity.

Ontologies

The Semantic Web is based on its ontologies. Ontologies are playing the key role in the process of realizing semantic information processing. Ontologies are themselves classified in several types. The most general case is the distinction between core ontologies and upper-level ontology. There are many core ontologies but only one upper-level ontology. The structure of ontology (and ontologies) is strictly hierarchical.

What are the promises?

“What are the real values for using ontologies? The real value of using ontologies and the Semantic Web is that you are able to express for the first time the semantics of your data, your document collections, and your systems using the same semantic resource and that resource is machine-interpretable: ontologies. Furthermore, you can reuse what you´ve previously developed, bring in ontologies in different or related domains created by others, extend yours and theirs, make the extensions available to other departments within your company, and really begin to establish enterprise- or community-wide common semantics.” Daconta, p. 237

RDF (Resources Description Framework)

Additional to the link structure of HTML, RDF (Resource Description Framework) comes with a pointer to the resource of the data (object, information) introducing a semantic dimension to the strict syntactic definition of HTML.

A description is a set of statements about the resource.

The RDF model is often called a “triple” because it has three parts: subject, predicate, object.

Subject: This is the resource that is being described by the ensuing predicate and object.

Predicate: This is a function from individuals to truth-values with an arity based on the number of arguments it has.

Object: This is either a resource referred to by the predicate or a literal value.

Statement: This is the combination of the three elements, subject, predicate, and object. (Daconta)

All this is governed by the principle of identity.

“We should stress that the resources in RDF must be identified by resource IDs, which are URIs with optional anchor ID.” (Daconta, p. 89)

This linguistic characterization of the RDF triple is defining a statement and adding to its syntax some meaning guarantied by the identifiable IDs. This relation is decidable, that is, the connotation exists or it exists not, therefor it is true or false–TND.

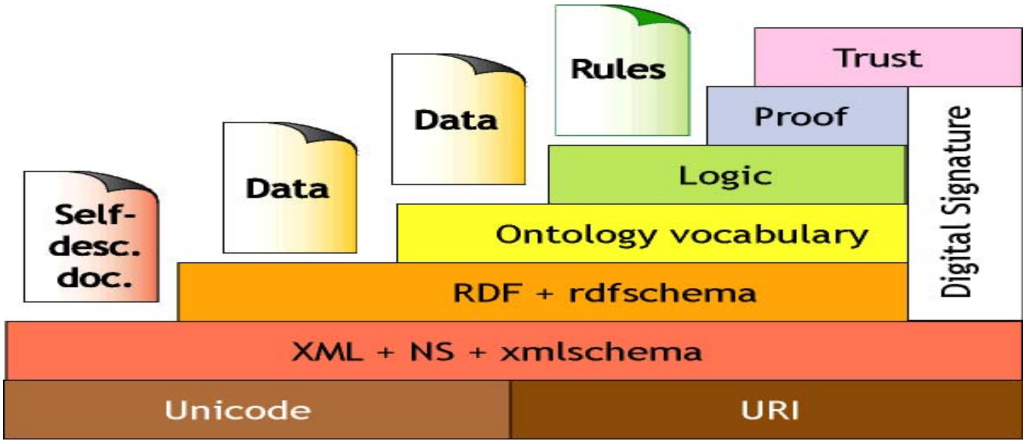
Missing linguistic contexts

At this point I would like to mention, that despite of its semantic relation and its foundation in a generally accepted ontology, this RDF triple is defining a statement in isolation, excluding its context. Later, contexts are introduced by ontologies. But the RDF definition is not involving them. As a consequence, all pragmatic points of views have to be introduced secondarily. It would be helpful, if we could introduce this contextual information at the very beginning of our construction. Without this we will simply repeat the paradoxes of knowledge engineering of the AI projects. That is, meaning of a sentence is context-dependent and contexts are defined by meaningful sentences.

The Semantic Web Stack

In this proposal I will concentrate myself on the basics of Semantic Web as it is proposed by its inventor Tim Berners-Lee:

Tim Berners-Lee´s three-part vision: (collaborative web, Semantic Web, web of trust).



Trust
Proof
Logic Framework, Rules
Ontology, Contexts
RDF Schema
RDF M&S
XML; Namespace
URI; Unicode
and
Digital Signature: Signature, Encryption

Problems with trust and signature

To begin with the top: trust. Let´s have a look to an example.
BMW-Example:
Trust or Distrust? Serious or a joke? How serious is the joke? Or is it simply stupidity?

Hierarchies everywhere

Taxonomies

A taxonomy is a semantic hierarchy in which information entities are related by either the *subclassification of* or the *subclass of* relation.

One of the basic distinctions of GOL is the distinction between *urelements* and *sets*. We assume the existence of both urelements and sets in the world and presuppose that both the impure sets and the pure sets constructed over the urelements belong to the world. This implies, in particular, that the world is closed under all set-theoretical constructions. Urelements are entities which are not sets. They form an ultimative layer of entities without any set-theoretical structure in their build-up. Neither the membership relation nor the subset relation can unfold the internal structure of urelements.

In GOL, urelements are classified into two main categories: *individuals* and *universals*. There is no urelement being both an individual and a universal.

Diagramm 1 **UML hierarchy diagram of a General Ontology**

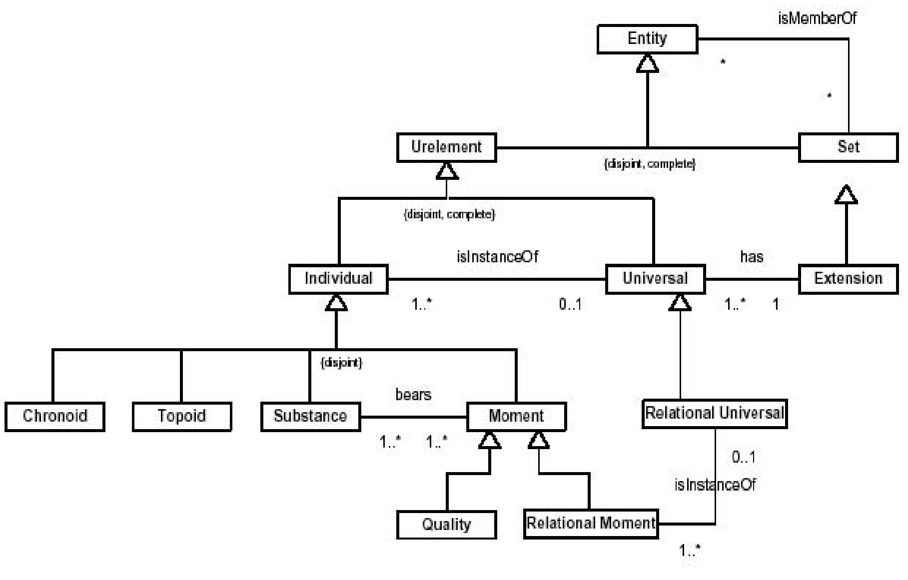
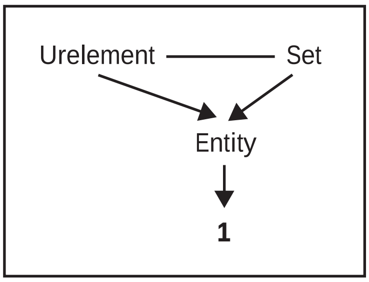


Fig. 1. A UML class diagram describing the basic concepts of GOL.

Conceptual graph of the basic triple (Entity, Urelement, Set) and its uniqueness 1.



Uniqueness means that there is one and only one ontology defined in terms of Urelement, Set and Entity. This also means, there is only one World, and at the end it means, there is only one WWW, too. But this is homogenizing complexity and diversity, and is simply a monstrous nomiminalisation. In other word, it is one and only one way of thematizating the world, the mono-contextural one.

> The development of an axiomatized and well-established upper-level ontology is an important step towards a foundation for the science of Formal Ontology in Information Systems. Every domain-specific ontology must use as a framework some upper-level ontology which describes the most general, domain-independent categories of reality. For this purpose it is important to understand what an upper-level category means, and we proposed some conditions that every upper- level ontology should satisfy. The development of a well-founded upper-level ontology is a difficult task that requires a cooperative effort to make signicant progress.

Diagramm 2 **Axiomatic Foundation of Upper-Level Ontologies**

Axioms of Basic Ontology

(a) Sort and Existence Axioms

1. $\exists x(Set(x))$,
2. $\exists x(Ur(x))$
3. $\forall x(Set(x) \vee Ur(x))$
4. $\neg\exists x(Set(x) \wedge Ur(x))$
5. $\forall x(Ur(x) \leftrightarrow Ind(x) \vee Univ(x))$
6. $\neg\exists x(Ind(x) \wedge Univ(x))$
7. $\forall xy(x \in y \rightarrow Set(y) \wedge (Set(x) \vee Ur(x)))$

(b) Instantiation

D. $ext(x,y) =_{df} Univ(x) \wedge Set(y) \wedge \forall u(u :: x \longleftrightarrow u \in y)$.

1. $\forall xy(x :: y \rightarrow Ind(x) \wedge Univ(y))$
2. $\forall x(Univ(x) \rightarrow \exists y(Set(y) \wedge \forall u(u \in y \longleftrightarrow u :: x)))$

(c) Axioms about sets

1. $\forall uv\exists x(Set(x) \wedge x = \{u, v\})$
2. $\{\phi^{Set} \mid \phi \in ZF\}$, where ϕ^{Set} is the relativization of the formula ϕ to the basic symbol $Set(x)$.[3]

Contributions to the Axiomatic Foundation of Upper-Level Ontologies, Wolfgang Degen, Heinrich Herre

All these axioms of the formal general ontology GOL are not only defining a (probably) consistent framework for all possible applicative, core ontologies, but are also asking a hard price for it: there is no dynamics in this framework of ontology. Everything is what it is, e.g. Urelement or Set. Any dynamics is secondary and localized in “chronoids”, “topoids”, etc. which are special cases of Individuals. In other words, no Urelement can become a set and vice versa, simply because this ontology is mono-contextural, lacking any fundamental perspectivism and interactivity with diversity.

2 How to introduce the Dynamic Semantic Web?

The Semantic Web movement is not only strong and inevitable, it is also open to the future. On a pragmatic level it is open for an increasing multitude of local and personalized systems. It´s general definition is monitored by the W3C, but in encouraging new developments and not restricting its future progress.

In this sense the Semantic Web movement includes without problems a spectre from Aristotelian fundamentalists to Rhizomatic Anarchists.

In other words, it is not in contradiction to the guidelines of the Semantic Web to develop as a new branch the paradigm of DSW.

It is a philosophical question if this branch is well understood as branch and should not be better thematized as something quite different, namely as an interlocking mechanism between core and upper ontologies and their logics distributed over different irreducible upper ontologies.

From a pragmatic point of view, DSW is better localized as a new branch or discipline of the Semantic Web.

The map of the Semantic Web assembles all sorts of theories, methods, implementations from philosophy to hard core programming, including AI and data-base technologies, logics, semantics, context theory, linguistics, neural networks, etc. on all levels of scientifity and scholarship, not excluding some confusions and other cocktail events.

This is allowing a great diversity of different approaches to be involved in the development of the Semantic Web and its extension to the Dynamic Semantic Web, and many other invention, too.

Decentralization and Heterogeneity

To deal in a flexible and controllable way with decentralized heterogeneities, hierarchies are not delivering the best possibilities. Here is the moment where *heterarchies* come into the play.

Decentralization and Heterogeneity is obviously in conflict with the strict reglementations of upper-level (first order) ontology as it is formalized in the general ontology GOL.

> Two different contexts relating respectively to species and environment point of view.
> With such different interpretations of a term, we can reasonably expect different search and indexing results. Nevertheless, our approach to information integration and ontology building is not that of creating a homogeneous system in the sense of a reduced freedom of interpretation, but in the sense of **navigating alternative interpretations**, querying alternative systems, and conceiving alternative contexts of use.
>
> To do this, we require a comprehensive set of ontologies that are designed in a way that admits the existence of **many possible pathways** among concepts **under a common conceptual framework**. This framework should reuse domain-independent components, be flexible enough, and be focused on the main reasoning schemas for the domain at hand. **Domain-independent, upper ontologies** characterise all the general notions needed to talk about economics, biological species, fish production techniques; for example: parts, agents, attribute, aggregates, activities, plans, devices, species, regions of space or time, etc. (emphasis, r.k.)

http://www.loa-cnr.it/Publications.html

2.1 Heterarchies, in general

In contrast to the Semantic Web with its tree structure, that is, with its fundamental hierarchic organization on all levels of conceptualization and realization, the Dynamic Semantic Web comes with a strong decision for heterarchies.

Heterarchies are not fully understood if we are not studying the interactivity between hierarchies. In this sense heterarchies are the framework of the interactivity of hierarchies. In other words, heterarchies are ruling the interplay between an irreducible multitude of different trees.

One great advantage is, each of these trees is inheriting the well known and proven methods and technologies of their classical predecessor, that is, logics, taxonomies, proof systems etc.

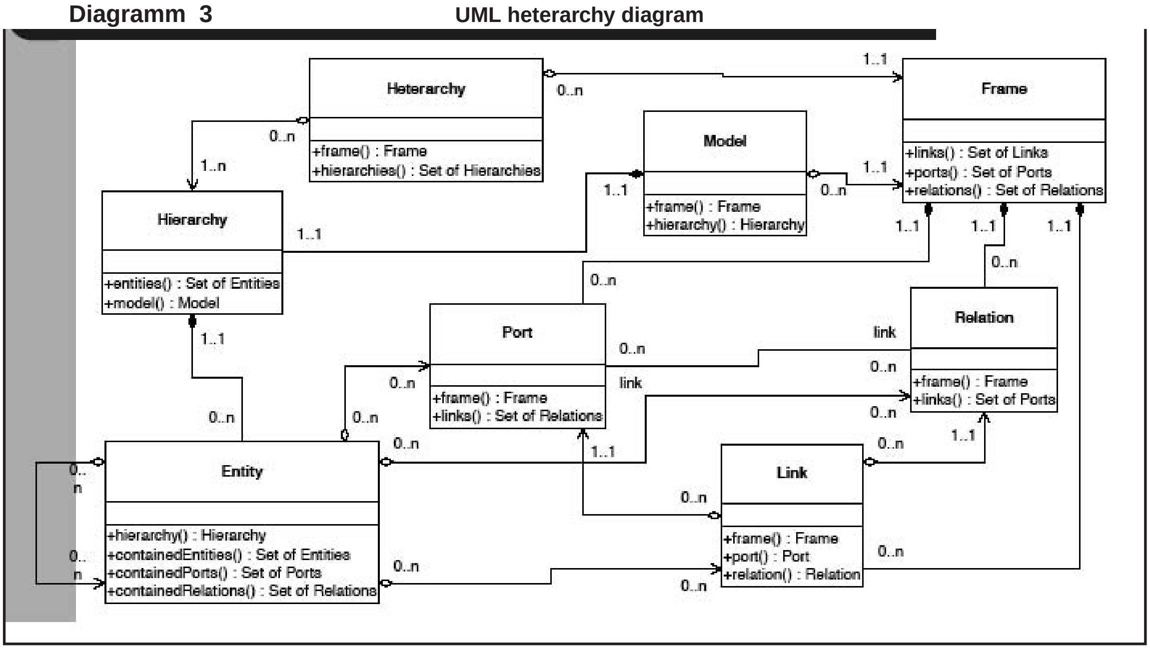
> "Whereas hierarchies involve relations of dependence and markets involve relations of independence, heterarchies involve relations of interdependence."
>
> "Stark has proposed "Heterarchy" to characterize social organizations with an enhanced capacity for innovation and adaptability.
>
> Networked or lateral organizations are in direct contrast with the tree-like, vertical chains of control of traditional hierarchies. The second feature means that heterarchies require diversity of components and building blocks." [Stark, 1999, page 159],

http://www.c3.lanl.gov/~rocha/GB0/adapweb_GB0.html

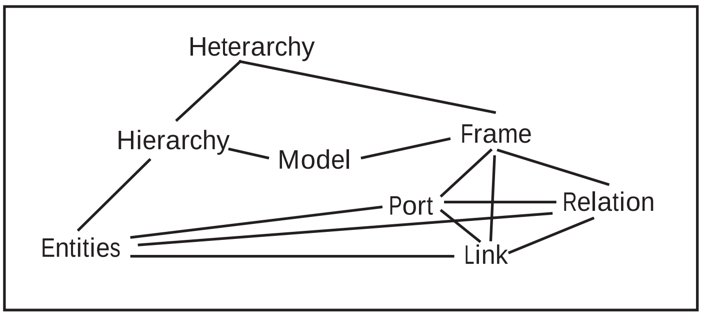
To give a more transparent modeling of the interactivity between hierarchies as it is proposed by the *proemial relationship* it maybe helpful to set the whole construction and wording into an UML diagram and to use the modeling of heterarchy worked out by Edward Lee as a helpful tool to explicate proemiality in terms of UML modeling.

Also the proemial relationship is not restricted to ontology and the distribution of hierarchical ontologies in a heterarchic framework and despite the fact that UML has no mechanisms of category change, metamorphosis and mediation it seems to be a helpful exercise to find a correspondence between the UML heterarchy diagram and the construction of proemiality which is more based on elementary terms of relationality. The heterarchy diagram is a class diagram which models the static structure of the system. Proemiality has, also it is fundamentally dynamic, its static aspects. It is this static aspect we can model with the help of the UML heterarchy diagram. A further step of UML modeling of proemiality will have to involve more dynamic models like interaction and activity diagrams.

Diagramm 3 **UML heterarchy diagram**



The conceptual graph of the UML heterarchy diagram may highlight its structure more directly.



It shouldn't be misleading to read the diagram as (methodological) hierarchy between the terms Heterarchy, Hierarchy and Entities. The additional terms Model, Frame, Port, Relation and Link are defining the structure of the interaction of the different hierarchies.

Abstract theories

Each hierarchy has its own ontology, logic, algebra, proof systems etc. To give an idea of the concept of interactivity between hierarchies let´s introduce the terminology of abstract objects or types or theories.

```
name=
  sorts s
    opns
        f: S^n --> s
        p: s^n
    eqns
       variable declaration
        L = R
```

"First of all, a name is given to the theory so that it becomes an identifiable unit binding together a number of operations and their properties into useful modules.

Keyword sorts opens the theory, listing the sorts or types of objects being defined in the abstract type.

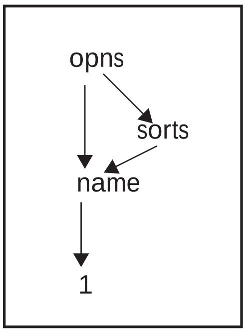
Next we have keyword opns followed by one line for each of the operations or predicates being defined in the abstract type.

Constants are seen as zero-arity operations.

The equations are defining equivalences between strings." (Downward, p.179)

Short, the abstract theory consists of the categories name, sorts, operations, equations which build, again, a strict hierarchy of their tectonics:

```
name=
   sorts
       opns
        eqns
```



The arrows in this diagram represents conceptual dependencies in the notion of name. The notation

opns —> sorts

for example, means that:

the concept of opns varies as the concept of sorts varies.

In particular, it means that the concept of opns, the one that we have in mind, cannot be independent of the concept of sorts and neither can a particular opn be independent of its particular sort.

The notation

sorts —> name

means that the concept of sorts varies as the concept of nat0 varies.

Therefore the notion of opns varies as the notion of nat0 varies:

opns —> name.

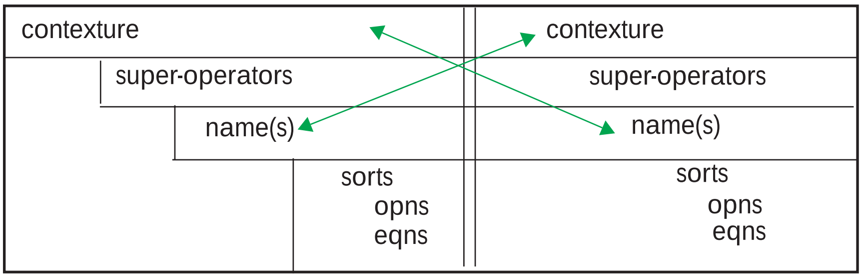
In a conceptual diagram, 1 represents the absolute. The notion

name —>1

expresses that the name notion is absolute, for it tells us that the name notion varies as the absolute varies – which is not at all.

Heterarchies are managing distributed hierarchies, therefor we are able to distribute abstract theories as such. This in itself would produce an interesting type of parallelism, architectonic parallelism. But more interesting are the interactions between hierarchies. A very conservative interaction is a one-to-one translation from one abstract theory to another abstract theory, based on morphisms. This form of interaction is basic for a successful realization of DSW applications.

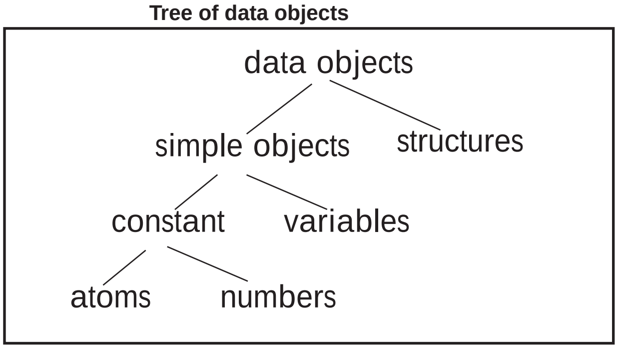
But the advantage of DSW come into play with the possibility of metamorphosis, that is the change of categories. This capability of DSW enables evolution of the system, discovery and creation of new domains, and marks the distinct difference to other architectures of a Semantic Web.



A simple example

There is an easy way of producing conflicts in a dialogical system, if e.g. L1 declares A as a simple object and L2 declares simultaneously A as a complex object, that is a structure. Obviously it is possible, in the polycontextural approach, to model this conflict and to resolve it in another logical system, say L3, this without producing a metasystem subordinating L1 and L2.

Diagramm 4 **Tree of data objects**



Furthermore, the conflict has a clear structure, it is a metamorphosis of the terms „simple object“ in L1 and „structure“ in L2. This metamorphosis is a simple permutation between sorts over two different contextures based on the chiastic structure of the mediation of the systems. But it respects the simultaneous correctness of both points of view in respect of being a „simple object“ and being a „structure“. In this sense it can be called a symmetrical metamorphosis.

Today computing is often characterized by its interactivity. But the programming languages have not changed to respond to this situation. They are still, in principle, monologic.

Ontology and the Semantic Mapping Problem

Why do we need all these abstract theories of translation and metamorphosis?

“One important issue in understanding and developing ontologies is the ontology or semantic mapping problem. We say “or semantic problem” because this is an issue that affects everything in information technology that must confront semantic problems–that is, the problem or representing meaning for systems, applications, databases, and document collections. You us always consider mappings between whatever representations of semantics you currently have (for systems, applications, databases, and document collections) and some other representation of semantics (within your own enterprise, within your community, across your market, or the world).

“This semantic problem exists within and without ontologies. That means that it exists within any given semantic representation such as an ontology, and it exists between (without) ontologies. Within an ontology, you will need to focus on a specific context (or view). And without (between) ontologies, you will need to focus on the semantic equivalence between different concepts and relations in two or more distinct ontologies.” Daconta, p. 218/19

This citation shows us the importance of mappings (translations, morphisms) between distinct ontologies. But don´t forget, these ontologies are applied, core ontologies, regional, and not general ontologies. They are parts, subsystems, instantiations of the one and only one general ontology, as formulated in GOL. This is an enormous restriction. Because, before we can interact with each other we have to agree to this general and global framework of GOL. But this is not always reasonable at all.

The mechanism of metamorphosis

DSW is introducing mappings, morphisms, translations and metamorphosis between first order ontologies, and is not concerned with regional, core ontologies only.

How does it work? The basic framework is given by the proemial relationship (Günther 1970).

"The answer is: we have to introduce an operator (not admissible in classic logic) which exchanges form and content. In order to do so we have to distinguish clearly between three basic concepts. We must not confuse

a relation

a relationship (the relator)

the relatum.

The relata are the entities which are connected by a relationship, the relator, and the total of a relationship and the relata forms a relation. The latter consequently includes both, a relator and the relata.

However, if we let the relator assume the place of a relatum the exchange is not mutual. The relator may become a relatum, not in the relation for which it formerly established the rela-

tionship, but only relative to a relationship of higher order. And vice versa the relatum may become a relator, not within the relation in which it has figured as a relational member or relatum but only relative to relata of lower order.

If:

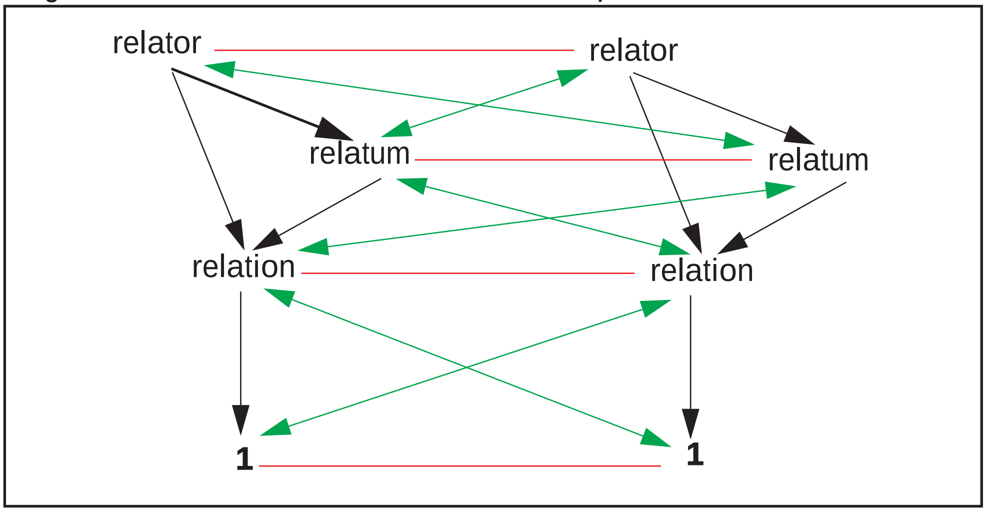
$R_{i+1}(xi, yi)$ *is given and the relaturn (x or y) becomes a relator, we obtain*

R_i *(xi-1, yi-1) where Ri =* x_i *or* y_i*. But if the relator becomes a relatum, we obtain*

$R_{i+2}(xi+1, yi+1)$ *where* $R_{i+1} = x_{i+1}$ *or* y_{i+1}*. The subscript i signifies higher or lower logical orders.*

We shall call this connection between relator and relatum the 'proemial' relationship, for it 'pre-faces' the symmetrical exchange relation and the ordered relation and forms, as we shall see, their common basis." Günther

Diagramm 5 **Proemial relationship**



PR: Rel(X,Y, Z,1) —> Rel(X,Y, Z,1)

Coincidence relation: id(Xi) eq Xj

Order relation: ord(Xi, Yi)

Exchange relation : exch(Xi) eq Yj

3 Development of a DSW Prototype Business Application

Increase in effectivity

This “killer application” will show a significant increase in flexibility, which goes hand in hand with an increase in speed and transparency of semantic information processing.

Attributes of a given static or stable, synchronic system

flexibility
speed
security
transformation

Attributes of dynamic evolving system

The dynamics of the semantic information processing in DSW opens up thew possibility to create new scenarios, invent new forms of interaction between business partners.

evolution
metamorphosis
co-creation
self-modification

How are the chances to develop a DSW Web Service?

Happily the Semantic Web community has developed lots of useful tools, free or commercial, to be used to develop the prototype of a DSW business application.

3.1 Web Services and Semantic Web, the classical view

http://www-106.ibm.com/developerworks/xml/library/x-ebxml/

Diagramm 6 **Web Service Scenario**

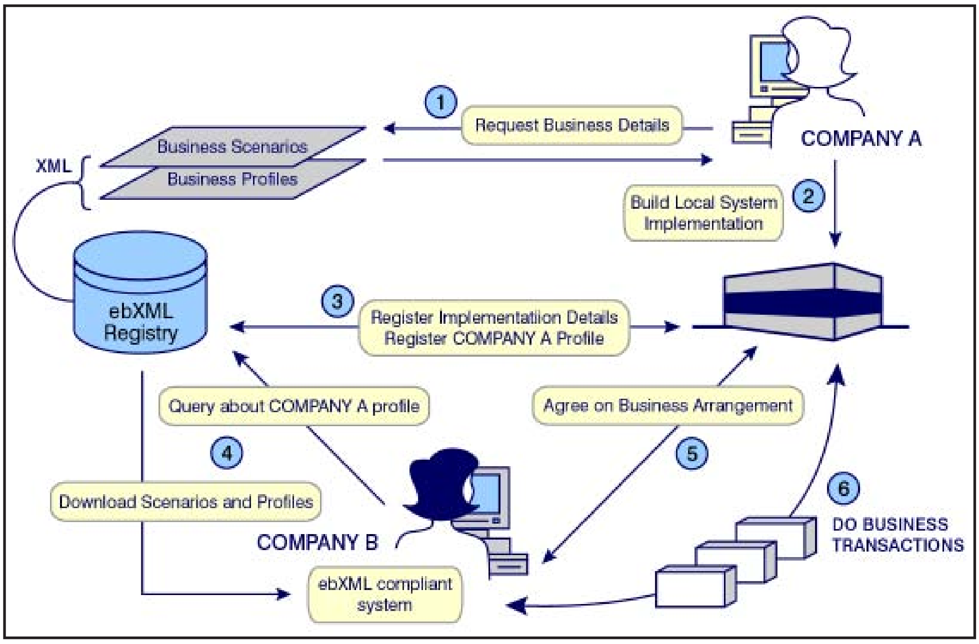
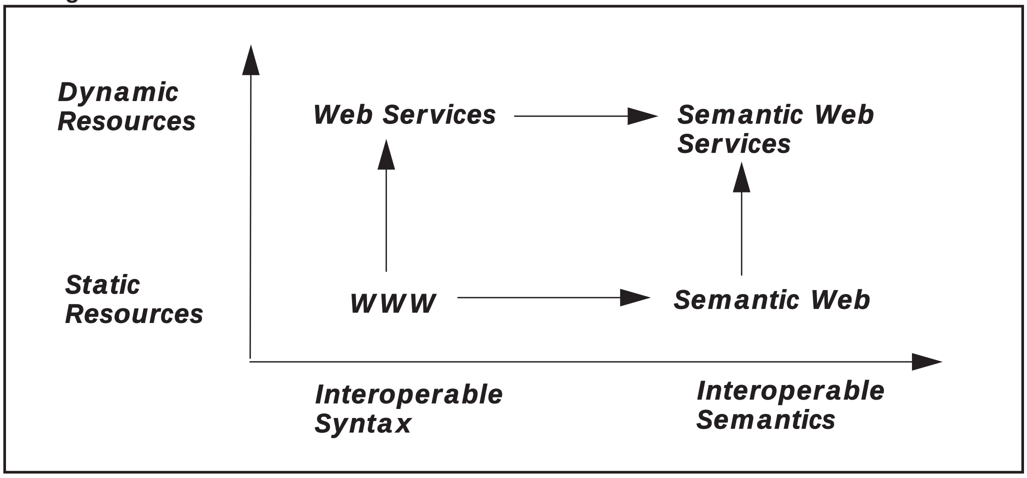


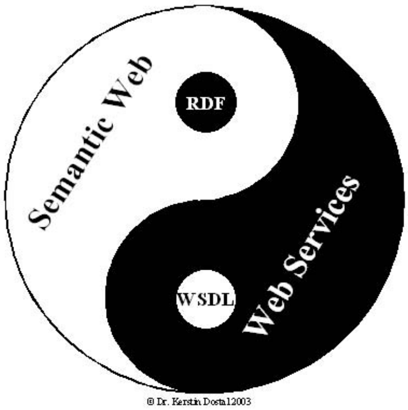
Diagramm 7 **Semantic Web Services**



Daconta, p.7

A metaphor of the internal dynamics of the components *Semantic Web, Web Services* and *RDF*, *WSDL* is given by the chiastic figure of the Ying-Yang-Picture by Wolfgang Dostal and Mario Jeckle, Semantik, Odem einer Service-orientierten Architektur.
http://www.jeckle.de/semanticWebServices/intro.html

Diagramm 8 **Ying-Yang-Picture**



3.2 A DSW business application is a DSW Semantic Web Service

THE Internet and THE WWW doesn't exist. THE WWW is a crude and awfully misleading nominalisation and abstraction from the evolving heterogeneous complexity of what we call the WWW.

THE Web Services are not a homogeneous business. They come in different and not homogeneous forms, that is, again, in heterogeneous definitions.

Heterogeneity itself is not a static term, too. It is a nominator for a flexible, loosely coupled evolving complexity of decentralized systems.

The Web is not only defined by its abstract specification but also by its use. The meaning of a sentence is not given by a catalog of administered meanings, but by its pragmatic use. And the administration of meaning is one and only one very special use of sentences and their meaning.

The picture of the situation has to be enlarged from Syntax&Semantics to, at least, Syntax&Semantics&Pragmatics (Hermeneutics).

Pragmatics or Hermeneutics is introducing different points of view, different irreducible contexts, that is, contextures, different approaches etc.

Syntax&Semantics&Pragmatics&Mediation

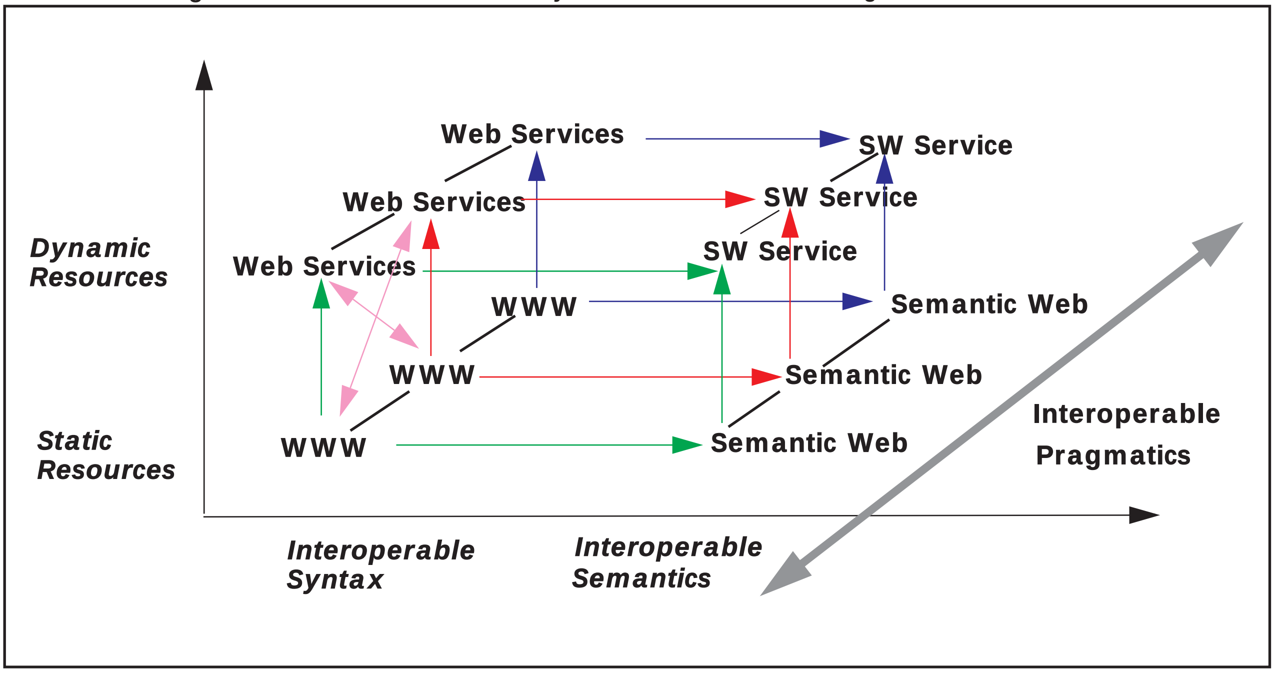
Mediation (Proemiality, Chiasm) is introducing the interlocking mechanism, the interactivity of all these different contextures.

Negotiation (Berthold Daum) is realized by human beings. But it is strongly supported by the mechanisms and rules of mediation. Insofar, DSW is not only introducing computer-aided semantics, but also several levels of computer-assisted negotiation.

This is in contrast, or better, in positive addition to Daum´s statement: *"Also obvious is that by the default the communication between observers can only be of informal nature. Consistent logical systems are only defined within a given context and, in general, cannot be used for knowledge transfer between different ontologies. The conse-*

quence is that some means of informal communication, such as natural language or heuristic mediation systems, is inevitable." Daum, p.185

Diagramm 9 Dynamic Semantic Web as a Pragmatic Web



Maybe that the structure of the metaphoric dynamism of the Ying-Yang-Picture is captured and formalized by the dynamics of distribution and mediation of contextures containing the basic quadruple of its different realizations.

3.3 What has do be developed to realize DSW?

Dynamic Semantic Web (DSW) consists in general of two main parts:
1. poly-Semantics
2. inter-Semantics or Pragmatics of mediation and navigation

Remember the Semantic Web hierarchy:
Trust, Proof, Logic Framework, Rules, Ontology, Contexts and
RDF Schema, RDF M&S, XML; Namespace and
URI; Unicode and
Digital Signature

poly-Semantics deals with the decomposition and distribution of different heterogeneous taxonomies, ontologies and their methods.

inter-Semantics deals with the interlocking mechanisms between the different heterogeneous contextures and their methods.

poly-Ontologies: Development of polycontextural ontologies

poly-Logics: Development of polycontextural logics and proof systems

3.4 How to establish a DSW system in a existing company?

It is not necessary to transform at first a business information system into a Semantic Web and in Semantic Web based Web Services. We can directly create a Dynamic Semantic Web transformation of the knowledge management system of an organisation.

What we can do on a informal non-technical level

Discover the heterogeneity of your data base.

Instead of trying to homogenize the different data systems it is more reasonable to understand them as an interacting system of heterogeneous parts. As a mediating tool to the full decomposition of a monolitic database into its heterogeneous parts, the method of *Metapattern* introduced by Pieter Wisse maybe a helpful methodology.

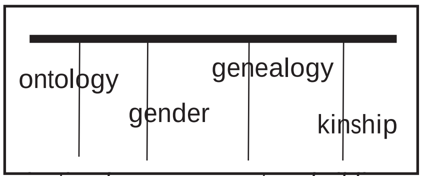
The classical Prolog example to prove an "aunt"-relationship can be decomposed from its hierarchical ontology into different situations mapped into different contextures and visualized in the metapattern.

kinship: married/not-married, in-law, aunt

gender: male, female

genealogy: parent, sibling

ontology: different/not-different



It is also possible that there is some over-determination because parent and sibling could also be part of kinship.

In Prolog all the facts belong to one ontology or to one semantic general domain or universe. All the rules are based on this mono-contextural ontology and on the corresponding logical operators AND and OR of the again, mono-contextural logic. Everything therefor is linearized and homogenized to a global or universal domain. This, if corresponding fairly with the real world situation is of great practicality and efficiency in both direction, in the case of the formal system, Prolog, and in the case of its data base.

But often, if not always, real world applications are much more complex than this. Even the fairly classical example is presupposing all sorts of facts which are not mentioned in the definition and which would belong to a different real world situation.

Instead of linearizing the above separated contextures kinship, gender, genealogy, ontology into one universal domain, for the example here represented by kinship, the polycontextural modeling is asking for an interweaving and mediating of these different contextures together to a complex poly-contexturality.

Why should we model a simple situation with highly complex tools into a complex model if we can solve the problem with much simpler tools? Simply because the classical approach lacks any flexibility of modeling a complex world. The truth is, that the simple approach needs an enormous amount of highly complicated strategies to homogenize its domains to make it accessible for its formal languages.

Decompose your data jungle into heterogeneous contextures.

Build your ontologies out of the distinct heterogeneous contextures.

Discover the interlocking mechanisms between heterogeneous systems.

Learn to navigate between different contextures and points of view.

With the help of the tools of implemented chiasms you have control and transparency about your navigations.

Navigation is more than translations (semantic mapping) or merging of local ontologies it opens up the possibility to access distinct “foreign” ontologies for cooperation which would otherwise be undiscovered.

To make business is not restricted to one business model, like the US american one. Globalization has not to homogenize different other ways of making business. Dynamic Semantic Web opens ways of mediating heterogeneous approaches on all levels of information processing.

Find leading metaphors for decomposition, mediation, navigation, negotiation which are accepted by your group and organization.

What we can do on a formal, engineering level

What are the Tools?

Research and commercial tools for creating ontologies

OntoEdit

Protege

OilEd

Evolving and self-modifying systems

Dynamics between Ontologies and contexts

Goguen on Semiotics and Category Theory

Further Extension of the Smartness of objects (data) (p. 3)

Logically it is a chiasm of Universe and sorts in many-sorted first order logics.

Heterarchies, in ontologies

Heterarchies, in logics

Heterarchies, in proof systems

Heterarchies, in taxonomies

Cybernetic Ontology and Web Semantics

back to page 1

There's more than one way to describe something

"No, I'm not watching cartoons! It's *cultural anthropology*."

"This isn't smut, it's *art*."

"It's not a bald spot, it's a *solar panel for a sex-machine.*"

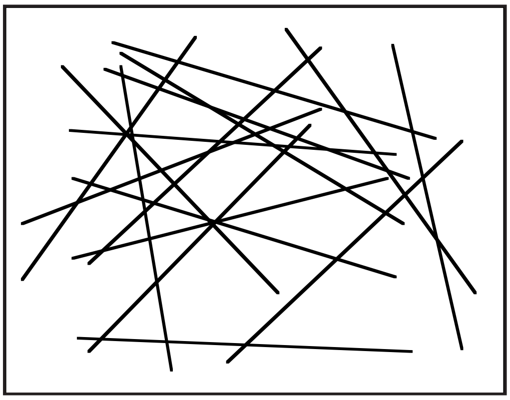
Reasonable people can disagree forever on how to describe something. Arguably, your Self is the collection of associations and descriptors you ascribe to ideas. Requiring everyone to use the same vocabulary to describe their material denudes the cognitive landscape, enforces homogeneity in ideas.

And that's just not right.

Metacrap: Putting the torch to seven straw-men of the meta-utopia
Cory Doctorow
http://ontology.buffalo.edu/

1 Life as Polycontexturality

By showing how Becoming has a component of Being as well as Nihility, he (Hegel) unwittingly laid ground to a theory of "poly-contexturality". Because, if we want to establish such a theory, we should not assume that all contexturalities can be linked together in the way a geographical map shows one country bordering on the next in a two-dimensional order. If the contexturality of Becoming overlaps, so to speak, the contexture of Being as well as of Nothingness, and the contexture of Becoming in its turn may be overlapped by a fourth contexture which extends beyond the confines of the first three, we will obtain a multi-levelled structure of extreme logical complexity.
Table I



Hegel´s logic further shows that if a plurality of contextures is introduced one cannot stop with three. In fact, one has to postulate a potential infinity of them. If one believes Hegel and there are most convincing arguments that one should - then each world datum in the contexturality of Being should be considered an intersection of an unlimited number of contextures. Table II with its seeming chaos of straight lines crossing each other at all possible angles may illustrate what is meant. Each contexture is logically finite insofar as its structure is confined to two values. But their respective ranges are infinite because one can generate, within the respective domain, a potential infinity of natural numbers. We have indicated the logical finiteness of the different contextures by having them represented by lines no longer than 2 inches.

The concept of contexturality illustrates the age-old logical distinction between identity and sameness. If I count 1, 2, 3, 4, º and so does my neighbor, then the numbers we both count are the same. However, insofar as these numbers have their existence only in the counting process, they are not identical because the two counting procedures can be clearly distinguished as having different origins in two separate organic systems. In other words: in the situation described above the sequence 1, 2, 3, 4, º turns up in two separate contextures. And no matter how far I count there is no number high enough to permit me to cross over to the psychic space of my neighbor.

Gunther, Life as Polycontexturality

New ontology, new Logics

This essay presents some thoughts on an ontology of cybernetics. There is a very simple translation of the term "ontology". It is the theory of *What There Is* (Quine). But if this is the case, one rightly expects the discipline to represent a set of statements about "everything". This is just another way of saying that ontology provides us with such general and basic concepts that all aspects of Being or Reality are covered. Consequently all scientific disciplines find their guiding principles and operational maxims grounded in ontology and legitimized by it. Ontology decides whether our logical systems are empty plays with symbols or formal descriptions of what "really" is.

The following investigation arrives at the result that our present (classic) ontology does not cover "everything". It excludes certain phenomena of Being from scientific investigation declaring them to be of irrational or metaphysical nature. The ontologic situation of cybernetics, however, is characterized by the fact that the very aspect of Being that the ontologic tradition excludes from scientific treatment is the thematic core and center of this new discipline. Since it is impossible to deny the existence of novel methods and positive results produced by cybernetic research, we have no choice but to develop a new system of ontology together with a corresponding theory of logic The logical methods that are used faute de mieux in cybernetics belong to the old ontological tradition and are not powerful enough to analyze the fresh aspects of Reality that are beginning to emerge from a theory of automata.

Gunther, Cybernetic Ontology

1.1 System Architecture in XML

"Also obvious is that by the default the communication between observers can only be of informal nature. Consistent logical systems are only defined within a given context and, in general, cannot be used for knowledge transfer between different ontologies. The consequence is that some means of informal communication, such as natural language or heuristic mediation systems, is inevitable." Daum, 185

Interactivity, between trans-contextural and transjunctional operators

Inevitably *"of informal nature"* only from the point of view of the local logical systems, but not under consideration of the more global logical operations of transjunction, which are exactly introduced for the purpose of trans-contextural interactions. Polycontexturality in the sense of Gunther, which is quite different from followers like Niklas Luhmann, is not only a *"combined system of multiple ontologies (polycontexturality) with a multileveled logic calculus"* as Daum recognized well, but also a complex system of interactivity between different contextures ruled by trans-contextural operations. These transjunctional and trans-contextural operators are operators in a exact formal sense, not only defined logically inside a contexture but also between contextures. The concept and formal definition of transjunctions had been introduced by Gunther in his famous paper *Cybernetic Ontology and Transjunctional Operations* (1962) even before he radicalized his position to a transition from multiple-valued ontologies to poly-contexturality. A more general approach of interactivity between contextures was introduced by Gunther in *"Natürliche Zahl und Dialektik"* (1972) but this concept goes back at least to the concept of an *inter-ontology* as considered in *"Natural numbers in Trans-Classic Systems"* (1970), *"The philosophical theory on which cybernetics may rest in the future may well be called an inter-ontology."* Following Gunther´s work I developed a complex philosophical and mathematical theory of interactivity in the framework of polycontexturality, developing and using notions like proemiality, chiasms, diamond strategies and co-algebras (SKIZZE-0.9.5).

We shouldn't forget to distinguish between different switches of contextures and bifurcational transitions of trans-contextural operations.

Bifurcations
Replications
Merging

1.2 Heuristic mediation of contextural switches

Also the introduction of trans-contextural operations is formal and operative, this interactions are not mechanical and predictable, but possible. Each decision a system takes to change contextures or to split into different contextures is spontaneous and creative. But this creativity is not based on chaotic “Willkür” it is not ruled but rule-guided by the trans-contextural operators. If we speak about the speechless of the counting process of natural numbers, the change from one contexture to another contexture of distributed natural numbers has to be commented, it is open to negotiation and interpretation, therefore we can speak not only about but of numbers. This way of speaking about trans-contextural changes, in other words of creativity, is not the free flouting way of speaking reclaiming deep insights about negativity and irrationality as opposed to mechanical rule-systems, but a new interweaving and interlocking process of speaking, conceptual writing and formal notations.

Rational decision-making of creative systems is in itself a polycontextural procedure, it is an interlocking mechanism of cognition and volition, a double gesture and not reducible to ultimate meta- or proto-systems.

2 Heideggers radical deconstruction of ontology

2.1 self-modifying media

Gunther´s chain of notions deliberating thinking from ontology:
ontology
meontics
poly-thematics
poly-contexturality
morphogrammatics
kenogrammatics
proemiality
negative languages

2.2 Freezing and melting ontologies

Ontology based web semantics, Semantic Web, is in danger to freeze the processuality of the development of the Internet.

Classical ontology, with pluralities in score and upper dimensions are not prepared for self-referential processes: the arrival of Web Semantics in the Internet is changing the Internet in introducing itself. It is a self-modifying media.

Heidegger, Whitehead, Gunther on self-modifying media processuality.

Web Semantics as based on ontologies is accepting classical logic in its Proof procedures as an ultimate system of rational reasoning. But logic itself is based on ontology, maybe analytic philosophy has forgotten this. Ask Quine.

Conflicts between flexibility, navigation and normation.

2.3 The world as a grid of upper-level ontologies

The significance of Heideggers questioning of classical ontology has a very practical reason for Web Semantics: It opens up the possibility of a multitude of interacting fundamental ontologies, that is of upper-level ontologies. Aristotelian ontology as proposed by the "hierarchy movement" of Web Semantics is blind of its restriction to one and only one contexture.

The world as the place in which a historical event like the development of Aristotelian ontology is possible does not consists of ontological entities, neither Urelements nor sets. The world gives or opens up the space and the fundamental possibility of ontologies of different types. Therefore, the loci where different ontologies are placed, positioned and situated are in a radical sense empty of any ontological, logical, semantical, arithmetical etc. meaning; they are empty places, written, inscribed as kenograms. The world as a kenogrammatic grid offers a structure for the distribution and interaction of different ontologies. Kenogrammatics, therefore, is the study of the structure and behavior of these grids of empty places. Trivially, because I am using a language to express these thoughts which is highly hierarchical it is natural to think that now the term "world" is the ultimate being. But this is wrong insofar as the whole mechanism, say of kenogrammatics, which is inscribed in a "trans-mathematical" formalism, shows a totally different behavior, that is a heterarchical in contrast to a hierarchical.

2.4 Ontology and logics of multi-media

2.5 Morphogrammatics of XML

3 Ontologies in different fashions

3.1 many-sorted logics

3.2 fibred category systems

3.3 polycontexturality

Fibres and navigation

4 Revival of classic ontology in Web Semantics?

The four systems concerned by this project provide this structure in very different ways and with different conceptual 'textures'. For example, the AGROVOC and ASFA thesauri put "aquaculture" in the context of different thesaurus hierarchies: according to AGROVOC the terms more specific than "aquaculture" are "fish culture" and "frog culture", whereas in ASFA they are "brackishwater aquaculture", "freshwater aquaculture", "marine aquaculture". Two different contexts relating respectively to species and environment point of view. With such different interpretations of a term, we can reasonably expect different search and indexing results. Nevertheless, our approach to information integration and ontology building is not that of creating a homogeneous system in the sense of a reduced freedom of interpretation, but in the sense of **navigating alternative interpretations**, querying alternative systems, and conceiving alternative contexts of use.

To do this, we require a comprehensive set of ontologies that are designed in a way that admits the existence of many possible pathways among concepts under a common conceptual framework. This framework should reuse domain-independent components, be flexible enough, and be focused on the main reasoning schemas for the domain at hand. **Domain-independent, upper ontologies** characterise all the general notions needed to talk about economics, biological species, fish production techniques; for example: parts, agents, attribute, aggregates, activities, plans, devices, species, regions of space or time, etc. On the other hand, the so-called core ontologies characterise the main conceptual habits (schemas) that fishery people actually use, namely that certain plans govern certain activities involving certain devices applied to the capturing or production of a certain fish species in certain areas of water regions, etc.

Upper and core ontologies provide the framework to integrate in a meaningful and intersubjective way different views on the same domain, such as those represented by the queries that can be done to an information system.

http://www.loa-cnr.it/Publications.html

Some links:
http://www.ifomis.uni-leipzig.de/People/People.html
http://ontoweb.aifb.uni-karlsruhe.de/
http://www.websemanticsjournal.org/

Ontology Groups
http://www.cs.utexas.edu/users/mfkb/related.html

Flexibility ruled by an upper framework?

"To do this, we require a comprehensive set of ontologies that are designed in a way that admits the existence of many possible pathways among concepts under a common conceptual framework."

Why should the common *"conceptual framework"* be thought in a hierarchical way? There are two possible ways of dealing with the task of finding an "upper ontology" which is "domain-independent" and so on. One is the classical way of *hierarchy*, as well established and studied and transformed to new applications like the search for a semantics of the Web. The other possibility which is able to cover all mentioned attributes of the "upper ontology" is offered by the strategy of *heterarchy* and *proemiality*. Heterarchy is neither hierarchy nor anarchy.

The classical approach seems to guarantee a good flexibility on the core base, the regional ontologies, by stabilizing its concepts on the upper level of the "common conceptual framework" which includes basic ontological and logical terms like "*parts, agents, attribute, aggregates, activities, plans, devices, species, regions of space or* *time, etc."* but the game doesn't stop here. What are "*parts*" from one vantage point can be "*wholes*" from another, "*agents*" can be understood as "*attributes*", "*activities*" as "*plans*", etc.

"Nevertheless, our approach to information integration and ontology building is not that of creating a homogeneous system in the sense of a reduced freedom of interpretation, but in the sense of ***navigating alternative interpretations****, querying alternative systems, and conceiving alternative contexts of use."*

What is the range of navigation? To navigate between alternative interpretations sounds quite polycontextural. But where are the limits, if not in the supposed basic logic and how does the navigation work? What are the rules of navigation? Are they ontological or logical or spontaneous?

Navigation and negotiation

The conflicting restless of interactivity between different ontology can come to a rest in a common upper ontology based on negotiation and agreement. But this upper ontology turns out to be a lifeless abstraction. Another result of negotiation could be a mediation between different ontologies which accepts the differences between the ontologies but is able to find intermediating rules of interactivity. Only in well established and simple situation we can discover a translation from one ontology to an other ontology conserving their ontological categories, like sorts to sorts, operations to operations, and so on.

Kenogrammatics as a common base of different ontologies

Different ontologies, if not anyway based on a common upper ontology and common first-order logic, have, even if they are incomparably different, irreducible to a common ground, one thing in common, they have, each for itself, a position. They take a position, occupy a position, a locus, where?, in some very general sense, in the world. This does not mean that they have in common a general concept of the world. This would be released by a general ontology and logic. But even general ontology and logic are taking place, are placing themselves in the world. It also does not mean that they share in abstracto a common empty locus. Each ontology is based on its own locus. And also the loci are empty they are not the same.

These loci have no attributes, no predicates, no relations, no processualities etc. nevertheless they exist, in a non onto-logical sense, but give place for ontology and logic, and ontologies and logics. There is also not a single primordial place, like nothingness or ultimate emptiness, there is multitude of empty places, differentiated between the same and not the same, in a non-logical sense.

These monsters of negative conceptuality are inscribed as kenograms (kenos, gr. empty). The grid of kenograms is the non-basic base of the distribution and mediation, the interactivity and navigationality of different ontologies.

Formal ontology, category theory and kenogrammatics

Formal upper ontologies are often described in terms of set theory. A more general approach would be to formalize ontologies with the means of category theory. The most basic and abstract distinction in category theory is the distinction between morphisms and objects.

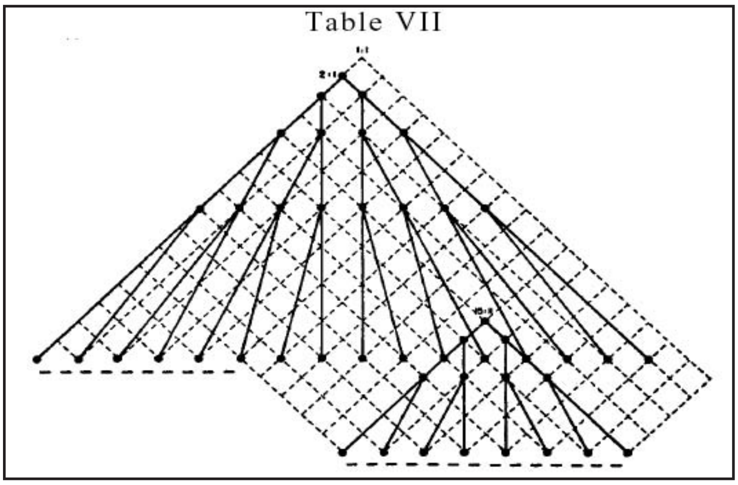
With this, another introduction of the empty positions, kenograms, of formal upper ontologies can be offered. Two ontologies may be conceptually different in the sense that one ontology is based on its objects, similar to the set theoretic based ontology, and the other one is based on its morphism, like a more processual and dynamic ontology. What are objects in one ontology are morphisms in the other one. This maybe a clue for a translation between both. This translation could be done by, again, a category theory, which is based more on objects or more on morphisms. Obviously, we would establish with this procedure some of the well known infinite regresses of meta-language constructions.

With the help of the diamond strategies we can ask for a “common ground” outside of the dichotomy of category theoretic objects and morphisms. To characterize the position of each formal upper ontology we look for a situation in which there are neither objects nor morphisms, where the whole dichotomy is rejected. This place of emptiness of objects and morphisms is accessible as kenogrammatics, that is, as the kenogrammatics of the play of objects and morphisms.

Kenogrammatic systems are not meta-languages but in some sense proto-inscriptual grammars.

What is wrong with kilts?

This happened recently in the funny conflict of taxonomic notions and cultures between Scotland and the EU. Kilts are skirts, skirts are connected to female, male is connected to trousers, therefore Kilts are female clothes. What to do? Introduce exceptions. In a few turns the ontology consists of thousands of exceptions and some simple general classificatory rules will be left. The other necessary strategy is to ban the object. Therefore nearly all sorts of Camembert cheese have to disappear. This madness happens automatically if we take distinctions like male/female and skirts/trouser as substantial and not as functional and depending on contexts. And how could the European taxonomy run together with one of the many Asian taxonomies? Taxonomy and ontology without ethnology is behind globalization movements.



Is this not exactly the situation of XML? XML tries to be a general language not subsuming the thousands real world languages of the Internet but enabling and supporting this diversity.

But how can this be done if XML is not more than a simple tree?

Web Semantics: Science, Services and Agents on the World Wide Web

This interdisciplinary journal focuses on research at the intersection of three major research areas: semantic web, agent technology and grid computing. We call this interdisciplinary field Web semantics. Web semantics investigates and develops the standards, ontology's, protocols and technology that contribute to the development of a knowledge-intensive and intelligent service Web. This is often referred to as the second generation of the Web.

Background

The data in computers exists in a bewildering variety of mutually incompatible forms and ever more intense efforts are needed to smooth the process of data integration. The most important such efforts lie in database standardization achieved through the construction of benchmark taxonomies into which all the classification systems pertinent to a given domain would need to be translated only once. Benchmark taxonomies can ensure that all databases calibrated in their terms would be automatically compatible with each other.

‘Ontology’ is the name given by information scientists to the construction of such benchmark taxonomies. This name was chosen in reflection of the fact that in building such taxonomies one is confronted by issues with which philosophical ontologists have grappled since Aristotle’s day, issues which have once again moved into the center of contemporary philosophy under the heading ‘analytic metaphysics.’

Information systems ontology has implications beyond the domain of data integration. Its methods are used for purposes of information retrieval and extraction from large corporations and libraries (for example of medical or scientific literature). These methods are currently being applied to the problems of navigation on the Internet in work on the so-called Semantic Web. They are used as a basis for work on natural language processing and automatic translation, in enterprise integration, and, most significantly, as a means of integrating the results of inquiries in neighboring scientific fields – for example when inquiries in computational chemistry or structural biology need to be cross-calibrated with the results of inquiries at higher (for example medical or epidemiological) levels of granularity, as for example in the work of the Gene Ontology Consortium .

http://ontology.buffalo.edu/proto-ifo/

Afortunadamente, la situación es hoy muy diferente, gracias a los trabajos pioneros de tres caballeros. Gothard Gunther, un filósofo, ahora profesor en la Universidad de Hamburgo, que desarrolló el más fascinante sistema lógico de valores múltiples [Gunther 1976], muy diferente de los de Tarsky, Quine, Turquette y otros. Lars Lofgren, un especialista en lógica de Lund, Suecia, que introdujo la noción de 'autología',1 es decir, de los conceptos que pueden ser aplicados a sí mismos y que, en algunos casos, se necesitan a sí mismos para existir. Me ocuparé de estos puntos en un momento. Finalmente, Francisco Varela, que está sentado aquí mismo y que, como ustedes saben, expandió el cálculo de indicaciones de G. Spencer-Brown transformándolo en el cálculo de la autoindicación [Varela 1975].

http://ladb.unm.edu/econ/content/cuadeco/1997/january/principios.html

Mr Latifs Laundrette

Many Sorted Logic: Frequently one has a pile of clothes with many different sorts of washing instructions (different temperatures or spin speeds) but not enough of any type to make a full load. Use of Many Sorted Logic will enable all these clothes to be washed together in a single universe (washing machine) whilst preserving the integrity of the clothes.

http://www.aisb.org.uk/hacker/1998.html

Ontology, the new obsession

1 On the General Ontological Foundations of Conceptual Modeling

Diagramm 10 **Aristotelian Hierarchy**

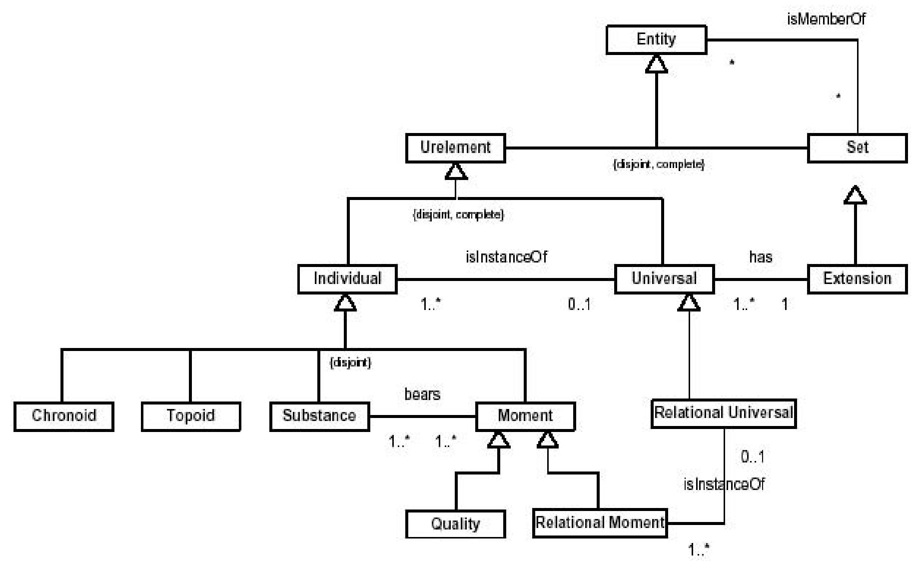


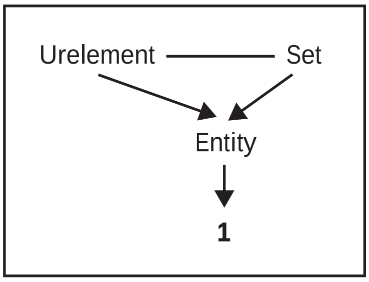
Fig. 1. A UML class diagram describing the basic concepts of GOL.

2 Urelements and Sets

One of the basic distinctions of GOL is the distinction between *urelements* and *sets*. We assume the existence of both urelements and sets in the world and presuppose that both the impure sets and the pure sets constructed over the urelements belong to the world. This implies, in particular, that the world is closed under all set-theoretical constructions. Urelements are entities which are not sets. They form an ultimative layer of entities without any set-theoretical structure in their build-up. Neither the membership relation nor the subset relation can unfold the internal structure of urelements.

In GOL, urelements are classified into two main categories: *individuals* and *universals*. There is no urelement being both an individual and a universal.

Conceptual graph of the basic triple (Entity, Urelement, Set) and its uniqueness 1.



Comments

"We assume the existence of both urelements and sets in the world" in doing this, do "we" belong to this world or not?

"This implies, in particular, that the world is closed under all set-theoretical constructions." Maybe we can live with that. But didn't we not just learned that, to develop a non-onto-theo-logical ontology, we should questioning the very presupposition of classical ontology, namely its presupposed "world". Today, it is not nonsensical to ask "Which world do you mean?" There is surely one world which is build up of Ur-Elements and Sets, but what´s about the other worlds? And what´s between these worlds? And what happens if we cannot resist to clone this very concept of Ur-Elements, too?

"Ur-Elements", are they not Kant´s Ding an sich-type monsters?

What is your Urelement is my "chronoid", why not?

In the world of Ur-Elements there is no liveliness and metamorphosis. All changes in this world concept are based on Ur-Elements, which are stable and eternal.

Why do we need set theory to build ontologies? With this decision we are loosing the chances of a much more flexible modeling say by category theory and combinatory logic. Not to speak of the possibilities opened by polycontextural logics and its first order ontologies.

3 Formal Ontology and First Order Logic, revisted

The new, post-analytic movements towards a reformulation of ontology goes back to Brentano, Meinong and a restricted reading of Husserl and is restoring an old discussion about the relationship between ontology and logics which went lost during the success of formal logic and later by the dominance of computer science paradigms. This discussion is extensively documented in the German literature of the 50th.

Gotthard Gunther, again, was a lonely voice, in America and Germany, to empathize the importance of the connection between ontology and formal logic after the early discussion disappeared from the academia. But in contrast to the new neo-Aristotelian movement, Gunther was able to connect his work to another, still not recognized movement of ontology, the transcendental ontology of Husserl, called phenomenology and the deconstructive efforts to surpass the limits of classical ontology by Martin Heidegger, as a radical non-Aristotelian ontology, called polycontextural theory going hand in hand with an equal non-Aristotelian logic. Not surprisingly Gunthers work was intrinsically connected with attempts to formalize Hegels dialectics and to develop a *"Cybernetic Theory of Living Systems"* at the BCL.

His ontology is therefore not "conservative" and "descriptive" but "constructive" and "revolutionary" thematizing not so much what just is, as given or even natural, but what has to be done, the artificial, and what is primordially interwoven with time, the ontology of living tissues, natural and artificial, and beyond.

> The present paper outlines a formalisation of elementary formal ontology. In contradistinction to a *material* ontology, *formal* ontology is concerned, not with the specification of the constituents (individuals, properties and relations) in a particular domain or region of the world, but with the axiomatisation of the most general, pervading categories that partition and shape reality as a whole.
>
> As Barry Smith has pointed out, the use of the qualifier "*formal*" is liable to give rise to a fundamental misunderstanding: formal ontology is not merely the application of formal-logical methods to the study of metaphysics.
> Rather, the very success of mathematical logic has led to a "running together of the formal and formal logical", and ultimately to a confusion of ontology with logic and with the study of the structure and semantics of artificial languages, at least as far as much philosophy in the analytic tradition is concerned.
> Only fairly recently, in an influential collection of studies in the philosophy of Brentano, Husserl and their followers was there triggered a revival of a scientific metaphysics in the Aristotelian tradition that is not a mere appendix to predicate logic and set theory.
> Indeed, the *formal/material* distinction has a wider range than just the specialist area of mathematical logic; it reflects the general opposition between form and matter in the realm of things as well as in the realm of truths. Just as formal logic studies the abstract relations between propositions, so formal ontology is concerned with the formal relations between entities.
> Formal-ontological *constants* are like formal-logical ones insofar as their meaning can be characterised purely in terms of operations and transformation rules. Formal *relations* (such as parthood, dependence, but also identity and instantiation) are not mediated by ties (accidents, moments) of any sort, in contrast to material relations (such as "being a parent of", "being the moon of", and so on), but hold directly of their relata. Formal properties and relations can therefore be instantiated by objects in all material domains or spheres of being.
>
> That is why formal ontology as the study of formal categories can justifiably be claimed to be the most general possible theory about the world.

> Thus it should not come as a surprise that formal ontology is *realist* rather than *conceptualist*, inasmuch as it is an inquiry into the general features, the real aspects of the denizens of the world out there, and not into the basic characteristics of the conceptual framework which we happen to be equipped with as members of the human species or a particular ethnic group.
> Formal ontology is *conservative* or "descriptive" instead of revolutionary or "revisionary", insofar it takes - salva consistentia - our everyday ways of speaking about the world at face value as the most detailed and corroborated description of reality available, but proceeds to theoretical revisions of so-called commonsense if required for the sake of coherence and, above all, scientific adequacy. p. 2-3

Formalised Elementary Formal Ontology, p. 2-3
ISIB-CNR Internal Report 3/2002
Padova, Italy, June 2002
Luc Schneider, MSc, MA

> 4 A Four-Category Ontology
> 4.1 Universals and Particulars
> Like Lowe ([70], pp. 203-209) and Smith ([81], p.291, & [117]), I adopt a four-category ontology based on Chapter 2 of Aristotle's *Categories* ([3], 1a, 20 ?), which classifies possibilia according to whether they are:
> 1. said of or attributed to a subject or not, i.e. universals and particulars,
> and
> 2. inhering in a subject or not, i.e. accidents and substances.
> ibd. p. 36

4 Contributions to the Axiomatic Foundation of Upper-Level Ontologies

Wolfgang Degen, Heinrich Herre

Unary basic symbols.

$Ur(x)$	(urelement)	$Set(x)$	(set)	$Ind(x)$	(individual)
$Univ(x)$	(universal)	$Mom(x)$	(moment)	$Subst(x)$	(substantoid)
$Sit(x)$	(situoid)	$Top(x)$	(topoid)	$Chron(x)$	(chronoid)

Symbols for binary and ternary basic relations.

$\in$	(membership)	$::$	(instantiation)	$:\succ$	(inherence)
$<$	(part-of)	$:\mu(x,y,z)$	(rel. part-of)	$:\sqsubset$	(framing)
$: ass(x,y)$	(y ass. to y)	$:\triangleright$	(is contained in)	$: occ(x,y)$	(x occupies y)
$ext(x,y)$	(is extension)				

An ontological signature ? is determined by a set S of symbols used to denote sets (in particular extensional relations), by a set U of symbols used to denote universals, and by a set K of symbols used to denote individuals. An ontological signature is summarized by a tuple ? = (S ,U;K).

The syntax of the language $GOL(\Sigma)$ is defined by the set of all expressions containing the atomic formulas and closed with respect to the application of the logical functors $\vee, \wedge, \rightarrow, \neg, \leftrightarrow$, and the quantifiers $\forall, \exists$. We use untyped variables $x, y, z, \ldots$; terms are variables or elements from $\mathsf{U} \cup \mathsf{S} \cup \mathsf{K}$; r, s, s_i, t denote terms. Among the atomic formulas are expressions of the following form: $r = s$, $t \in s$, $r :\succ \langle s_1, \ldots, s_n \rangle$, $v :: u$, $t {:} \sqsubset s$, $t {:} \triangleright s$.

Axioms of Basic Ontology

(a) Sort and Existence Axioms

1. $\exists x(Set(x))$,
2. $\exists x(Ur(x))$
3. $\forall x(Set(x) \vee Ur(x))$
4. $\neg\exists x(Set(x) \wedge Ur(x))$
5. $\forall x(Ur(x) \leftrightarrow Ind(x) \vee Univ(x))$
6. $\neg\exists x(Ind(x) \wedge Univ(x))$
7. $\forall xy(x \in y \rightarrow Set(y) \wedge (Set(x) \vee Ur(x)))$

(b) Instantiation

D. $ext(x, y) =_{df} Univ(x) \wedge Set(y) \wedge \forall u(u :: x \longleftrightarrow u \in y)$.

1. $\forall xy(x :: y \rightarrow Ind(x) \wedge Univ(y))$
2. $\forall x(Univ(x) \rightarrow \exists y(Set(y) \wedge \forall u(u \in y \longleftrightarrow u :: x)))$

(c) Axioms about sets

1. $\forall uv\exists x(Set(x) \wedge x = \{u, v\})$
2. $\{\phi^{Set} \mid \phi \in ZF\}$, where ϕ^{Set} is the relativization of the formula ϕ to the basic symbol $Set(x)$.[3]

KIF adopts a version of the Neumann-Bernays-Gödel set theory, GOL assumes ZF set theory.

6 Conclusions

The development of an axiomatized and well-established upper-level ontology is an important step towards a foundation for the science of Formal Ontology in Information Systems. Every domain-specific ontology must use as a framework some upper-level ontology which describes the most general, domain-independent categories of reality. For this purpose it is important to understand what an upper-level category means, and we proposed some conditions that every upper- level ontology should satisfy. The development of a well-founded upper-level ontology is a difficult task that requires a cooperative effort to make signicant progress.

Formal GOL, referring to the ontology of Aristotle seems to be specially conservative and seems to have no connection to the new trends of digitalism and computionalism. Also, it lacks an understanding and application of Category Theory as a description and construction language.

4.1 Formal GOL and the nature of Digital Metaphysics

Eric Steinhart

"More precisely, programs are ordering of abstract transformations of abstract states of affairs. Their executions are series of concrete transformations of concrete states of affairs, that is, histories. The set of all executions of a program is a nature. Programs have truth-values, and a program is true of a thing exactly to the extend that its nature is coextensive with the nature of the thing."

4.2 Formal GOL and the Metaphor of Cellular Computation

Ali Mohammed"
Computationalism

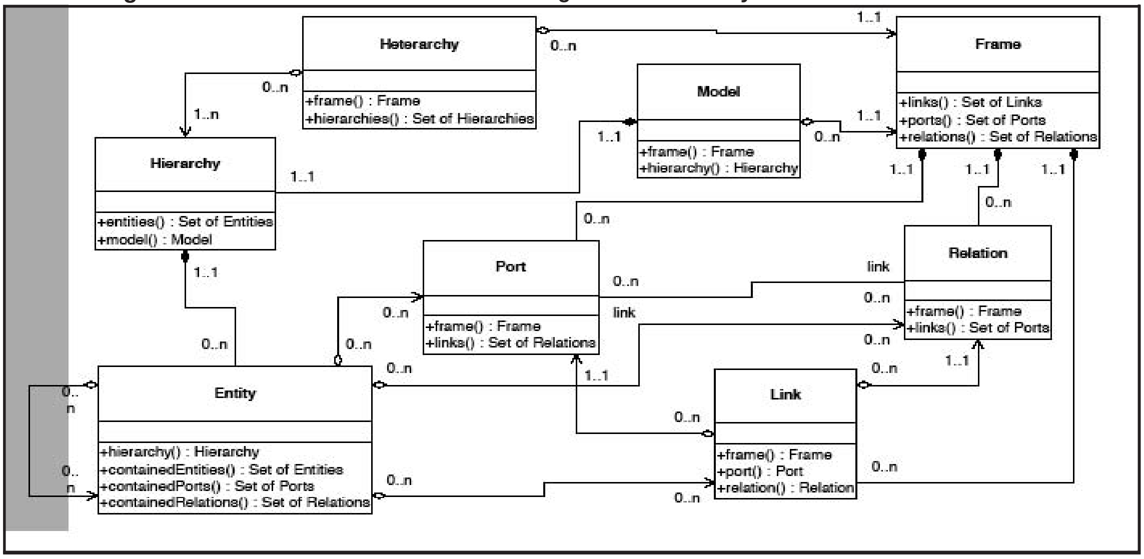
Nature as a CAM

Heterarchies, another obsession

1 Orthogonalizing the Issues

Edward A. Lee, UC Berkeley

Diagramm 11 **UML Diagram of Heterarchy**



Heterarchy
Hierarchy, Frame
Model
Port, Relation
Link
Entity

????
Polycontexturality
Mono-contexture, Proemiality
Type of Proemiality
Type of Metamorphosis, Relations: Order-, Exchange-, Coincidence
Transjunction
Objectionality
Port:: loci of mediation

1.1 Distribution of hierarchical ontologies on heterarchies

1.1.1 UML diagrams of UML diagrams

Heterarchization of the hierarchy ontology UML diagram in respect to the heterarchy UML diagram.

1.1.2 Disseminated formalisms

The same procedure can be applied to the heterarchization of the formal hierarchical ontologies. There whole formalism has to be distributed, including the specific ontological and the general logical definitions.

The kernel of GOL

Dissemination of the kernel of GOL

Interactivity, metamorphosis and simultaneity of different GOLs

1.1.3 Towards poly-GOL

Typology
Algebraic GOL
Co-Algebraic GOL
Metamorphic GOL; Proemiality of algebraic and co-algebraic GOL
Kenomic GOL

1.1.4 Gunther´s Hierarchy of First Order Ontologies

Gunther is developing his First Order Ontologies (FOO) an the basis of the distinction between logic and ontology using two further distinctions "affirmation/negation" and "designation/non-designation" in many-valued logical systems.

> "We shall define an *ontology* as a structural system in which the distinction between designating and non-designating values is inapplicable, and witch is determined by nothing else but the number of values available. In an ontology all values designate. However, if values permit a division between designation and non-designation, the system in question may be considered a *logic*.", Gunther 1968, p. 37/p.149

By a first order ontology he understands a *"theory of Being (ontos on) in contrast to the plurality of second order ontologies referring to the plurality of classes of existing objects."* These second order ontologies are referred in philosophy as *regional* ontology (Regionalontologie), in contrast to fundamental ontology or simply ontology.

This many-valued ontology allows the additional distinctions of mono-, dia- and polythematic ontologies and reflectional mappings, with and without repetitive redundancy, of the ontologies in the logical systems.

> "No self-reference is possible unless a system acquires a certain degree of freedom. But any system is only free insofar as it is capable of *interpreting* its environment and *choose* for the regulation of its own behavior between different interpretations." p. 44/p.156

As we can see, the term "self-reference" is not understood as in the tradition of the famous *Circulus Creativus* of Heinz von Foerster, both at the BCL, or the re-entry figure of George Spencer Brown, but in the tradition of complex transcendental logics as introduced by Kant, Hegel, Schelling and further developed also by the Soviet cyberticians (Levebvre). On the other hand, the second order circular interpretation of self-reference is not excluded, it is a quite special case of the complex reflectional mapping process of a living system reduced to a cognitive system.

Gunthers approach to self-referentiality in the framework of polycontexturality involves simultaneously cognitive and volitive procedures. It is not enough to make the statement *"Living systems are cognitive systems, and living as a process is a process of cognition."* Maturana, p.13, 1970. Excactly, because we learn nowhere anything in the texts of Second Order Cybernetics about the ontology and the logics of the "as"-operator of this statement concerning with system and process, living and cognition. As far it is an interesting, and at its time, a provocative statement, but it is still "magic" –and not operational. Why not?

> "However, there is a fundamental distinction between the idea of a self-referential universe as it was conceived in a former mythical philosophy of nature, as, for example, in Fechner´s "Weltseele", or, if we want to go back to the most ancient Scriptures of mankind, as in the saying of the Chhandogya Upanishad "Self is all this", and the idea of self-referentiality as we conceive it here. In the mystical philosophy of nature it was assumed that the universe was self-referential as a whole–because no distinction was made between auto-referentiality and self-referentiality. This led, if a living system was considered to be a (complete or incomplete) structural replica of the Universe, automatically to the holistic interpretation of an organism. In contra-distinction to this tradition we maintain, however, that, althoug the universe as a whole may be considered to be auto-referential, it can have the property of *self*-reference only in preferred ontological locations of suitably high complexity structure." Gunther, Natural Numbers, p. 32/33; p. 250/251

What to do with all that for a theory of semantics for a Semantic Web?

The Internet is not given, its elements are not entities; the Internet has to be read and its elements have to be interpreted. Interpretation involves freedom to chose a thematization, a perspective of cognition, it involves not only an observer but hermeneutical procedures. Otherwise we understand by the Internet a system of being to be studied and classified by means of ontology in the very sense, also modernized and formalized, by the Aristotle-Leibniz tradition.

The project *Semantic Web* is a challenge for a formalized and operative hermeneutics. Set-theoretical and mereological ontology is mapping only an extremely static and one-sided hierarchical aspect of the “living” tissue of the Web.

A multitude of interacting hierarchies is a question of cognition and volition interpreting the textures of the Web.

Translations from one language to another are not based on a common natural ur-language, but on the co-creative interplay between different languages, natural or artificial.

Ontology in the sense of GOL is “subjectless”. It is a theory of being excluding self-referentiality by definition. Therefore it is a monolitical theory of what is, of objectivity without any freedom of interpretability. Again, this is very useful for subjectless domains, but useless, if not dangerous, in all senses of the word, for worlds including subjects. Today it seems to be quite tricky to find such a subjectless world. Especially if we are forced to ask who is producing this ontology of a subjectless world and even our robots are asking for more "subjectivity". Ontology as *"the most general possible theory about the world"* is fundamentally incomplete. It is incomplete on a semiotical level., incompleteness of ontology and incompleteness of logic, and an a graphematical (grammatological) level, it is not only kenogrammatically incomplete but blind for its own kenogrammatics.To insist on a *realist* point of view to build a general ontology in contrast to a *conceptualist* understanding of ontology allowing some interpretability of the world is a decision which can not be justified easily using scientific and philosophical arguments. At least this decision is not part of the “new” formal ontology. At this point we are confronted with questions of Power and epistemological fundamentalism.

back to page 1

Dynamic Semantic Web

Ontologies: Their Glory and the new bottlenecks they create.
The bottlenecks of the current web techology create
• problems in searching information,
• problems in extracting information,
• problems in maintaining information, and
• problems in generating information. Dieter Fensel

The advent of Web services, and the Semantic Web described by domain ontologies, highlight the bottleneck to their growth: ontology mapping, merging, and integration.
Stephen L. Reed and Douglas B. Lenat, Mapping Ontologies into Cyc

The Dynamic Semantic Web has to deal with the *dynamics* of the Web.
The Web is at a first glance at least distributed, dynamic, massive and an open world (Heflin, Hendler).
What is the Semantic Web? It is "a vision of the future in which the "web of links" is replaced by a "web of meaning" where the meaning is machine readable.
To introduce a web of meaning, *ontologies* appears as the main concepts and tools.
Therefore, the first job of DSW is to develop a dynamics of ontologies.

1 SHOE: Dynamic ontologies on the Web

"Dynamic ontologies on the Web" is the title of an approach by the authors of SHOE.
The dynamics of SHOE works with the constructs of ontology definition, modularization, revision and versioning with the help of the techniques "ID", "USE", "RENAME", etc. as methods of Evolution and Integration of ontologies.
All these concepts are realized and have their semantics in the framework of Hierarchy ruled by FOL.

Problems
Introduction, Navigation, Negotiation and Integration are restricted to hierarchical Unification.

2 Polycontextural Dynamics

DSW can not be realized by restricting it to this kind of ontological dynamics. In contrast to the mono-contextural approach of SHOE, DSW has to be realized in the framework of Heterarchy of polycontextural logics and ontologies.

How can we map ontologies onto Heterarchies?

A first but useful explication of the concept Heterarchy is given by the UML heterarchy diagram.

2.1 Heterarchies

Hierarchies are distributed and mediated by the rules of heterarchy.

Each hierarchy contains ontologies in the classical sense.

2.2 Proemial relationship

The mechanism of the interplay between different ontology is realized by the proemial relationship.

2.3 Poly-Semiotics

Signs in ontologies

signs relative to objects

signs relative to signs

signs relative to users

user: modeller, conceptionalist, instance etc.

Interaction between semiotics based on the immanent difference of "subjectivity" of the users between I- and Thou-subjectivity.

This leads to a post-Peircean semiotics of chiastic nature.

3 Short comparition of SHOE and DSW

Is it possible to develop a Semantic Web with its ontology and logics without having to forget and to deny everything we learned from philosophy, linguistics, logics, semiotics, grammatology and AI in the last century?

3.1 Multiple inheritance

Multiple inheritance can easily be modelled in SHOE:
<DEF-CATEGORY NAME="Chair" ISA="AdministrativeStaff Professor">

Here Chair has 2 parent concepts: AdministrativeStaff and Professor.

As long as there are no contradictions this construction is working. But there are no guaranties to avoid contradictions by means of multiple inheritance, as we know from all sorts of conceptual modellings. Simply change the definition of the organisation and the constellation is producing a conflict and later a contradiction.

3.2 Ambiguity and polysemy

All concepts in an ontology have to be disambiguated.
In SHOE, again, this is easily done by renaming.

<DEF-RENAME > CHAIR in furniture-ont to Seat
<DEF-RENAME > CHAIR in academy-ont to AcademyHead

As long as we live in a very small world this strategy will work. But it stops to work immediately if we accept the dimensions of the Web. The process of renaming runs into a non-stopping procedure.

3.3 Chiastic polycontextural modelling

Also because the renaming procedure to avoid polysemy and ambiguity is not surviving the dynamics of a Dynamic Semantic Web the chiastic modelling is introduced as another more dynamic way of modelling the situation of polysemy and ambiguity.

Instead of domesticating the foreigner ontology into the home ontology by renaming the disturbing concepts a poly-contextural modelling is accepting the new ontology as such but has to offer a mechanism which allows to deal with the new double face situation of accepting and of mediating both ontologies. The process of mediating ontologies accepts the ambiguity between the concepts but rejects its logical conflicts and contradictions because now ambiguity is distributed over two ontological contextures ruled by two logical systems.

In accordance with the constructiviste point of view of conceptualizing as a semiotic process, in contrast to the neo-Aristotelian fundamentalist position of GOL, terms, objects, concepts have to be understood as relative to their use (Wittgenstein, Derrida) and not as pre-given entities of the world (universe).

4 Architectonic Parallelism of DSW

Navigation

Negotiation

Interactivity

Complexity

Reflectionality

5 Dynamics in the Semantic Web Context

There are many attempts to bring more dynamics into the Web. Some answers from the authorities: W3C, DARPA, MIT, ETH Zürich and McLuhan Institute

5.1 Dynamic Ontologies (Heflin, Hendler)

http://www.cs.umd.edu/projects/plus/SHOE/pubs/#aaai2000

The Web is dynamic.
The Web is massive.
The Web is an open world.
in: Towards The Semantic Web: Knowledge Representation In A Dynamic, Distributed Environment, Heflin 2001

Ontology Mapping and Translation

Will the inevitable proliferation of ontologies really solve the semantic interoperability problem? The answer is clearly no. The widespread adoption of ontologies only gets us half-way to semantic interoperability nirvana by forcing the use of explicit semantics. The other major challenge is mapping from one agent's ontology to another agent's ontology. The approaches to solve this problem range from static manually created ontology mappings to dynamic ondemand agent-based negotiation of ontology mappings.
in: Hendler, Semantic Web Technologies for Aerospace

Diagramm 12 **Dynamic Ontologies on the Web**

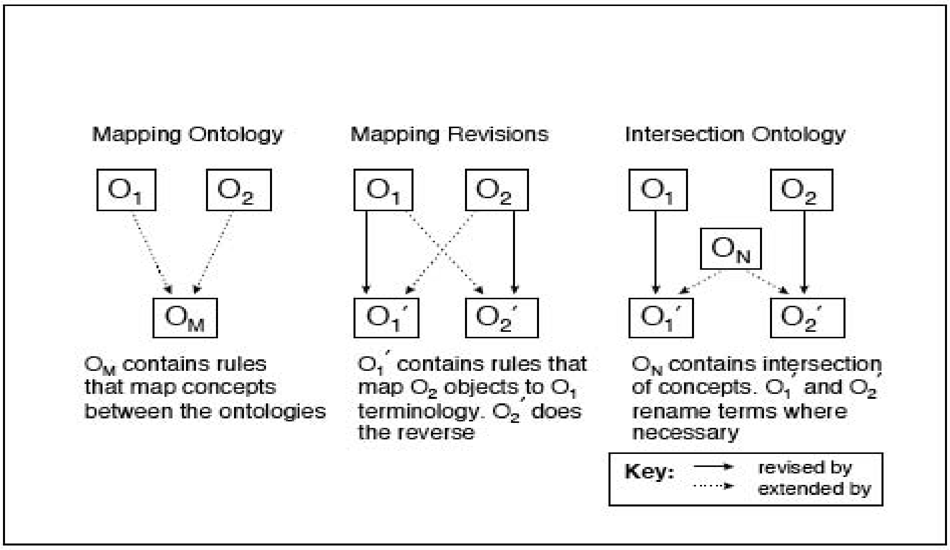


Figure 2. Integration Methods

5.2 Water: Static and Dynamic Semantics of the Web

http://web.media.mit.edu/~lieber/Lieberary/Dynamic-Semantics/Dynamic-Semantics.pdf

Less concern has been given to dynamic semantics of the Web, which is equally important. Dynamic semantics have to do with the creation of content, actions which may be guided by

- *User-initiated interface actions*
- *Time*
- *Users' personal profiles*
- *Data on a server*

and other conditions.

5.3 Cultural dynamic Web

http://semanticweb2002.aifb.uni-karlsruhe.de/proceedings/Position/veltmann.pdf

Towards a Semantic Web for Culture and Challenges for a Semantic Web

Kim H. Veltman, McLuhan Institute, Maastricht

Logic *is, of course, an excellent starting point. Tim Berners-Lee has a conviction, which can be traced back to early history of Oxford from which he comes, that logic is a way to separating the wheat of truth from the chaff of idle claims. Logic is universally applicable: it reflects the scientific spirit. It represents the dimension concerning which there ought, in theory, to be no debate.*

5.4 Dynamic Semantic Web

In contrast to the precedent approaches the PCL based contribution to a Semantic Web and its dynamics is not accepting the limitations of expression, computation and interactivity forced by logic and its logical systems.

Peter Wegner has clearly analyzed the reason of the failure of the Japanese 5th Generation project: its believe in logics and its logic based programming languages, like Prolog. We have not to accept all the thesis about the change of paradigm in computer science proposed by Wegner, but I agree fully with his analysis of the role of logic. But again, Wegner and his school is not able to think about changing logics, instead he proposes some more empirical concepts to develop his intuition of paradigm change based on interactivity.

It is not necessary to repeat history again and again.

5.5 Dynamics with Modularity

Farshad Hakimpour, Andreas Geppert, Ontologies: an Approach to Resolve Semantic Heterogeneity in Databases

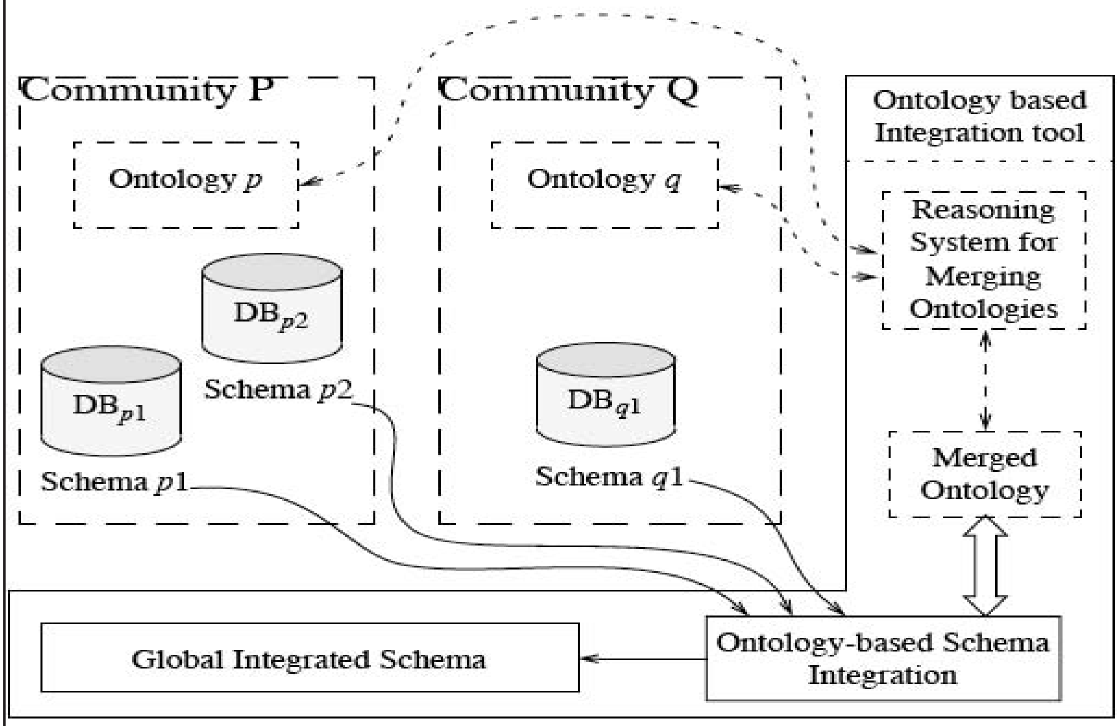


FIGURE 5. Global schema generation based on a common ontology produced by integration of domain ontologies.

This ontology dynamics is based on a constructivite epistemology not naively presuposing data systems. Different communities with different ontologies are introduced.

This Global schema of ontology integration is not telling us what happens with the presupposition of the difference of the ontologies p and q, namely their different Community P and Q.

It maybe of no special problem to integrate DBp1 and DBp2, simply because they are objects of the same community P. What happens to Community Q after merging ontology q with ontology p via merging schema p1, p2 with schema q1?

In this way of thinking, not many possibilities are open: Community P may disappear, or Community Q or a new super-community R will be constructed.

Merging companies, fusions of organizations, always have to deal with this problem. It seems to be an everyday problem, but there are no global solutions in sight.

Diagramm 13

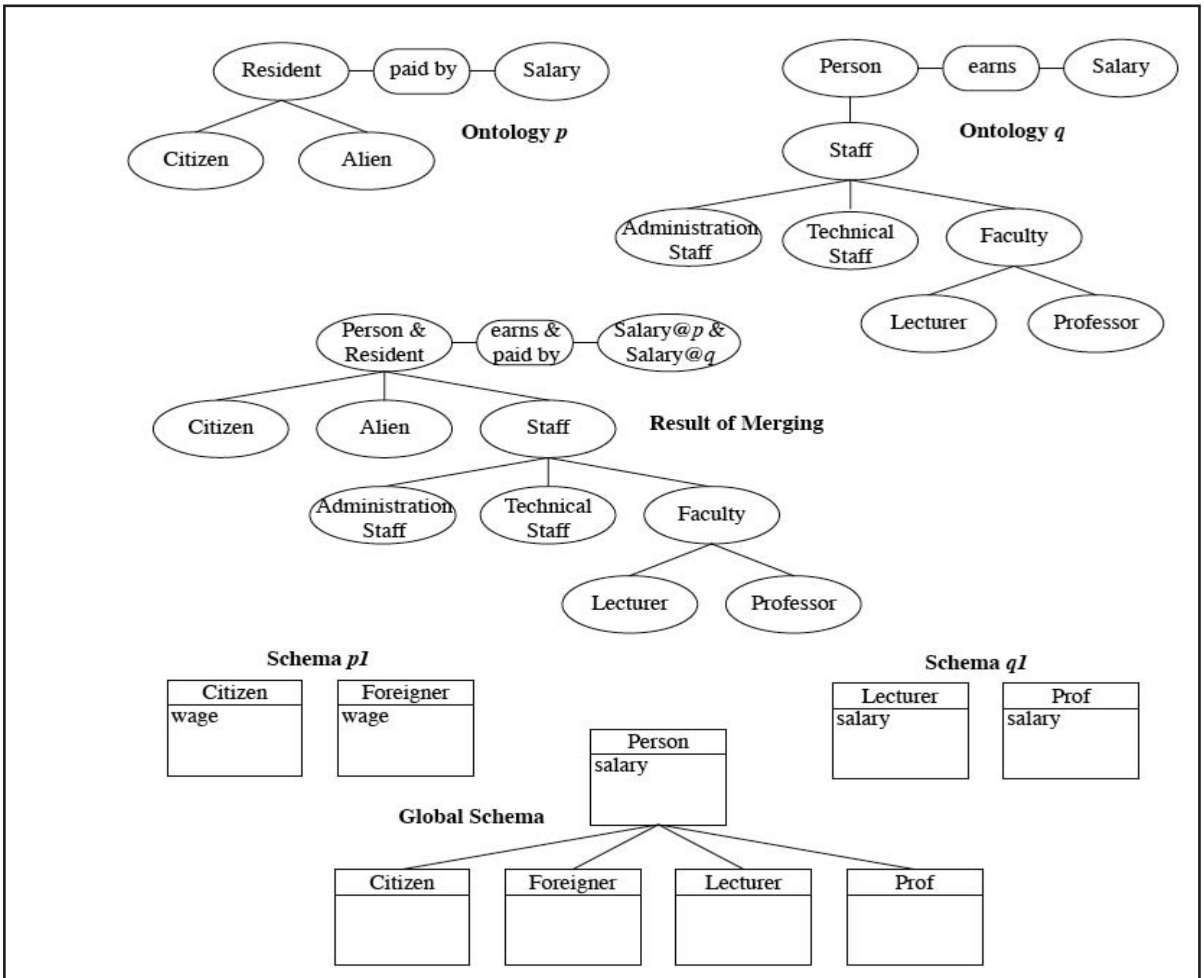


FIGURE 7. Result of finding two equal concepts and creating a class Person in global schema.

A nice vizualitation of a merging is given by robert lee
ai.kaist.ac.kr/~jkim/cs570-2003/ lecture-tp/SemanticWeb.ppt

Diagramm 14

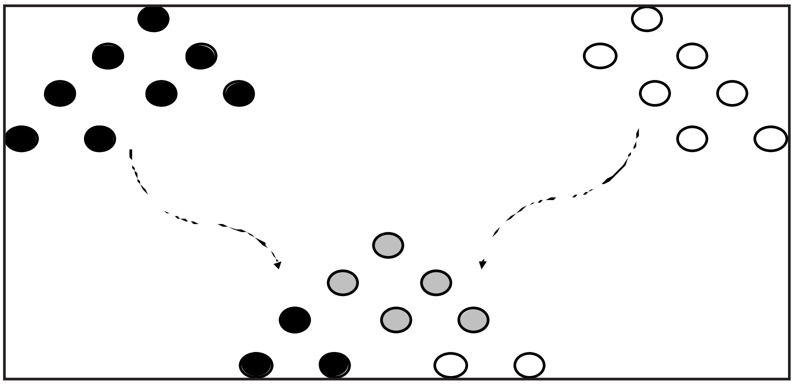


Diagramm 15

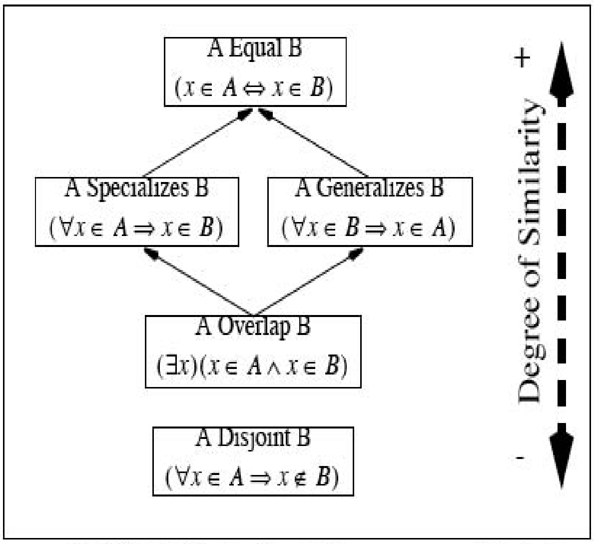


FIGURE 6. Similarity relations among ontological definitions

Obviously, for this scheme of *Degrees of Similarities of Ontologies*, everything Joseph Goguen mentioned abaut classic semiotics is true in an even more strict sense for ontologies.

Semiotics and Ontologies

Semiotics, as the general theory of signs, would seem a natural place to seek a general HCI framework. However

(1) semiotics has not developed in a precise mathematical style, and hence does not lend itself well to engineering applications;

(2) it has mostly considered single signs or systems of signs (e.g., a novel, or a film), but not representations of signs from one system by signs from another, as is needed for studying interfaces;

(3) it has not addressed dynamic signs, such as arise in user interaction; and

(4) it has not paid much attention to social issues such as arise in cooperative work.

A new project to address such problems has so far developed precise algebraic definitions for sign systems and their representations, and a calculus of representation providing laws for operations that combine representations as well as precise ways to compare the quality of representations. Case studies have considered browsable proof displays, scientific visualization, natural language metaphor, blending, and humor, while social foundations are grounded in ideas from ethnomethodology.

Joseph Goguen, Algebraic Semiotics and User Interface Design, 2000

http://www.isr.uci.edu/events/dist-speakers00-01/goguen00.html

Dynamics in Ontologies and Polysemy

back to page 1

1 Dynamic Ontologies in SHOE

SHOE is a well established approach to the Semantic Web emphasizing dynamics of ontologies.

http://www.cs.umd.edu/projects/plus/SHOE/

The dissertation of Henflin gives us a perfect introduction.

http://www.cs.umd.edu/projects/plus/SHOE/pubs/#heflin-thesis

Diagramm 16

Ontology Scheme

Ontology
USE-Ontology DEF-Relation DEF-Category DEF-Inference DEF-Rename

Generally, an ontology is a tupel O = (V, A)
V: Vocabulary
A: Axioms

Dynamics of SHOE-Ontologies are given by the operations of

Ont-Building
Ont-Revising
Ont-Versioning
Ont-Perspectiving

Short: Ont-Dyn = {Build, Rev, Vers, Persp}

The dynamics Ont-Dyn don't change the general definition of ontology. The operation of Ont-Dyn is closed, that is, Ont-Dyn(Ont-Dyn(Ont)) = Ont

Ont-Dyn(Ont-Dyn) = Ont-Dyn

The USE-Ontology operation is the key for modularity in SHOE. USE is building ontologies out of other ontologies. That is, ontologies are understood as modules.

Ontology = ($Module_0$, $Module_1$, ..., $Module_n$)

$Module_0$ contains the general base-ontology

The USE-ontology operation is producing a vertical and hierarchic chain of ontology extensions.

Ont-Dynamics: Ont ——> Ont: O^i —> O^i : $O^i{}_1$, $O^i{}_2$ —> $O^i{}_{1+2}$

Linear Modularization: O^i —> O^i: $O^i{}_{1+2}$ —> $O^i{}_1$, $O^i{}_2$

Examples of modules (ontologies)

A SHOE Module can be any ontology which is not a base ontology and which is fulfilling the syntactic definition of an ontology.

http://www.cs.umd.edu/projects/plus/SHOE/onts/index.html

general-ont = (Web-Res, Agent, PhysObject, Event, Location, Address, Activity)

document-ont = (Document, unpublished, published)

university-ont = (Faculty, Student, University, Department)

agents-ont = (sequentiell, parallel)

Ontology Dependencies (SHOE)

Below is a tree showing the dependency of ordering of the most recent versions of each ontology.

- Base Ontology, v. 1.0
  - Dublin Core Ontology, v. 1.0
  - General Ontology, v. 1.0
    - Beer Ontology, v. 1.0
    - Commerce Ontology, v.1.0
    - Document Ontology, v. 1.0
      - University Ontology, v. 1.0
        - Computer Science Department Ontology, v. 1.1
    - Personal Ontology, v. 1.0
  - Measurement Ontology, v. 1.0
    - Commerce Ontology, v.1.0
  - TSE Ontology, v. 1.0

http://www.cs.umd.edu/projects/plus/SHOE/onts/index.html

1.1 Dissemination of Ontologies, a more formal description

Polycontextural logics enable to add a new operation to extend ontologies. The horizontal operation of mediation MED is used to add ontological Modules not vertically like the USE operation but horizontally and therefore is producing a heterarchic organisation of the ontological modules.

Diagramm 17 **USE(USE(USE))**

Ontology1
USE-Ontology DEF-Relation DEF-Category DEF-Inference DEF-Rename
Ontology2
USE-Ontology DEF-Relation DEF-Category DEF-Inference DEF-Rename
Ontology3
USE-Ontology DEF-Relation DEF-Category DEF-Inference DEF-Rename

Diagramm 18 **MED (ont1, ont2, ont3) = ont $^{(3)}$**

Ontology1	Ontology2	Ontology3
USE-Ontology DEF-Relation DEF-Category DEF-Inference DEF-Rename	USE-Ontology DEF-Relation DEF-Category DEF-Inference DEF-Rename	USE-Ontology DEF-Relation DEF-Category DEF-Inference DEF-Rename

MED (ont1, ont2, ont3) = ont $^{(3)}$

MED(USE) /= USE(MED)

The mediation of USE ontologies is not the same as the use of mediated ontologies.

MED (Ont) /= Ont

The mediation of ontologies is surpassing the definition or type of the given ontologies.

The interplay of USE and MED defines the ontology grid in its vertical (iterative) and in its horizontal (accretive) dimensions. The grid is produced by the operation DISS (dissemination) which is the interplay of USE and MED, or in other words, the interplay between hierarchy (HIER) and heterarchy (HET).

$DISS_{accretive}$ (ONT) = MED(USE(ONT)) and

$DISS_{iterative}$ (ONT) = USE(MED(ONT))

DISS(ONT) = $DISS_{iterative}$ $DISS_{accretive}$ (ONT) = GRID (ONT)

Mediated ontologies are opening up the possibility for metamorphic changes of the basic categories of the ontologies involved in the interaction.The most basic change surely is the exchange between a base ontology, Mod_0, and a core ontology, say Mod_i. What is basic and primary in one ontology can be simultaneously secondary in another neighbor ontology.

This type of ontology-change is ruled by the proemial operator (chiasm) PR.

PR(Mod0, Modi, Ont1, Ont2)

Example: Disseminating basic concepts

Basic concepts like time, numbers, truth-function are defined in a base-ontology, which is by definition not to be transformed by any operations of Ont-Dynamics.

Veltman who is engaged to enrich the current trends of the Semantic Web toward a much more cultural and historical Semantic Web. He is criticizing SHOE of having implemented only the western model of calender. The real problem seems not be to add different cultural modules of chronology, topography and languages etc., but who to add them. If they are added vertically, in the sense of an iterative hierachical addition of modules, nothing has changed at all.

Only in the case of horizontal organisation of the basic ontologies a simultaneous multi-cultural and multi-lingual use can be processed and interaction between the different world views can be realized without restrictions by a ultimate upper ontology of what kind ever.

My thesis is, not the content but the very structure of the whole ontology is under question. If the modules of whatever content are added vertically, we stay in the western-centred paradigm of thinking. If we allow horizontal organization of the ontologies we are leaving this empire of hierarchical power to a heterarchical world of chiastic interplay of world views.

1.2 Computational complexity of hierarchy and heterarchy

(This is only a very first appraoch to the topic of complexity!!!)

Compl (USE(Ont1...Ontn) > Compl (MED(Ont1...Ontn))

Compl (HIER) > Compl (HET)

The tree of Ont1 may contain 2^m knots, and Ont2 may contain 2^n,

Compl(HIER(Ont1, Ont2)) = 2^{n+m}

Compl(HET(Ont1, Ont2)) = $2^m + 2^n$

This gives the number of knots for isolated parallel mediated ontologies Ont1 and Ont2. Additionally to this we have to calculate the number of interactions between Ont1 and Ont2.

2 Polysemy: Ontology Extension with the procedure rename

An interesting case of combining ontology modules together arise if the ontologies contains equal terms. In contrast to simple multiple inherence the situation of polysemy is introduced.

Remember:

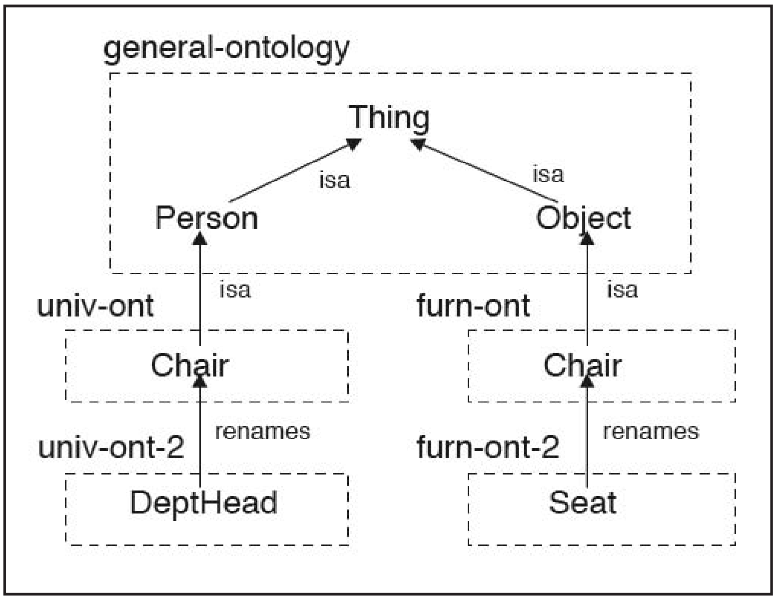
> ***The Web is distributed.*** *One of the driving factors in the proliferation of the Web is the freedom from a centralized authority. However, since the Web is the product of many individuals, the lack of central control presents many challenges for reasoning with its information. First, different communities will use different vocabularies, resulting in problems of synonymy (when two different words have the same meaning) and polysemy (when the same word is used with different meanings).*
>
> *One of the hardest problems in any integration effort is mapping between different representations of the same concepts – the problem of integrating DTDs is no different. One difficulty is identifying and mapping differences in naming conventions. As with natural language, XML DTDs have the problems of polysemy and synonymy. (12)*
>
> *Recall that the Web is a decentralized system and its resources are autonomous. As a result, different content providers are free to assign their own meanings to each nonlogical symbol, thus it is likely that multiple meanings will be assigned to many symbols. Different axiomatizations for the same symbolsmay result fromthe polysemy of certain words, poor modeling, or even malicious attempts to break the logic. (23)*

The main principle of ontology is demanding for disambiguating the polysemy of the used term. The simplest and historically oldest method to do this is given by *renaming* the terms. This is working perfectly in a very small world. But as we have learned, not only the weather system is massive, complex, open worlded, but also our WWW.

It is probably not very difficult to find, even if restrict ourselves to the english language, hundreds of different meanings of a term, here in the example of “chair”. Therefore the renaming procedure can easily explode to a massive and complex topic in itself, destroying the aim of the simple and innocent procedure of renaming.

> *The problems of synonymy and polysemy can be handled by the extension mechanism and use of axioms. An axiom of the form P1(x1; : : : ; xn) $ P2(x1; : : :; xn) can be used to state that two predicates are equivalent. With this idiom, ontologies can create aliases for terms, so that domainspecific vocabularies can be used.*
>
> *For example, in Figure 3.1, the termDeptHead in OU2 means the same thing as Chair in OU due to an axiom in OU2. Although this solves the problem of synonymy of terms, the same terms can still be used with different meanings in different ontologies.*

Diagramm 19 **Figure 3.2**



There are many open questions. How does it fit together to have an ontological relation “isa” and an obviously linguistic operation “rename”? To bring the modules furn-ont and furn-ont2 and also univ-ont and univ-ont2 together we need at least a mediation third module, which is reflecting the terminology of both. But this linguistic ontology would produce itself similar possibilities of polysemy.

Polysemy means:

A=C and
B=C and
A /=C

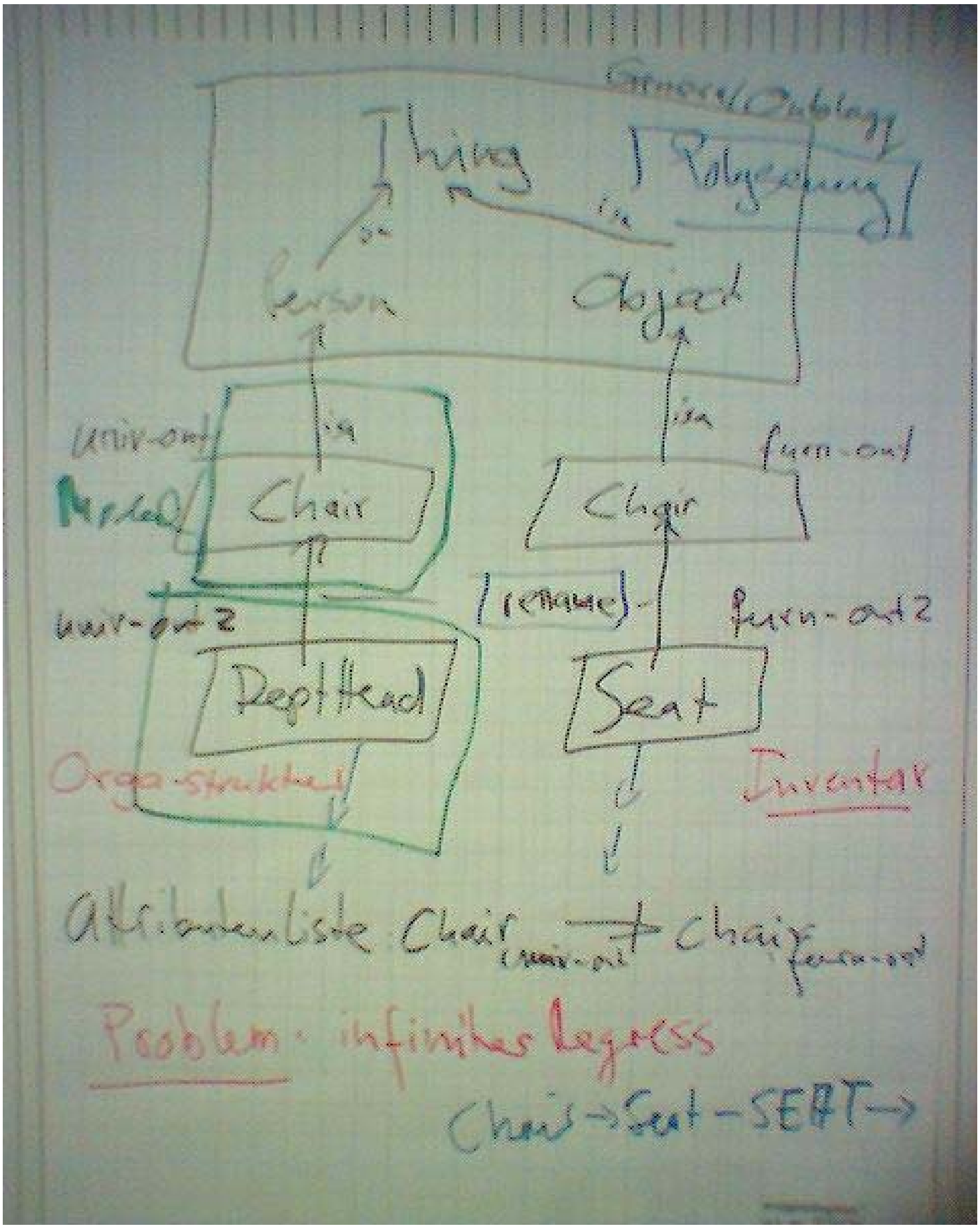
Do it again

There is no reason to not to start the game of polysemy again with the term Seat as furniture and Seat as seat, e.g. position, in the hierarchy of a department. And we can disambiguate this polysemy again with the help of the term Chair. A seat as department is a chair and a seat as furniture is a chair. And now we can turn around as often as we want...

Extension of ontologies by renaming is not violating the principle of verticality, that is hierarchy. Therefore, the tree is growing and with it its computational complexity.

It becomes obvious that the procedure of renaming is part of the broader activity of *negotiation*. Without a proper mechanism of solving the problems of renaming the amount of not machine-assisted negotiation is growing in a contra-productive way, conflicting the very aims of the Semantic Web to support machine-readable semantic information processing.

Diagramm 20


Thing
Polysemy
Person
Object
isa
Chair
furn-ont
univ-ont 2
furn-ont2
DeptHead
Seat
Inventar
Problem
Chair → Seat – SEAT →

http://www.mindswap.org/cgi-bin/2002/searchdamlont.pl

ONTOLOGYHYPER-
DAMLDUMP
ONTConvert to OWLColorn3HIT ON
1NSO-ont[H] [H] [D]OWLcolor viewn3 viewChairmanOfTheJointChiefsOfStaff
2NSO-ont[H] [H] [D]OWLcolor viewn3 viewViceChairmanOfTheJointChiefsOfStaff
3UNSPSC[H] [H] [D]OWLcolor viewn3 viewBedpans-or-commode-chairs-for-people-with-disabilities
4UNSPSC[H] [H] [D]OWLcolor viewn3 viewCamping-chairs-or-stools
5UNSPSC[H] [H] [D]OWLcolor viewn3 viewChair-lifts-or-chair-transporters,-for-people-with-disabilities
6UNSPSC[H] [H] [D]OWLcolor viewn3 viewChairs
7UNSPSC[H] [H] [D]OWLcolor viewn3 viewCoxit-or-arthrodesis-chairs-for-people-with-disabilities
8UNSPSC[H] [H] [D]OWLcolor viewn3 viewMechanized-chairs-to-assist-with-sitting-or-standing-for-people-with
9UNSPSC[H] [H] [D]OWLcolor viewn3 viewPatio-chairs
10UNSPSC[H] [H] [D]OWLcolor viewn3 viewRestaurant-chairs
11UNSPSC[H] [H] [D]OWLcolor viewn3 viewVibrating-chairs-for-training-deaf-people
12UNSPSC[H] [H] [D]OWLcolor viewn3 viewWheelchair-accessories
13UNSPSC[H] [H] [D]OWLcolor viewn3 viewWheelchair-lifting-platforms
14UNSPSC[H] [H] [D]OWLcolor viewn3 viewWheelchair-ramps
15UNSPSC[H] [H] [D]OWLcolor viewn3 viewWheelchairs
16cs1[H] [H] [D]OWLcolor viewn3 viewChair
17cs1[H] [H] [D]OWLcolor viewn3 viewChair
18cyc-transportation[H] [H] [D]OWLcolor viewn3 viewElectricWheelchair
19cyc-transportation[H] [H] [D]OWLcolor viewn3 viewWheelchair
20univ1[H] [H] [D]OWLcolor viewn3 viewChair

20 hits in 186 ontology files

Douglas B. Lenat

The success of the Semantic Web hinges on solving two key problems:

(1) enabling novice users to create semantic markup easily, and

(2) developing tools that can harvest the semantically rich but ontologically inconsistent web that will result.

To solve the first problem, it is important that any novice be able to author a web page effortlessly, with full semantic markup, using any ontology he understands. The Semantic Web must allow novices to construct their own individual or specialized-local ontologies, without imposing the need for them to learn about or integrate with an overarching, globally consistent, master ontology.

The resulting Web will be rich in semantics, but poor in ontological consistency. Once end-users are empowered by the Semantic Web to create their own ontologies, there will be an urgent need to interrelate those ontologies in a useful way. The key to harvesting this new semantic information will be the creation of the Semantic Web-aware agents that can cope with a diversity of meanings and inconsistencies across local ontologies. These agents will need the capability to interpret, understand, elaborate, and translate among the many heterogeneous local ontologies that will populate the the Semantic Web.

http://www.cyc.com/cyc/cycrandd/areasofrandd_dir/sw

These agents will not only *"need the capability to interpret, understand, elaborate, and translate .."* but they also have to be non-human agents, that is programs. What´s difficult to master for human beings should be a fine job for our new agents. It seems that the unsolved problems of AI are emerging again in a new setting.

3 Polycontextural modelling of polysemy

The Internet is a giant semiotic system. Sowa

Polycontextural modelling can be made more transparent if we don´t forget that the concept of ontology is only a very reduced case of general semiotics. (I leave it for further reflections to abandon also semiotics in favor of polycontexturality.)

Exposing a polycontextural modelling of polysemy I am forced to use semiotic distinctions not available in the Semantic Web language SHOE.

3.1 Semiotic Diagram

Remember Charles Sanders Peirce:

> *A sign, or representamen, is something which stands to somebody for something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object. It stands for that object, not in all respects, but in reference to a sort of idea, which I have sometimes called the ground of the representamen. (CP 2.228)*

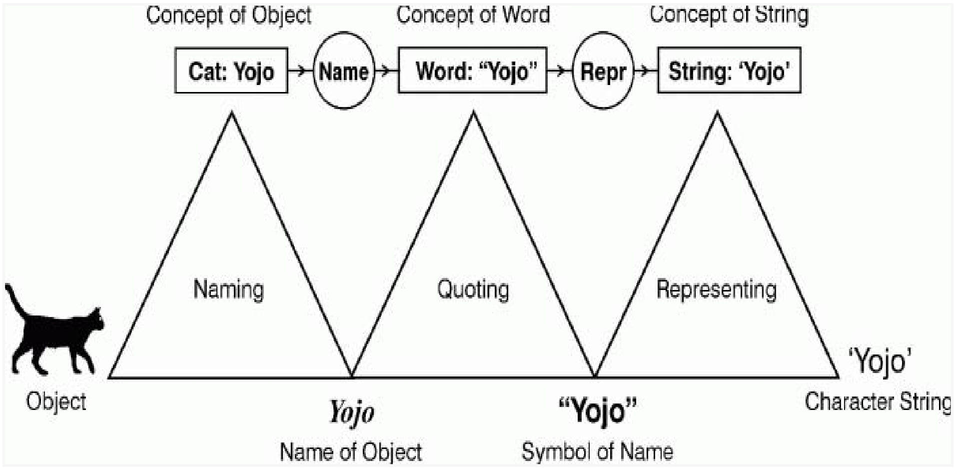
Sowa:

> *Many of the ontologies for web objects ignore physical objects, processes, people, and their intentions.*
>
> *A typical example is SHOE (Simple HTML Ontology Extensions), which has only four basic categories: String, Number, Date, and Truth (Heflin et al. 1999).*
>
> *Those four categories, which are needed to describe the syntax of web data, cannot by themselves describe the semantics. Strings contain characters that represent statements that describe the world; numbers count and measure things; dates are time units tied to the rotation of the earth; and truth is a metalanguage term about the correspondence between a statement and the world. Those categories can only be defined in terms of the world, the people in the world, and the languages people use to talk about the world. Without such definitions, the categories are meaningless tags that confer no meaning upon the data they are attached to.*

Ontology, Metadata, and Semiotics
John F. Sowa

http://users.bestweb.net/%7Esowa/peirce/ontometa.htm

Diagramm 21



A nice semiotic picture of our world of semantic knowledge. It is surely better than the lack of any semiotic knowledge.

Diagramm 22

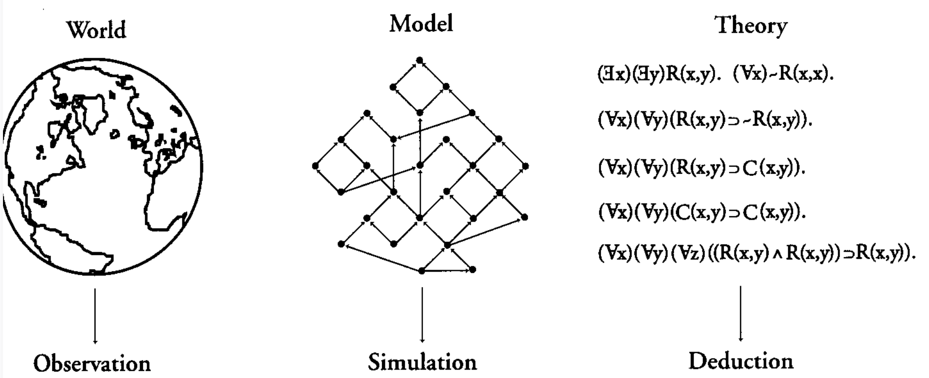
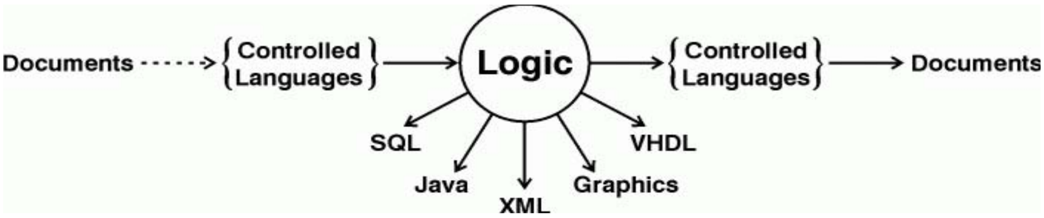


FIGURE 6.13 Three sources of knowledge about the world

Pure logic is ontologically neutral

It makes no presuppositions about what exists or may exist in any domain or any language for talking about the domain. To represent knowledge about a specific domain, it must be supplemented with an ontology that defines the categories of things in that domain and the terms that people use to talk about them. The ontology defines the words of a natural language, the predicates of predicate calculus, the concept and relation types of conceptual graphs, the classes of an object-oriented language, or the tables and fields of a relational database. Sowa

Diagramm 23



Everyone who has studied polycontextural logics know that logic isn't as neutral as it is believed by the community of logicians and computer scientists. At least, logic is presupposing a special type of formality to be accessible to formalization, and this formality as such can turn out as logics restricting content. But it is crucial to understand this neutrality statement because it describes exactly the situation as it is established in contemporary (western) thinking.

Ask for other opinions and paradigms Charles S. Peirce or Gotthard Gunther.

3.2 Reflectional semiotic modelling of polysemy

A reflectional analysis of polysemy is an analysis of the semiotic actions or behaviors of agents which is leading to the phenomenon of polysemy and its possible conflicts with other semiotic or logical principles. Therefore, such an analysis is more complex, because it has to describe the situation intrisically, that is from the inside and not from the outside from the position of an external observer.

Mono-contextural introduction of "isa":
S1: Chair is part of a furniture ontology
S2: Chair is part of a department ontology
S3: Chair is part of a vocabulary

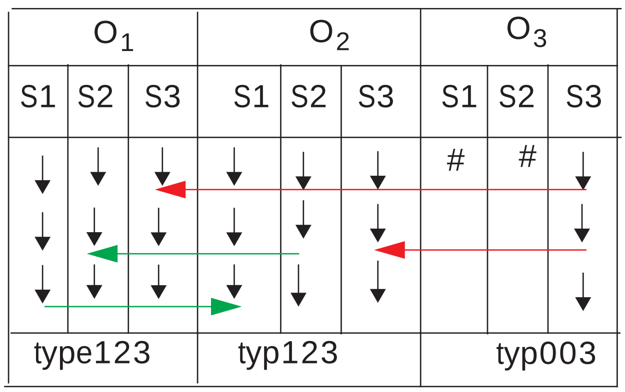
Poly-contexturally we have to distinguish the situations "isa as":
O1S1: Chair as such, that is, as an object "Chair"
O2S2: Chair as such, that is, as a person "Chair".
O3S3: Chair as such, that is, as the token "Chair"

Here, "as such" means, that the ontologies Person, Object and Vocabulary can be studied and developed for their own, independent of their interactivity to each other but mediated in the constellation of their poly-contexturality, that is, their distribution over 3 loci.

Voc O3S3 in Furn O1S3 : The token "Chair" as used to denote the object "Chair"
VocO3S3 in Dept O2S3 : The token "Chair" as used to denote the person "Chair"

Chair O2S2 in Dept O1S2 : The object Chair as used in the person ontology Dept
Chair O1S1 in Furn O2S1 : The person Chair as used in the object ontology Furn

Diagramm 24



Reflectional situations

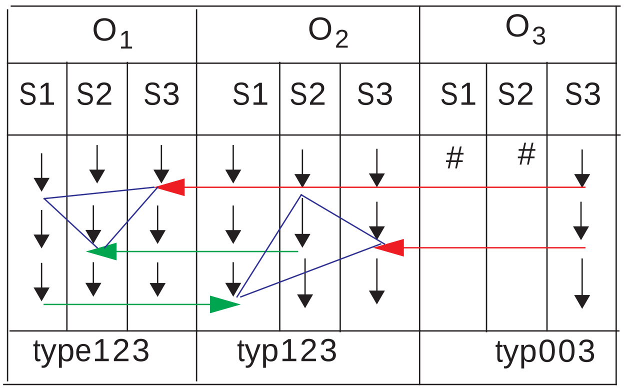
Chair O2S2 in Dept O1S2:
System O1S1 has in its own domain space for a mirroring of O2S2. This space for placing the mirroring of O2S2 is the reflectional capacity realized by the architectonic differentiation of system O1. In other words, O1 is able to realize the distinction between its own data and the data received by an interacting agent. Data are therefore differentiated by their source, e.g. their functionality, and not only by their content.

Chair O1S1 in Furn O2S1:
System O2S1 has in its own domain space for a mirroring of O1S1.

Some exclusions

Some more fascinating possibilities, which are excluded in this construction:
The word Chair as a DeptChair: (empty chair): Voc O3S3 in Dept O2S2
The word Chair as a Furn: (decoration): Voc O3S3 in Furn O1S1
The DeptChair as an object Chair (in a game): Dept O2S2 in Furn O1S1
The DeptChair as a token Chair (as a symbol): Dept O2S2 in Voc O3S3
The FurnChair as a person Chair (Breschnijew) :Furn O1S1 in Dept O2S2

Diagramm 25



A (re)solution of the problem

The solution of the (new) problem is in the (old) problem which the (new) problem is the (old) solution.

The department Dept for itself has no conflict with polysemy. This conflict between Dept and Furn is mediated by the Voc. That is, the Person of the Dept as Chair are persons and nothing else.

The furniture Furn for itself has no conflict with polysemy. This conflict between Furn and Dept is mediated by the Voc. That is, the Chairs as objects of the Furn are chairs and nothing else.

The vocabulary Voc for itself has no conflict with with polysemy between Dept and Furn.

The meaning of the polysemic situation is realised by

Meaning of (O3S3) = interaction of (O1S3, O2S3)

The conditions for a conflict arises excactly between

O1 (S1,2,3) and O2 (S1,2,3) mediated by O3S3 as visualized by the blue triangles.

Both Furn and Dept are using Voc and both are using the string Chair. Both are different and are mapping the Voc differently relative to their position, thus the Voc has to be distributed over different places according to its use or functionality. The Voc used by Furn is in another functionality than the Voc used by Dept.

Until now we have not yet produced a contradiction but only a description of the situation of polysemy, that is, the necessary conditions for a possible ontological contradiction.

A user-oriented or behavioral-oriented approach to the modelling of polysemy has to ask "For whom is there a conflict?". Therefore we have additionally to the semantic and syntactic modelling of the situation to introduce some pragmatic instances. In our example this can be the user of a Query which is answering in a contradictional manner.

Query´s contradiction

Now we have to deal with the contextures: (Query, Voc, Furn, Dept).

In the classic situation the Query answers with a logical conjunction of Chair as Person and Chair as a Department member, which are logically excluding each other and therefore producing for the user a contradictorily answer. Logic comes into the play also for the polycontextural modelling, but here conjunctions too, are distributed over different contextures. And therefore, a contradiction occurs only if we map the complex situation all together onto a single contexture. If we give up all the introduced ontological distinctions of polycontexturality and reducing therefore our ontologies to a single mono-contextural ontology we saved our famous contradiction again. But now, this contradiction is a product of a well established mechanism of reduction. And sometimes it isn't wrong to have it at our disposition.

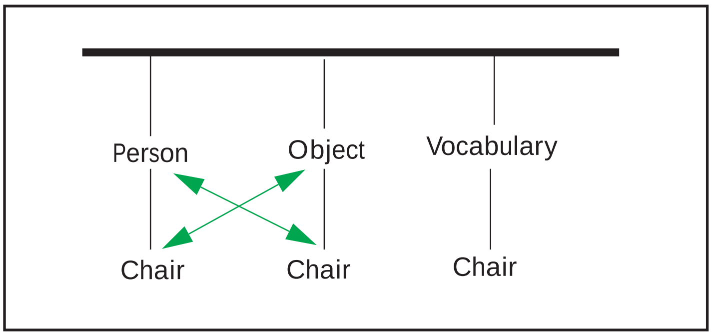
Extension by mediation

The procedure of renaming can now be understood as an accretive ontology extension, using another additional ontology, by the procedure MED-ontology.

To change from Chair as a furniture to Seat and from Chair as Dept to DeptHead is not only a linguistic procedure of renaming in the vocabulary it is also the use of two other ontologies in which these terms are common.

From the point of view of the new ontologies the conflict between Furn and Chair becomes obvious and transparent as a linguistic conflict of using a Voc. Only from the point of view of DeptHead and Seat the conflict appears as a conflict of synonymy. From the positions of Chair as Furn and Chair as Dept their is only a conflict per se. Without the possibility of an insight into its structure and kind of the conflict and therefore there is also no chance for a solution of the conflict.

Diagramm 26



Chiastic situation of the polysemy example:

Person becomes Object and Object becomes Person both relative to their common Vocabulary, that is the word "Chair".

4 Some Polylogical Modelling of Polysemy

To each ontology we have a corresponding logic (or logical system).

Ont ——> Logic

Med(Ont1, Ont2, Ont3) = Ont(3) ——> MED(Logic1, Logic2, Logic3) = Logic(3)

A contexture is the common framework of a logic and its corresponding ontology.

Conjunctive connection of ontological modules A, B, C, D in each contexture:

L_1: A and B and C and D

L_2: A and B and C and D

L_3: A and B and C and D

$L^{(3)}$: $A^{(3)}$ and and and $B^{(3)}$ and and and $C^{(3)}$ and and and $D^{(3)}$

The binary case for short: $L^{(3)}$: (A and B); (A and B); (A and B)

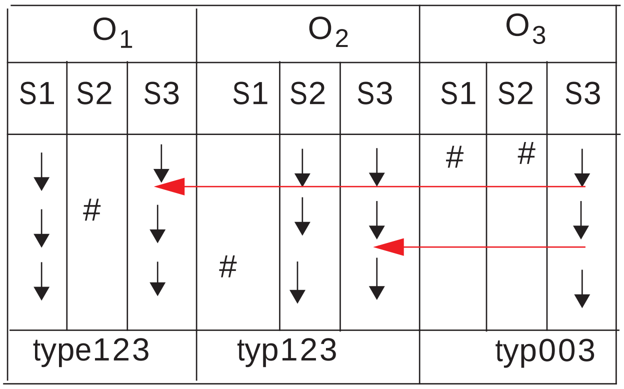
As we see, the possible places for reflecting the neighbor systems are empty, marked with "#" in the case of the monoform junctional distribution.

Diagramm 27

O_1			O_2			O_3		
S1	S2	S3	S1	S2	S3	S1	S2	S3
↓ ↓ ↓	#	#	#	↓ ↓ ↓	#	#	#	↓ ↓ ↓
type100			typ020			typ003		

This corresponds to the purely parallel situation of the ontologies as such without any interaction at all. But nevertheless, these logics are distributed over three places and mediated together in the architectonics of the logical frame $L^{(3)}$.

Diagramm 28



Additionally to the intra-contextural realizations of conjunctive chains we observe a first interaction from the logical system to its neighbor systems. Again, this interaction is not overriding its neighbors but is offered by the neighbors logical space to succeed realization. In other words, the neighbor systems are mirroring, that is, reflecting the interactivity of the logic system L3 in a place or locus of their own systems.

How is this realized? Also no conjunction or disjunction or other intra-logical operation is able to leave its place, we are not lost in the cage of mono-contexturality, because by construction, logical operations which are crossing the borders of their systems are accessible, this is the family of transjunctions.

A transjunction has a continuation simultaneously in its own and in its neighbor systems.

For short, we have in $L^{(3)}$: (A and B; A and B; A trans B)

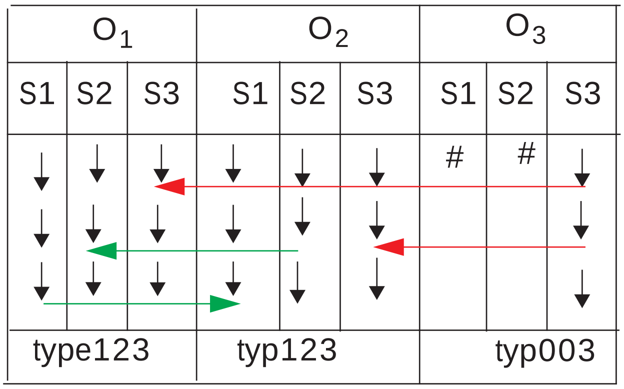
In L_3 the transjunction is crossing to logic L_2 simultaneously to logic L_1 and staying with other parts of the formula in its own logic L_3.

It is easily to see, that the classical conflicts of multiple inheritance would be produced if the mapping would not be transjunctional and reflectional but a simple mapping onto the systems as such, that is, mapping of O3S3 onto O1S1 and O3S3 onto O2S2.

The same argumentation is used for the logical operator “implication” and works in the same sense also for meta-logical constructions like the inference rule(s).

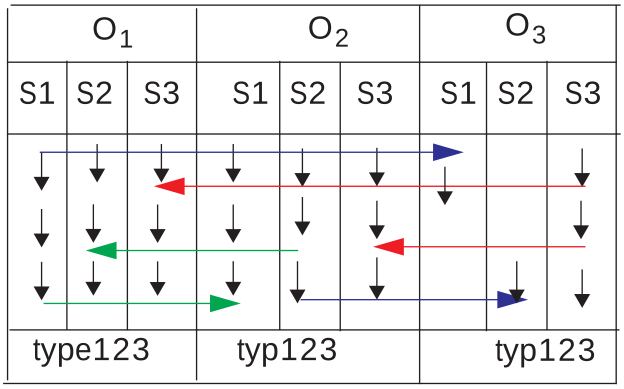
Therefore inferencing in poly-contextural systems is architectonically parallel.

Diagramm 29



$L^{(3)}$: (A trans B); (A trans B); (A trans B)

Diagramm 30



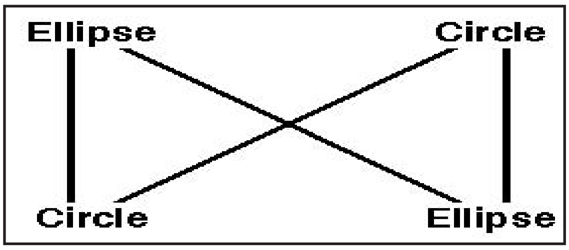
Even more interesting interactions are possible with the introduction of transjunctional mappings from O1S1 to O3S1 and from O2S2 to O3S2.

In these cases, reflectionality enters the domain of the vocabulary Voc. The Voc , again, is not only a collection of facts which exist per se in a dictionary. A vocabulary exists in being used. Therefore the other system s are influencing the system of the vocabulary. The difference is, that these lexical influences are not yet incorporated by the vocabulary in the sense of O3S3. That the reason way they occur in the reflectional ebvironment of Voc as reflecting and accepting the interactive influence of Furn and Dept to the domain of Voc.

4.1 Inconsistency, Contradiction and Polysemy

Building, Sharing, and Merging Ontologies, John F. Sowa

Figure 14 shows a "bowtie" inconsistency that sometimes arises in the process of aligning two ontologies.



On the left of Figure 14, Circle is represented as a subtype of Ellipse, since a circle can be considered a special case of an ellipse in which both axes are equal. On the right is a representation that is sometimes used in object-oriented programming languages: Ellipse is considered a subclass of Circle, since it has more complex methods. If both ontologies were merged, the resulting hierarchy would have an inconsistency. To resolve such inconsistencies, some definitions must be changed, or some of the types must be relabeled. In most graphics systems, the mathematical definition of Circle as a subtype of Ellipse is preferred because it supports more general transformations.

http://users.bestweb.net/~sowa/ontology/ontoshar.htm#Formal

For whom are this two positions a contradiction? Where does the inconsistency appear? Obviously both positions are clean in themselves. The inconsistency or logical contradiction occurs only by the mixing both and mapping them into a third general common position. What happens? The merging produces a new object which involves both different positions and at the same time denies the autonomy of those positions.

Again, for the case of managing a small household, the strategy of subordination maybe accepted for the one or other short termed practical reasons. But, by whom? For more official, and serious solutions, the idea of resolving by the device *“To resolve such inconsistencies, some definitions must be changed, or some of the types must be relabeled.”* is not a proof of profound thinking and knowledge about practicability.

4.1.1 From merging to mediating interactivity

From an actional point of view in contrast to an entity ontology standpoint it is more apprpriate to consider the process of merging as a process of conflict resolution. This type of modelling is reasonable only if we accept the relevance of the two different point of views, if both positions have their own reason to exist. Otherwise it would only be a question of terminology and adjustments (renaming, relabelling).

The above example of a “bowtie inconsistency” can easily modelled as a chiastic interaction between two different positions offering at least a conceptual description of the situation as introduced.

Chiasm (Ellipse, Circle, Pos1, Pos2):
OrdRel(Ellipse1, Circle1)
OrdRel(Circle2, Ellipse2)
ExchRel(Ellipse1, Circle2)
ExchRel(Circle1, Ellipse2)
CoincRel(Ellipse1, Ellipse2)
CoincRel(Circle1, Circle2)

To model the full picture of the chiastic situation we can move to the Diamond Strategies.

4.1.2 Diamond strategies and merging inconsistent ontologies

A framework of the distribution of places needed to merge inconsistent or dual ontologies is given by the Diamond Strategies.

Position: a given ontology.

Opposition: the dual ontology to the positioned ontology, short, the contradicting ontology.

Neither-Nor: the position which is neither one nor the other ontology, but in respect to this two ontologies. It is the place of the rejection of both ontologies. Positively, it is the empty place which is common to both in respect of rejecting the ontologies.

Both-And: the position which gives place for both, the first and the second ontology at once. At this place, the position as well as the opposition is accepted, that is, the contradiction between both ontologies is accepted as such.

I hope it becomes slowly clear that the diamond strategies are not at all identical with the tetra-lemma of Buddhist philosophy despite some analogy in the wording.

Rejection of an alternative and acceptance of an inconsistency has nothing to do with negation or set theoretic union of concepts. One of the main differences is that the tetra-lemma is not reflectional at all. It is a good starting point but only as a configuration about the world as it is without including any observational reflectionality.

It is obvious too, that the acceptance of inconsistency is not understood in the sense of para-consistent logics. Nevertheless, it is interesting for other reasons to deal inconsistencies in a para-consistent setting.

Today it shouldn't be a technical problem to represent complementary objects at once on a screen or where ever.

The discipline which would have to deal with such complementary objects and their theories would be called *"Dynamic Diagrammatics"* as a further development of the Peirceian based Diagrammatics.

Politics of examples

Examples and metaphors are not as harmless as it seems to be.

Some more realistic examples instead of innocent circles and ellipses, chairs, penguins and kilts etc. should be introduced. A simple example of renaming is globally introduced by Bush´s doctrine of pre-emptive war.

Logic of execution:
Human beings, animals
allowed to be killed, not allowed to be killed
Friedensfighter, terrorists

The Christian problem of executing humans in a non-war situation is pluntely solved by Bush and Sharon with the not at all rhethorical decision, that terrorist are animals.

In the more theological terminology, animals are replaced by the evil, because animals too are creatures of God.

5 Polycontextural modelling of multiple inheritance

Ontologies differ in how they handle the case of inheriting multiple properties.
Robert Lee

There are no problems neither with polysemy nor with multiple inheritance if you chose your examples carefully and then run away after you have been paid.

The multiple inheritance of CHAIR being a AdminStaff member and a Faculty member as Professor in the example of SHOE is surely innocent of any logical violations, leading to contradictions. SHOE is even excluding logical negations to avoid contradictions. But this is not the situation a Semantic Web designer should be concerned about.

It is simply bad propaganda and contra-productive advise if I have to read in different Web Semantic papers that they have solved the multiple inheritance problem properly.

Let´s have a short look at the scenario.

Several proposals have arisen for thesauri interchange formats based on either RDF or DAML+Oil. The major problems with these is that either they cannot accommodate the multiple inheritance common in many multilingual thesauri or that the semantics of thesauri in the ISO standards are not as precise as these languages require. The links in thesauri hierarchies define the top term in the hierarchy, and the broader or narrower coverage of terms down the hierarchy. There are also links between hierarchies to show equivalence in different languages, or similar meaning in the same language.

http://www.ercim.org/publication/Ercim_News/enw51/wilson.html

A more optimistic view is here. You simply have to do it before the game.

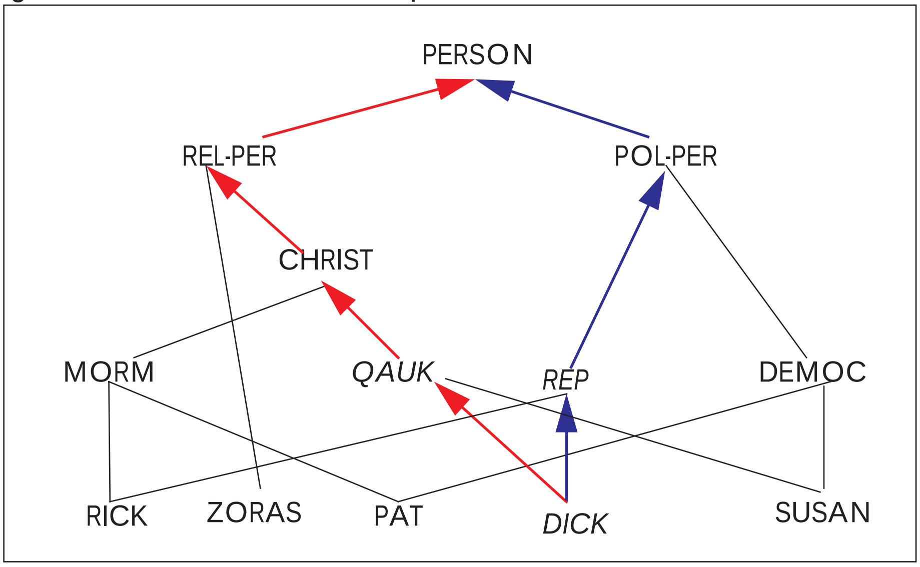
Very flexible ways of combination, such as multiple inheritance, can be specified for types in simple ways. Since agreement on supplied and required interfaces is all that is needed for the exchange of data in a distributed environment types already provide the glue for many useful applications.

The Quaker Example

Most Quaker are Pacifists
Most Republicans are non-Pacifists
Dick is a Quaker
Dick is a Republican.

Query: Is Dick a Pacifist?

Diagramm 31 **Multiple Inheritance**



There are many serious attempts to deal with multiple inheritance in the AI literature (Lokenda Shastri: *Semantic Networks: An Evidential Formalization and its Connectionist Realization*, Pitman London 1988)

It is not the place here to discuss Shastri´s solution. What we can learn is the introduction of different *relevance* criteria and *multiple views* on a token. It is only a simple step further to combine multiple views with multiple contextures and introducing irreducible polysemy into the very concept of "person".

Therefore, Dick has multiple personal identity, one as a Religious Person (REL-PER) and one as a Political Person (POL-PER).

With the introduction od POL-PER and REL-PER the simple question "Is Dick a Pacifist?" is wrongly placed and not well-formed because the particle "as" giving his perspective and role is excluded.

We have to ask "Is Dick *as* a POL-PER a pacifist?" and "Is Dick *as* a REL-PER a Pacifist?" And additionally, which is a very different question, we can ask "How is Dick as Dick, which is neither a political nor a religious person, dealing with his two positions of being a POL-PER and a REL-PER?" And here, we would have to consider the relations of interactions between the different ontologies.

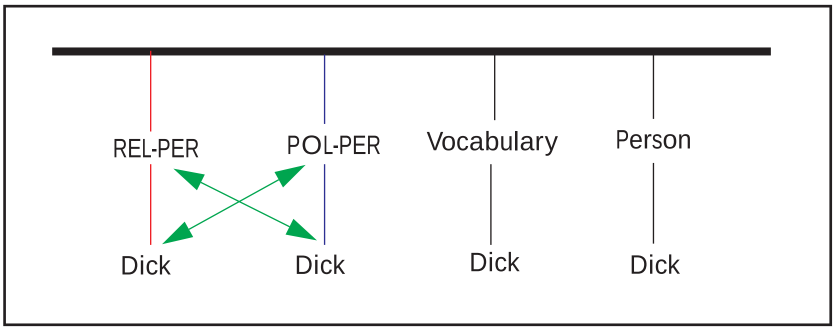
Only if we are reducing the two perspectives and eliminating the as-category, we are reconstructing the contradictions of this multiple inheritance situation. This maybe well known, but because of the lack of a logic which is genuinely dealing with different and mediated perspectives, like polycontextural logic, the implementation of the complex conceptual modeling is lost for mono-contexturality.

I can not go into the details here, but obviously, the polycontextural approach of modelling the multiple inheritance situation has to separate and then to mediate the ontologies REL-PER and POL-PER in a heterarchical interacting poly-ontology.

Obviously, the SHOE trick for multiple inheritance we have learnt before with Chair= (Dept, AdminStaff) doesn't work anymore. Because Dick as (REP, QUAK) is producing a contradiction by definition. By the way, the same can happen with the Chair example, we simply have to change the rules of the organization to a more strict regime.

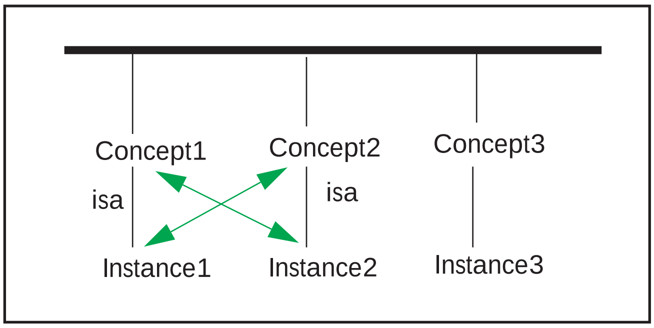
Again, a hint is given by the following chiastic metapattern diagram.

Diagramm 32



I added to the list of
Quaker
Penguine
Whale
Oistrich
Fleuve
etc.
the very neglected case of Kilts.

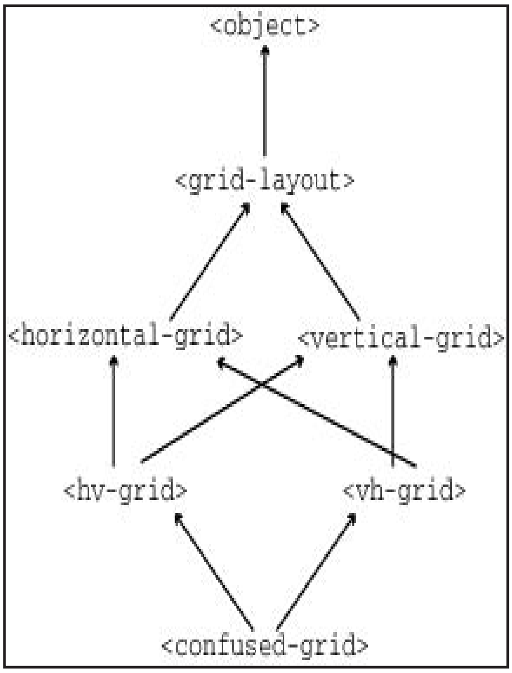
Diagramm 33



Kilt as an instance of female clothes proposed by the Eurpean Administration, that is as a skirt and therefore female, is surely in contradiction to the Scottish definition of Kilts. A chiastic resolution of this crucial conflict has simply to understand that Kilts are Instances of a very different Concept2. It doesn't mean that the Instance1 “Kilt” becomes itself a Concept2, but that the contradiction in system1 with Instance1 and Kilt gives reasons to a *switch* to system2 with concept2 as maybe “folklore” and Kilt as an Instance2 of Concept2. But both systems are as mediated systems not isolated.

Is the Grid of the Dynamic Semantic Web a confused Grid?

Why linearizations? *In a class-based object-oriented language, objects are instances of classes. The properties of an object - what slots or instance variables it has, which methods are applicable to it - are determined by its class. A new class is defined as the subclass of some pre-existing classes (its superclasses - in a single-inheritance language, only one direct superclass is allowed), and it inherits the properties of the superclasses, unless those properties are overridden in the new class. Typically, circular superclass relationships are prohibited, so a hierarchy (or heterarchy, in the case of multiple inheritance) of classes may be modeled as a directed acyclic graph with ordered edges. Nodes correspond to classes, and edges point to superclasses.*



It is possible that an inheritance graph is inconsistent under a given linearization mechanism. This means that the linearization is over-constrained and thus does not exist for the given inheritance structure. An example of an inconsistent inheritance relationship appears in example 1c. <confused-grid> is inconsistent because it attempts to create a linearization that has <horizontal-grid> before <vertical-grid>, because it subclasses <hv-grid>, and <vertical-grid> before <horizontal-grid>, because it subclasses <vh-grid>. Clearly, both of these constraints cannot be obeyed in the same class.

Kim Barrett et al, A Monotonic Superclass Linearization for Dylan

http://www.webcom.com/haahr/dylan/linearization-oopsla96.html

```
define class <grid-layout> (<object>) É end;
 define class <horizontal-grid> (<grid-layout>) É end;
 define class <vertical-grid> (<grid-layout>) É end;
 define class <hv-grid> (<horizontal-grid>, <vertical-grid>) É end;
 define method starting-edge (grid :: <horizontal-grid>)
   #"left"
 end method starting-edge;
 define method starting-edge (grid :: <vertical-grid>)
   #"top"
 end method starting-edge;
```

Example 1a: A simple use of multiple inheritance

```
 define class <vh-grid> (<vertical-grid>, <horizontal-grid>) É end;
```

Example 1b: Reversing classes in the linearization

```
 define class <confused-grid> (<hv-grid>, <vh-grid>) É end;
```

Example 1c: An inconsistent class definition

6 Query, questions and decisions

"Only undecidable questions have to be decided by man" ? HvF

As long as our queries are answering our questions with only non-ambiguous, non-polysemous statements, we are dealing with a very reduced case of semantics. It is semantics reduced to a machine-readable and machine-understandable situation, therefore there is no need for cognitive reflectional decisions.

If i am asking for the earliest flight to Frankfurt/M and the answer is "6.30h", then i have to accept it as the answer to my question. And nothing has to be interpreted, understood or decided. (Except, that the flight is much to early for my rituals.)

Semantics as a reflectional system is not dealing primarily with facts but with meanings. Meanings are at least reflectional multi-leveled, or as we know from Second-order Cybernetics, second-order concepts. That is concepts of concepts (of facts).

What is the purpose of a query system? A query system has to support and to assist decision-making for humans and as far as possible also for machines.

It seems reasonable to make a distinction between machine- and human-decidable decisions. Machine decidable decisions are on the level of dis-ambiguous dis-ambigue meanings, that is zero-level or 1-level meaning.

ambiguous ambigue
dis-ambiguous ambigue
ambiguous dis-ambigue
dis-ambiguous dis-ambigue

To make it easier, a simpler correlation to polysemy is possible by one-to-one, many-to-one, one-to-many and many-to-many relations. All well known in rhethorics and linguistics since Aristotle.

From Metapattern to Ontoprise

back to page 1

1 Parallelism in Polycontextural Logic

Additionally to the well known OR- and AND-parallelism, polylogical systems offer two main extensions to the *logical* modeling and implementation of parallelism. First the distribution of the classical situation over several contextures and second, the trans-contextural distributions ruled by the different transjunctional operators. The distribution over several contextures corresponds to a concurrent parallelism where the different processes are independent but structured by the grid of distribution. The trans-contextural parallelism corresponds to a parallelism with logical interactions between different contextures.

> "The tree corresponding to the search for a solution to a question seems open to various kinds of parallelism. The most obvious technique, called OR parallelism, allows processes to search disjunctive subtrees in parallel, reporting back to the parent node the result(s) of the search.
> The advantage of OR parallelism is that the searches are completely independent of each other and may execute concurrently (except that both may share access to a common data base storing facts and rules). The process performing the search of one subtree does not communicate with processes searching other subtrees." Michael J. Quinn, 212, 1987

Prolog is based not only on its logic, used as an inference machine, but also on its semantics or ontology, realized as a data base. Therefore the process of parallelising has to deal with a deconstructive dis-weaving of the data base´s ontology.

1.1 Strategies towards a polycontextural parallelism in Prolog

Like in the case above, where the number systems had to be cloned, in the Prolog case, the data base has to be decomposed into disjunct parts. These separated conceptual parts, or conceptual subsystems, have to be distributed over different contextures in a mediated polycontexturality.

Additionally the Prolog parallelism which is based on OR- and AND-parallelism has to be mapped into distributed logics, that is, into a polylogical system.

The Prolog example allows to explain in more a plausible way the decomposition or cloning of the common universe of discourse, that is, the data base of facts, into different subsystems. And secondly it is easier to introduce parallelism based on polycontextural logic than on arithmetics and combinatory logics.

Polycontextural logic is not widely known but more accessible than combinatory poly-logic and poly-arithmetics, which I am just introducing. Additionally there exists since 1992 a working implementation of a tablex proof system of an interesting subsystem of polycontectural logics in ML, running on Unix systems like NeXT.

1.1.1 An intermediate step with Metapattern

As an intermediate step in the shift of conceptualization from a hierarchical to a heterarchical way of concept building it maybe helpful to use the strategy of metapattern (Wisse). Metapatterns are used as an new modeling strategy for complex informational systems. Metapatterns are not involved in changing the basic assumptions of programming languages or even their logic as with the PCL approach.

Metapatterns could be helpful to move the process of parallelisation from the OR- and AND-level, that is, from the logical level to the deeper level of the data base, with its facts and rules, shared by the classical parallelism.

> She can relax on a fixed object orientation because — the metapattern determines that — situation and object are relative concepts (Wisse 2001). A particular situation is also object in another, higher-level situation. Likewise, an object can act as situation in which another, lower-level object resides. Situation, then, is a recursive function of object and relationship. Wisse

Hierarchy or chiasm?

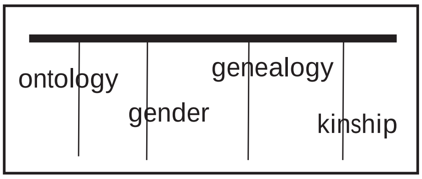
> It is this concept of situation that characteristically sets the metapattern apart from traditional object orientation (and provides it with advantages over OO; Wisse 2001). Compared to an object that (only) exists absolutely, an object believed to exist in a multitude a different situations can unambiguously be modeled – to be equiped – with corresponding behavioral multiplicity. Wisse 2001

> The radical conclusion from the orientation at situational behavior is that an object's identification is behaviorally meaningless. The modeler does not have to explicitly include something like an original signature in all her models. Essentially a privileged situation may implied. It serves the only purpose of guaranteeing sameness or, its equivalent, persistent identity across (other) situations. Being a situation in its own right, when included in a model it is represented by a seperate context. Made explicit or not, its role is to authenticate an object’s identity in other situations by establishing the signature in other contexts.

> **Identity as a network of nodes**
>
> Traditional object orientation assigns identity at the level of overall objects. Context orientation replaces this view of singular objects with that of plusrality within the object; the object always nneds a context to uniquely identify the relevant part of an overall object, which is what identifying nodes regulate. When behaviors are identical, no distinction between contexts is necessary.

1.2 Deconstruction of a typical PROLOG example

The classical prolog example to prove an "*aunt*"-relationship can be decomposed from its hierarchical ontology into different situations mapped into different contextures and visualized in the metapattern.



kinship: married / not-married, in-law, aunt

gender: male, female

genealogy: parent, sibling

ontology: different / not-different

It is also possible that there is some overdetermination because *parent* and *sibling* could also be part of *kinship.*

In Prolog all the facts belong to one ontology or to one semantic general domain or universe. All the rules are based on this mono-contextural ontology and on the corresponding logical operators AND and OR of the again, mono-contextural logic. Everything therefore is linearized and homogenized to a global or universal domain. This, if corresponding fairly with the real world situation is of great practicality and efficiency in both direction, in the case of the formal system, Prolog, and in the case of its data base.

But often, if not always, real world applications are much more complex than this. Even the fairly classical example is presupposing all sorts of facts which are not mentioned in the definition and which would belong to a different real world situation.

I don't criticize this kinship model. It is doing its job to explain in a first step Prolog perfectly. Again, I am using this example for deconstructive reasons, that is for introducing the PCL way of thinking. This is, again a form, I guess, of legitimate abuse of classical models.

Instead of linearizing the above separated contextures *kinship, gender, genealogy, ontology* into one universal domain, for the example here represented by *kinship*, the polycontextural modeling is asking for an interweaving and mediating of these different contextures together to a complex poly-contexturality.

Compared to the original mono-contextural modeling this is involving much more complicated mechanisms than it is necessary in the classical case.

Why should we model a simple situation with highly complex tools into a complex model if we can solve the problem with much simpler tools? Simply because the classical approach lacks any flexibility of modeling a complex world. The truth is, that the simple approach needs an enormous amount of highly complicated strategies to homogenize its domains to make it accessible for its formal languages.

To decompose the basic classical ontology into different disjunct domains is a well known procedure and should not be confused with the decomposition, or de-sedimentation of an ontology in the PCL case. In PCL the domains are not simply disjunct and embraced by the general ontology but interwoven in a complex mechanism of interactions.

1.2.1 Polylogical modeling of the metapattern

The metapattern approach has helped to dissolve the hierarchical conception of the "aunt"-relation into different aspects.

In Prolog, the aunt-relation is defined as follows:

ant(x,y):= female(x), sibling(x,z), parent(z,y).

additionally the rule for sibling is:

sibling(x,y):= parent(z,x), parent(z,y), (x/==y).

The aunt-function is fullfilled and is true, if all components which are connected by the conjunction *et* (AND) are true.

true(aunt(x,y) iff (true(female(x)) et true(sibling(x,z)) et true(parent(z,y)))

Metapattern distribute the AND (or: et) over different heterarchical places but gives no formalism to handle this distribution. Polylogics is also distributing these conjucn-tions but in transforming them at the same time into operators of mediation. Polylogics is shortly defined as a distribution and mediation of classical logics.

ant(x,y) := female(x) § sibling(x,z) § parent(z,y)

sibling(x,y):= parent(z,x) § parent(z,y) § (x/==y)

Therefore the polylogical truth-function is transformed to:

aunt(x,y) eTrue ==> $aunt^{(3)}$e(x,y) e (T_1,T_2,T_3)

The metapattern of parts of the formulas can be transformed into the diagram.

S1	female(x)			
S2		sibling(x,z)		
S3			parent(z,y)	
S4				aunt(x,y)

How to read the transformation?

In Prolog, each term as such has an identical meaning. If the variable x is denoted with “mary” and mary is female, then the relation or attribute female(mary) is true. Also the variables x, y, z,... are identical. Obviously no “x” will be read as an “y”; we don´t make a "x" for a "u".

In polylogic the situations are happily a little bit more flexible. The variables are flex-ible to occur as variables in different systems. The variable “x” can occur as the vari-able x in system S1, that is the variable x can occur *as* variable x1.

In the same sense the denotation “mary” can occur as female or as sibling or as parent or as something else. Mary *as* Mary, again something else, maybe a secret.

Our model suggest the following reading:

x as female: x1 and mary as female: mary1

x as sibling: x2 mary as sibling: mary2

z as sibling: z2 stuart as sibling: stuart2.

y as parent: y3 kathleen as parent: kathleen3

z as parent: z3 edward as parent: z3

The result: aunt(mary,kathleen).

x as aunt: x4 mary as aunt: mary4

y as -aunt: y4 kathleen as beeing in relation to her aunt: kathleen4

Also the simultaneity for "mary" of being female and sibling, which is ruled in the Prolog model by the conjunction “et”, is realized in the polylogical model, obviously by the mediation rule “§”.

This example is very simple because the elements of the partition are simple, there are no composed formulas included. Insofar there is no need to involve polycontextural negations, junctions and transjunctions. Only the operator of mediation "§" between distributed attributes and relations are involved.

Only if we freeze the scenario to a static ontological system all the flexibility of the as-function, not to confuse with the as-if-function, can boil down to the well known non-flexible structure. But to allow a flexible ontology with x as x1, as x2, etc. or mary as female, as sibling, etc. allows to change ontology and to be ready for new situations without starting the system from scratch. It is easy to freeze complexity, but there are no known rules how to make a frozen and dead systems alive. Maybe that’s the reason why artificial life is nevertheless so hard.

1.2.2 Prolog´s ontology

Prolog refers as it has to do as a programming language based on First Order Logic (FOL) on attributes, relations between attributes and inference rules etc. and not on behaviors and contexts.

To be a *parent* is classically an attribute of a person, described as a relation to other persons, in PCL this attribute becomes a *behavior*, maybe of a person, in a complex situation. To be parents is not necessary connected with the attribute to be *married*, to be a *sibling* has not to be restricted to have the same parents, to be married has not to involve different *gender*, and so on. And even that a person is different to another person, or that the person is identical to itself is not as natural as it seems to be. All these presumptions are reasonable, and are corresponding to possible real world models only if all the possible ambiguities and over-determinations are ruled out in favor to a very special model of kinship.

The solution to this situation of complexity is not so much to enlarge the given ontology and to introduce the new differences and attributes to cope with the new situation. Because this strategy is based on the exact same ontological presuppositions and is therefore only repeating the old scenario again.

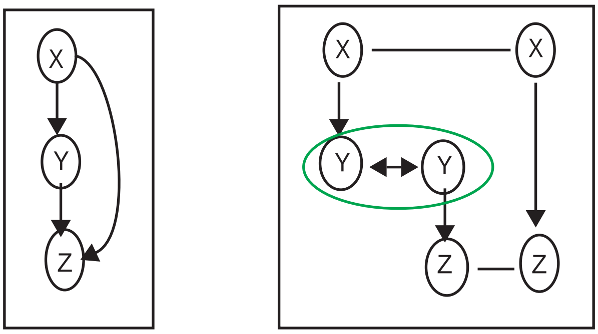
In the framework of PCL mechanism are offered for a great flexibility in interlocking and interweaving different points of view, situations, and modeling.

The decomposition of an universal domain into its different components is not only introducing a conceptual advantage for the process of modeling but also on a computational level a new form of parallelism is introduced.

The whole manoeuvre is quite similar to what I proposed as a proemial relation between sorts and universes in many-sorted first order logics.

1.2.3 The devil is in the detail

Polycontexturality is not starting somewhere in a complexity, it is virulent at the very beginning of the basic definition of relationships.



Y as child of X and Y as the father of Z has to be mediated, synchronized, realized. Only in a stable hierarchical ontology this relationship of Y as “child of” and “father of” is automatically connected. And therefore “father of father” can be equal to “grandfather” and realized by a conjunction of the two relations, father(X,Y) et father(Y, Z) eq grandfather(X, Z).

In a polycontextural setting this identity of Y, as child and as father, can not be presupposed but has to be established in a possible context. Y as child and Y as father has to be brought together in a way that the transitivity can hold. It is easily possible that the transitivity is broken for some reasons and that it has to be re-established. The reason why the transitivity can be broken lies in the poly-contextural assumption that a entity or a relation is not a simple identity but involved in a cluster or an intersection of a multitude of possible contextures. Only for restricted and regulated situations a complex situation can be reasonably reduced to a mono-contextural one in which transitivity holds unrestricted. Therefore, identity can not be presupposed it has to be realized from case to case.

Because of the relative autonomy of both relations in a complex kinship system, we can calculate and study them simultaneously, realizing some elementary parallelism. This is obviously not possible in a strict biological interpretation of the father-child-relation. There we have to accept the hierarchical dependencies of the relations. But again, we have to be aware that this is the case only because we restrict the setting to a mono-contextural case. In contrast, real world social relations are always highly complex.

Therefore we have two options, the mono- and the polycontextural. The advantage of the later one is flexibility, the advantage of the first one is stability. Both have there weakness, flexibility is risky and dangerous, stability is restricting and killing.

2 Ontological transitions

2.1 From Types to behaviors

Identity as a network of nodes

Traditional object orientation assigns identity at the level of overall objects. Context orientation replaces this view of singular objects with that of plurality within the object; the object always neds a context to uniquely identify the relevant part of an overall object, which is what identifying nodes regulate. When behaviors are identical, no distinction between contexts is necessary.

From OO: super-level (type: person) —> sub-level(type: national), (type(foreigner) to

metapattern: (nationalship: person), (foreignship: person), (personship: person).

The class hierarchy of the OO model is transformed to a heterarchical model of behaviors, that is simultaneously ruling contexts.

2.2 From behaviors to interactivity

Behaviors, realized as in situations and contexts comes in plurality.

But metapattern doesn´t offer much mechanism of navigation between simultaneous contexts. What we get is the notion of a pointer, *"pointer information objects"*. They are supporting navigation from one context to another. But these pointers don´t give a hint how they could be implemented.

Metapattern points to the relevance of points of view.

From Context(type / instance) to Contextures(context(type / instance))

2.3 From objects to objectionality

2.4 The hidden rules: logic and interferencing

In contrast to the *modelling* aspect emphasized by the metapattern approach, from the point of view of *implementation* of the conceptual models we have to consider the underlying logics of the informational system, here ontologies for the Semantic web.

With this turn we are enabled to show the overwhelming advantage of the PCL approach over the classical modelling and implementing standards. It is the polycontectural, that is the polylogical apparatus which is framing the implementation of the deconstucted ontologies with the help of the metapattern. Without a polylogical implementation, the metapattern is an important modelling device but gives no guidelines for its real world implementation. This can by realized by polylogical funded data base logics.

Data base logics, as F-logic, are grounded on First Order Logics (FOL).

Normally, the user of say OntoEdit, is not involved in the questions of implementations. But to give the OntoEdit more flexibility, the user is offered a "General Axiom" plugin which allows her to define and edit axioms.

To check your new axioms an inferencing plugin is offered.

> Inferencing
> The inferencing plugin can be used to test the ontology and its axioms. In the text field on the upper right you can type queries to query the data model. These queries have to be in F-Logic syntax.

Obviously, the new rules added by the user are only useful if they correspond to FOL.

> F-Logic Tutorial, ontoprise GmbH
> Based upon a given object base (which can be considered as a set a facts), rules offer the possibility to derive new information, i.e., to extend the object base intensionally. Rules encode generic information of the form: Whenever the precondition is satisfied, the conclusion also is. The precondition is called rule body and is formed by an arbitrary logical formula consisting of P- or F-molecules, which are combined by OR, NOT, AND, <-, -> and <->. A -> B in the body is an abbreviation for NOT A OR B, A <- B is an abbreviation for NOT B OR A and <-> is an abbreviation for (A->B) AND (B<- A). Variables in the rule body may be quantified either existentially or universally. The conclusion, the rule head, is a conjunction of P- and F-molecules. Syntactically the rule head is separated from the rule body by the symbol <- and every rule ends with a dot. Non-ground rules use variables for passing information between subgoals and to the head. Every variable in the head of the rule must also occur in a positive F-Atom in the body of the rule. Assume an object base defining the methods father and mother for some persons, e.g., the set of facts given in Example 2.1.
> The rules in Example 7.1 compute the transitive closure of these methods and define a new method ancestor:
> FORALL X,Y X[ancestor->>Y] <- X[father->Y].
> FORALL X,Y X[ancestor->>Y] <- X[mother->Y].
> FORALL X,Y,Z X[ancestor->>Y] <- X[father->Z] AND Z[ancestor->>Y].
> FORALL X,Y,Z X[ancestor->>Y] <- X[mother->Z] AND Z[ancestor->>Y].
> man::person.
> woman::person.
> 8.2. Queries
> A query can be considered as a special kind of rule with empty head. The following query asks about all female ancestors of Jacob:
> FORALL Y <- jacob[ancestor->>Y:woman].
>
> The answer to a query consists of all variable bindings such that the corresponding ground instance of the rule body is true in the object base.

2.5 From Information to Knowledge

Is the logic of data, information and records the same as the logic of knowledge? And further, is logic enough for representing knowledge?

I don´t want to go into the interesting discussions about the relationship of logic and knowledge representation languages as developed by the AI researchers long ago. What has to be mentioned is that in their different approaches they all introduced some two-level languages of object-level and meta-level theories.

To give a further motivation to introduce a poly-contextural view of data-base systems it maybe helpful to use the difference between logic of data and logic of knowledge.

The logic of data is quite strict, and well established by the classical systems of logic. Data are strictly non-ambiguous, they maybe not precise, but there is no need for hermeneutical interpretation. Data are in this sense facts. There linguistic model is the name. Facts have names and names are unambiguos, they name an entity. If someone, a person, is called “Meyer”, he is not called in the same sense “Mueller”. If a database consists of data as facts, the rules of logic apply without any restrictions. It is therefore natural to mix these data systems with a hierarchical concept system and to represent them as trees with a single root. The basic names of the Web are URIs, they are based in numbers, and these don´t need any hermeneutics.

But the situation can be considered in a radical different way. If the data-base consists not so much of data as facts but of data as concepts, there is no need to accept the hierarchical system of the classical solution.

If a person is called “Mueller”, it´s about facts. If we deal with “persons” it´s not about facts it´s about concepts. Concepts and categories can be understood by the ontological model of names. This is the Aristotelian way. But this is, as we have learned in contemporary philosophy long ago, not the only way. It is a very restricted and obsolete position. Unfortunately it is what we learn from the ontologies of the Semantic Web.

The knowledge about facts is different from the knowledge about concepts. The knowledge about concepts involves some meta-language knowledge which belongs to another logical level than object-language knowledge.

The hierarchic architecture of concepts, as introduced by Aristotle and Porphyr, is a possible but not a necessary solution. It is oriented by object-knowledge. With this approach concepts are produced by abstraction over data sets. Objects, data, records, etc. are first. They have their identity defined on their object-level. There is no change of identity for objects. They are what they are. In this case, concepts are used to produce knowledge about objects and not knowledge about concepts.

Polycontexturality, like the metapattern approach, takes a different strategy. Objects are objects only in relationship to contexts. More adequate, objects are understood by their behavior. Therefore, an abstract object without any behavior, independent of contexts doesn’t exist; it is a nil object.

Therefore, classical objects, like data, have a one-level behavior, they exist by being named. They are the result of the process of naming.

Semiotically we are making a shift from the dualistic to a trichotomic semiotics, and further to a chiastic graphematics.

What are the objects of the Semantic Web?

While formalizing the principles governing physical objects or events is (quite) straightforward, intuition comes to odds when an ontology needs to be extended with non-physical objects, such as social institutions, organizations, plans, regulations, narratives, mental contents, schedules, parameters, diagnoses, etc. In fact, important fields of investigation have negated an ontological primitiveness to non-physical objects [7], because they are taken to have meaning only in combination with some other entity, i.e. their intended meaning results from a statement. For example, a norm, a plan, or a social role are to be represented as a (set of) statement(s), not as concepts. This position is documented by the almost exclusive attention dedicated by many important theoretical frameworks (BDI agent model, theory of trust, situation calculus, formal context analysis), to states of affairs, facts, beliefs, viewpoints, contexts, whose logical representation is set at the level of theories or models, not at the level of concepts or relations

Sowa ??

Interactions in a meanigful world

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1 Queries, question-answering systems

Questions are not innocent. There are no neutral questions. This is obviously true for human communication. But it is naive to think that questions to information systems are excluded from this constellation.

Data mining, elicitation and collection of explicit or implicit information, that is pre-given implicit or explicit answers to well-formed questions from a query system.

2 Diamond based interrogative systems

Questions which are not restricted to information about facts are including aspects of relevance, significance, context dependendness and other criteria of meaningful answers.

A simple scheme to support meaningful questions is given by the Diamond Strategies I introduced long ago.

3 Evocative communications

> William Olander in 1987: "Clough has developed yet another hybrid—a painting which is simultaneously genuine and artificial, cultural and natural, full and empty, without resorting, overtly at least, to the ideological apparatuses of late modernism."4 and Clough characterizes as: "transformation, inflection, turbulence; a very particular vibrating cosmic tension; weave of force; harmonics of intentionality; subliminal erotics of creation; spontaneity, evocativity; meaning as desire and fear in smoky arabesque; rippling quench; refracting enigmatic shimmer; the lethal chop of value; subtle ofity of itness; dancing with tradition, accepting, rejecting and relentless execution; the power in the compulsion to create as a measure of the ultimacy of humanness, depth of drama; a pulsing overlay, overlap, palimpsest, wave upon wave to come again & again & again..."
>
> —Nancy Whipple Grinnell, Curator, Newport Art Museum

Evocative questioning is beyond elicitation and installation (suggestion) and is opening up in a co-creative interplay new answers to new questions, new horizons of questioning.

How are we questioning an object which is characterized by highly hybrid, full of ambiguity and surprising paradoxes? Obviously it can not be done in the same way as we ask for a vacuum cleaner.

On Deconstructing the Hype

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This little exercise of deconstruction follows the simple scheme of the DiamondStrategies. All 4 positions of a context, affirmation, negation, neither-nor and both-at-once, have to be considered. All in the same strength of the argument. Here, in deconstructing the hype, that is the position, or positioning of the semantic web and similar, the dynamic semantic web, it will be at first restricted only to the process of rejecting, dualizing, reflecting the not reflected preconditions of the position and not involving the 2 positions of full rejection (neither-nor) and full acceptance (both-at-once).

1 The hype of the distributed, decentralized and open Web

At the beginning of our study we learnt that the Web is at least distributed, decentralized and an open world.

> ***The Web is distributed.*** *One of the driving factors in the proliferation of the Web is the freedom from a centralized authority.*
>
> *However, since the Web is the product of many individuals, the lack of central control presents many challenges for reasoning with its information.*
>
> *First, different communities will use different vocabularies, resulting in problems of synonymy (when two different words have the same meaning) and polysemy (when the same word is used with different meanings).*

There is no reason to deny this description at least as a starting point. Remember, the description of the weather system sounds very similar. But all these emphasis of the openness and decentralized distributedness of the Web is describing not much more than the very surface structure of the Web. It emphasize the use of the Web by its users not the definition and structure, that is, the functioning of the Web. There are no surprises at all if we discover that the structure of the Web is strictly centralized, hierarchic, non-distributed and totally based on the principle of identity of all its basic concepts. The functioning of the Web is defined by its strict dependence on a “centralized authority”.

If we ask about the conditions of the functioning of the Web we are quickly aimed at its reality in the well known arsenal of identity, trees, centrality and hierarchy.

Why? Because the definition of the Web is entirely based on its identification numbers. Without our URIs, DNSs etc. nothing at all is working. And what else are our URIs then centralized, identified, hierarchically organized numbers administrated by a central authority?

Again, all this is governed by the principle of identity.

“We should stress that the resources in RDF must be identified by resource IDs, which are URIs with optional anchor ID.” (Daconta, p. 89)

What is emerging behind the big hype is a new and still hidden demand for a more radical centralized control of the Web than its control by URIs. The control of the use, that is of the *content* of the Web. Not on its ideological level, this is anyway done by the governments, but structurally as a control over the possibilities of the use of all these different taxonomies, ontologies and logics. And all that in the name of diversity and decentralization.

All the fuss about the freedom of the (Semantic) Web boils down to at least two strictly centralized organizational and definitorial conditions: URI and GOL.

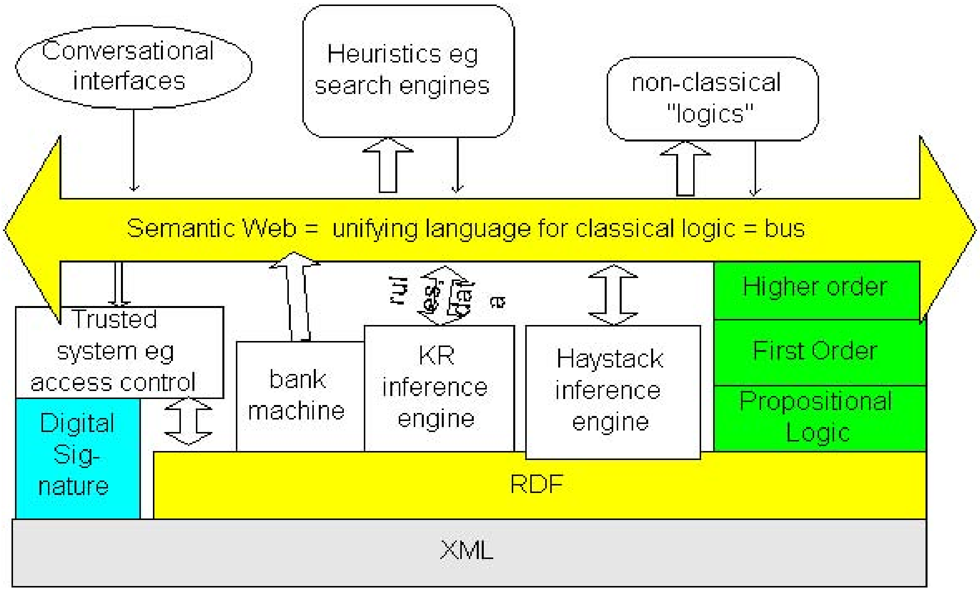
It is not my intention to deny the massive complexity of the Web and the growing Semantic Web on its surface structure. Again, remember:

> The World Wide Web currently links a heterogeneous distributed decentralized set of systems.
> Some of these systems use relatively simple and straightforward manipulation of well-characterized data, such as an access control system. Others, such as search engines, use wildly heuristic manipulations to reach less clearly justified but often extremely useful conclusions.
>
> In order to achieve its potential, the Semantic Web must provide a common interchange language bridging these diverse systems.

http://www.w3.org/2000/01/sw/DevelopmentProposal

Nevertheless, it is important not to confuse the fundamental difference of deep-structure and surface-structure of the Semantic Web. This fundamental difference of deep/surface-structure is used in polycontextural logic not as a metaphysical but as on operational distinction. And all the Semantic Web "cakes" are confirming it.

Here is another one from the W3C, its hidden cards, Unicode and URI, are shown in another game. Unicode and URI are the deepest layer of the Semantic Web Cake.



Beyond the layer of Unicode and URI we have to add their arithmetical and code theoretical layers. The Semantic Web Cake is accepting the role of logic, down its propositional logic, but is not mentioning arithmetics. As we have seen in Derrida´s Machines, arithmetics and its natural numbers are pre-given and natural. There is not much to add. There are many possible open questions with Unicode and URI, but not with its common arithmetics.

The open question which comes back to my proposal is “Why should the deep structure of the Web be questioned?”. At least, it is working. A simple answer, it is not enough. There are to many problems open which cannot be solved properly in the framework of the existing paradigm.

2 Conflicts between diversity and centralization of ontologies

Our media philosophers are still fantasizing about the virtuality of the Web and the new Global Brain and bodiless decentralized sex, but there is no worry, the authority of the URI is controlling the game from the very beginning. And now we are going a step further, still not remarked by the critical media studies, and have to deal with a much more sophisticated attempt to the centralization and control of the Web by the GOL. Without a General Ontology Language there is no Semantic Web at all. GOL maybe made explicit or may remain in the background, as a new cyber-unconsciousness like the URIs, but it is ruling together with the Unicode and URIs the whole game.

> The development of an axiomatized and well-established upper-level ontology is an important step towards a foundation for the science of Formal Ontology in Information Systems.
>
> Every domain-specific ontology must use as a framework some upper-level ontology which describes the most general, domain-independent categories of reality.
>
> For this purpose it is important to understand what an upper-level category means, and we proposed some conditions that every upper- level ontology should satisfy.
>
> The development of a well-founded upper-level ontology is a difficult task that requires a co-operative effort to make significant progress.

Why do we have to make such a drama about say, polysemy, if the Semantic Web is really in any sense decentralized etc.?

Our global village is dealing with the same, and simple problems, of the old Greek marketplace of discussions, all waiting for a great generalist, Aristotle, to make an end of the semantic chaos by introducing his GOL and Logic.

There is no surprise that the GOL of the Semantic Web is proud to be Aristotelian, it doesn´t change much to be more progressive with Whitehead , Bunge, Kripke or Montague.

All that is not working without conflicts. As we know from Guarani and probably also from the long history of western philosophical, logical and ontological thinking.

> Two different contexts relating respectively to species and environment point of view. With such different interpretations of a term, we can reasonably expect different search and indexing results. Nevertheless, our approach to information integration and ontology building is not that of creating a homogeneous system in the sense of a reduced freedom of interpretation, but in the sense of **navigating alternative interpretations**, querying alternative systems, and conceiving alternative contexts of use.
>
> To do this, we require a comprehensive set of ontologies that are designed in a way that admits the existence of **many possible pathways** among concepts **under a common conceptual framework**.
>
> This framework should reuse domain-independent components, be flexible enough, and be focused on the main reasoning schemes for the domain at hand. **Domain-independent, upper ontologies** characterise all the general notions needed to talk about economics, biological species, fish production techniques; for example: parts, agents, attribute, aggregates, activities, plans, devices, species, regions of space or time, etc. (emphasis, r.k.)

http://www.loa-cnr.it/Publications.html

The conflict between the desire and necessity to *“navigate alternative interpretations”* and the need of *“domain-independent upper ontologies”* is obvious and not easy to deal. Its virulence is quickly stopped by the acceptance of GOL, responsible for the definition of such simple things like *“parts, agents, attribute, aggregates, activities, plans, devices, species, regions of space or time”*.

As we know there are significantly different approaches to ontology
entity ontology (substantialism)
process ontology (functionalism)
system ontology (system theory)
structure ontology (structuralism)
difference ontology (deconstructivism)
and many more. Especially, there is also thinking and being beyond ontology.

It will turn out that the general theory is not so much an ontology GOL but a theory of translating and mediating different ontologies, first order as well second-order ontologies. A Dynamic Semantic Web would add to the translations some mechanisms of transformation and metamorphosis.
Its main candidate is well known too: category theory, the ultimate theory of translation.

3 Trees, Hierarchies and Homogeneity

The general language of the Semantic Web is XML. But what is XML? Short: a tree. The same is true for the other languages like RDF.
As developed in Derrida´s Machines the main structure of formal thinking is natural. Everything has an origin and is embedded in a tree. Natural deduction systems, natural number systems and also the limits of this paradigm of thinking is natural. And this is also the way the Semantic Web is organized. XML is a tree. The tree is natural and universal.
Again.

> *As Natural as 0,1,2*
> *Philip Wadler. Evans and Sutherland Distinguished Lecture, University of Utah, 20 November 2002.*
> *"Whether a visitor comes from another place, another planet, or another plane of being we can be sure that he, she, or it will count just as we do: though their symbols vary, the numbers are* universal. *The history of logic and computing suggests a programming language that is equally* natural. *The language, called lambda calculus, is in exact correspondence with a formulation of the laws of reason, called* natural deduction. *Lambda calculus and natural deduction were devised, independently of each other, around 1930, just before the development of the first stored program computer. Yet the correspondence between them was not recognized until decades later, and not published until 1980. Today, languages based on lambda calculus have a few thousand users. Tomorrow, reliable use of the Internet may depend on languages with logical foundations. "*

But the Semantic Web is artificial, and nobody until now has given a proof that the nature of artificiality is of the same nature as the concept of nature in all these natural deductions, natural numbers et al. Even to make such a distinction between natural and artificial is considered as obsolet and cranky by the academia.

4 Structuration: Dynamics and Structures

What have we learnt on our trip around the fascinating perspectives and problems of a Dynamic Semantic Web?

It is all about dynamics and structures. This brings us back to the central topics of DERRIDA´S MACHINES: Interactivity between structures and dynamics, that is, to the interplay of algebras and co-algebras, ruled by category theory and surpassed by the diamond strategies leading to polycontexturality and kenogrammatics.

We arrive back to terms like translation, metamorphosis, polycontexturality, kenogrammatics, algebra and co-algebra, swinging types of algebras and co-algebras, etc.

A new effort has to be undertaken to collect the concepts, problems and methods of the Semantic Web into a more general and formal framework.

Not surprisingly, the main topic of the Semantic Web is translation, in other words a "interchange language". Translation of taxonomies, ontologies and logics. Translation as interaction, merging and transforming different domains, points of view, contexts. The most general approach to translation is given by the methods of category theory and semiotic morphisms (Goguen) not yet applied by the Semantic Web community. In this sense, translation is conservative, keeping the linguistic categories, tectonics and topoi together, that is, saving the meanings during the process of translation.

It seems to be obvious, that the languages of translation, mediation and metamorphosis are not languages of a general ontology as containing the *"most general, domain-independent categories of reality"* but languages which are neutral to ontologies, describing what happens between ontologies. There purpose is not intra-ontological but inter-ontological, mediating ontologies and not functioning themselves as ontologies.

Dynamics is not only covered by conservative interchange but interwoven in permanent transformations ruled by the play of metamorphosis. Metamorphosis can be understood as an unrestricted interplay of categories disseminated in a polycontextural framework. Metamorphosis is not only preserving but subverting meanings in the process of interactivity. Translation is interchange, metamorphosis is creation of new meanings.

The behavior of the Semantic Web is best modelled in terms of an interplay of algebras and co-algebras in the general framework of category theory. But this is as I have shown enough only a very first step in modeling the interactivity of autonomous systems. This means, that I reject the idea of modeling the structural dynamics/dynamical structure by category theoretical morphisms only.

Interactivity comes with reflectionality, architectonics and positionality. These topics have to enter the game to design a more dynamic Semantic Web as it is considered by the very simple and conservative procedures of merging and integrating ontologies and creating contextual concept spaces.

5 Problems with semantics?

Do we introduce semantics with the addition of a second dimension of syntax to the well known syntax of XML? Is a double syntax enough to establish semantics?

Questions of this kind are very old and goes back to the 1930th when symbolic (mathematical) logic was looking for semantic foundations. It develops in a long chain of names like Tarski, Scholz, Hasenjaeger to model theory and from there to mathematical linguistics with Montague and producing all sorts of criticism, one from formalism with the claim that formal semantics is in itself nothing else than a second syntactic formal system (Curry) and from pragmatism, explaining that even semantics is not enough and has to be developed from a dialogical (Lorenzen) or game theoretic approach (Hintikka).

To introduce semantics into a formal system is not an easy thing if we start with syntax then adding semantics and pragmatics to it, repeating the classical "semiotic cake" of Morris. This is the well known historical way of doing things, it's structure is obviously hierarchic. it should be mentioned that the Morris approach is more a popularization of the genuine concepts of Charles Sander Peirce and not a further development. Peirceian semiotics is not a hierarchic system of syntax, semantics and pragmatics, but an irreducible triadic-trichotomic design of semiotics. There is no Peirceian cake. The advantage of Morris' cake is its hierarchical order which is compatible to a classical formal logic understanding. The Peirceian trichotomy is strictly heterarchic, demanding for a non-hierarchic concept of logic and mathematics (Peircian tricotomic mathemaitcs) which is still very hard to be developed.

The opposite of hierarchy is heterarchy. To deconstruct this hierarchical way of introducing semantics we have to propose a heterarchical structure of semiotics, parallelizing the chain of syntax, semantic, pragmatic and what ever to heterarchical structure. But this is even less easy done than the classical approach. And further more, a heterarchical approach is not simply parallelizing the aspects of semiosis but is involved into a dynamic metamorphosis of these aspects. Semantics is not simply semantics per se, from another point of view it is equally functioning as a syntactic or pragmatic aspect of the whole process of semiosis.

6 Problems with inferencing?

SHOE Ontology Example "CS Department"

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```
<HTML>
 <HEAD>

 <!-- Here we indicate that this document is conformant with SHOE 1.0 -->

 <META HTTP-EQUIV="SHOE" CONTENT="VERSION=1.0">


 <TITLE> Our CS Ontology </TITLE>
 </HEAD>
 <BODY>

 <!-- Here we declare the ontology's name and version -->

 <ONTOLOGY ID="cs-dept-ontology" VERSION="1.0">

 <!-- Here we declare that we're borrowing from another ontology -->

 <USE-ONTOLOGY ID="base-ontology" VERSION="1.0" PREFIX="base"
           URL="http://www.cs.umd.edu/projects/plus/SHOE/base.html">

 <!-- Here we lay out our category hierarchy -->

 <DEF-CATEGORY NAME="Organization" ISA="base.SHOEEntity">
 <DEF-CATEGORY NAME="Person" ISA="base.SHOEEntity">
 <DEF-CATEGORY NAME="Publication" ISA="base.SHOEEntity">

 <DEF-CATEGORY NAME="ResearchGroup" ISA="Organization">
 <DEF-CATEGORY NAME="Department" ISA="Organization">
 <DEF-CATEGORY NAME="Worker" ISA="Person">
 <DEF-CATEGORY NAME="Faculty" ISA="Worker">
 <DEF-CATEGORY NAME="Assistant" ISA="Worker">
 <DEF-CATEGORY NAME="AdministrativeStaff" ISA="Worker">
 <DEF-CATEGORY NAME="Student" ISA="Person">
 <DEF-CATEGORY NAME="PostDoc" ISA="Faculty">
 <DEF-CATEGORY NAME="Lecturer" ISA="Faculty">
 <DEF-CATEGORY NAME="Professor" ISA="Faculty">
 <DEF-CATEGORY NAME="ResearchAssistant" ISA="Assistant">
 <DEF-CATEGORY NAME="TeachingAssistant" ISA="Assistant">
 <DEF-CATEGORY NAME="GraduateStudent" ISA="Student">
 <DEF-CATEGORY NAME="UndergraduateStudent" ISA="Student">
 <DEF-CATEGORY NAME="Secretary" ISA="AdministrativeStaff">
 <DEF-CATEGORY NAME="Chair" ISA="AdministrativeStaff Professor">

 <!-- And now we lay out our relationships between categories -->
```

```
<DEF-RELATION NAME="advisor">
   <DEF-ARG POS="1" TYPE="Student">
   <DEF-ARG POS="2" TYPE="Professor">
</DEF-RELATION>

<DEF-RELATION NAME="member">
   <DEF-ARG POS="1" TYPE="Organization">
   <DEF-ARG POS="2" TYPE="Person">
</DEF-RELATION>

<DEF-RELATION NAME="publicationAuthor">
   <DEF-ARG POS="1" TYPE="Publication">
   <DEF-ARG POS="2" TYPE="Person">
</DEF-RELATION>

<!-- Lastly, we lay out our other relationships -->

<DEF-RELATION NAME="publicationDate">
   <DEF-ARG POS="1" TYPE="Publication">
   <DEF-ARG POS="2" TYPE=".DATE">
</DEF-RELATION>

<DEF-RELATION NAME="age">
   <DEF-ARG POS="1" TYPE="Person">
   <DEF-ARG POS="2" TYPE=".NUMBER">
</DEF-RELATION>

<DEF-RELATION NAME="name">
   <DEF-ARG POS="1" TYPE="base.SHOEEntity">
   <DEF-ARG POS="2" TYPE=".STRING">
</DEF-RELATION>

<DEF-RELATION NAME="tenured">
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   <DEF-ARG POS="2" TYPE=".TRUTH">
</DEF-RELATION>

</ONTOLOGY>
</BODY>
</HTML>

<DEF-INFERENCE DESCRIPTION="Transitivity of Suborganizations">
<INF-IF>
<RELATION NAME="subOrganization">
<ARG POS="FROM" VALUE="x" USAGE="VAR">
<ARG POS="TO" VALUE="y" USAGE="VAR">
</RELATION>
```

```
<RELATION NAME="subOrganization">
<ARG POS="FROM" VALUE="y" USAGE="VAR">
<ARG POS="TO" VALUE="z" USAGE="VAR">
</RELATION>
</INF-IF>

<INF-THEN>
<RELATION NAME="subOrganization">
<ARG POS="FROM" VALUE="x" USAGE="VAR">
<ARG POS="TO" VALUE="z" USAGE="VAR">
</RELATION>
</INF-THEN>
</DEF-INFERENCE>
```

7 Modularity

Modules can be added to a ontology by the <USE-ONTOLOGY> operation and adjusted with <DEF-RENAME>.

Modules are added conjunctively or disjunctively, that is hierarchically, to the ontology tree or lattice with a general ontology at its root.

The dynamics of the Dynamic Ontologies (Heflin, Hendler) are restricted to their hierarchical and mono-contextural order.

SHOE Semantics

Revisioning
Versioning

CNLPA-Ontology Modelling

back to page 1

1 CNLPA-ONTOLOGY-object

This type of modelling the CNLPA-ontology is focussed on its classes called *objects* in contrast to a later more *process*-oriented modelling proposed in the CNLPA-ontology-process. A step further towards a *polycontextural* modelling is introduced by the CNLPA-ontology-polylogic.

All three approaches are designed along the lines of the SHOE-CS Department-ontology.

```
<HTML>
 <HEAD>

 <!-- Here we indicate that this document is conformant with SHOE 1.0 -->

 <META HTTP-EQUIV="SHOE" CONTENT="VERSION=1.0">

 <TITLE> Our CNLPA Ontology-object </TITLE>
 </HEAD>
 <BODY>

 <!-- Here we declare the ontology's name and version -->

 <ONTOLOGY ID=cnlpa-ontology-object" VERSION="1.0">

 <!-- Here we declare that we're borrowing from another ontology -->

 <USE-ONTOLOGY ID="base-ontology" VERSION="1.0" PREFIX="base"
            URL="http://www.cs.umd.edu/projects/plus/SHOE/base.html">

 <!-- Here we lay out our category hierarchy -->

 <DEF-CATEGORY NAME="Organization" ISA="base.SHOEEntity">
 <DEF-CATEGORY NAME="Person" ISA="base.SHOEEntity">
 <DEF-CATEGORY NAME="Publication" ISA="base.SHOEEntity">
 <DEF-CATEGORY NAME="Seminars" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="Cooperations" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="Buildings" ISA="base.SHOEEntity">

<DEF-CATEGORY NAME="ResearchGroup" ISA="Organization">
 <DEF-CATEGORY NAME="Department" ISA="Organization">

 <DEF-CATEGORY NAME="Worker" ISA="Person">
 <DEF-CATEGORY NAME="Faculty" ISA="Worker">
 <DEF-CATEGORY NAME="Trainer" ISA="Worker">
 <DEF-CATEGORY NAME="AdministrativeStaff" ISA="Worker">
 <DEF-CATEGORY NAME="Teilnehmer" ISA="Person">

 <DEF-CATEGORY NAME="Secretary" ISA="AdministrativeStaff">
 <DEF-CATEGORY NAME="Chair" ISA="AdministrativeStaff Trainer">
```

```
<DEF-CATEGORY NAME="Owner" ISA="CHAIR">

<DEF-CATEGORY NAME="unpublishPublication" ISA="Publication">
<DEF-CATEGORY NAME="publishPublication" ISA="Publication">

<DEF-CATEGORY NAME="printPublication" ISA="Publication">
 <DEF-CATEGORY NAME="audioPublication" ISA="Publication">
 <DEF-CATEGORY NAME="videoPublication" ISA="Publication">
 <DEF-CATEGORY NAME="webPublication" ISA="Publication">
<DEF-CATEGORY NAME="researchPublication" ISA="Publication">

<DEF-CATEGORY NAME="Office" ISA="Building">
<DEF-CATEGORY NAME="Academy" ISA="Building">
```

RULES:

```
 <!-- And now we lay out our relationships between categories -->


 <DEF-RELATION NAME="advisor">
    <DEF-ARG POS="1" TYPE="regularTeilnehmer">
    <DEF-ARG POS="2" TYPE="Trainer">
 </DEF-RELATION>

 <DEF-RELATION NAME="ausbilder">
    <DEF-ARG POS="1" TYPE="Teilnehmer">
    <DEF-ARG POS="2" TYPE="Faculty">
 </DEF-RELATION>


 <DEF-RELATION NAME="member">
    <DEF-ARG POS="1" TYPE="Organization">
    <DEF-ARG POS="2" TYPE="Person">
 </DEF-RELATION>

 <DEF-RELATION NAME="publicationAuthor">
    <DEF-ARG POS="1" TYPE="Publication">
    <DEF-ARG POS="2" TYPE="Person">
 </DEF-RELATION>

 <!-- Lastly, we lay out our other relationships -->

 <DEF-RELATION NAME="publicationDate">
    <DEF-ARG POS="1" TYPE="Publication">
    <DEF-ARG POS="2" TYPE=".DATE">
 </DEF-RELATION>
```

```
<DEF-RELATION NAME="age">
    <DEF-ARG POS="1" TYPE="Person">
    <DEF-ARG POS="2" TYPE=".NUMBER">
</DEF-RELATION>

<DEF-RELATION NAME="name">
    <DEF-ARG POS="1" TYPE="base.SHOEEntity">
    <DEF-ARG POS="2" TYPE=".STRING">
</DEF-RELATION>


addressStreet(Address, .STRING)
   addressCity(Address, .STRING)
   addressState(Address, .STRING)
   addressZip(Address, .STRING)


</ONTOLOGY>
 </BODY>
 </HTML>
```

Constants

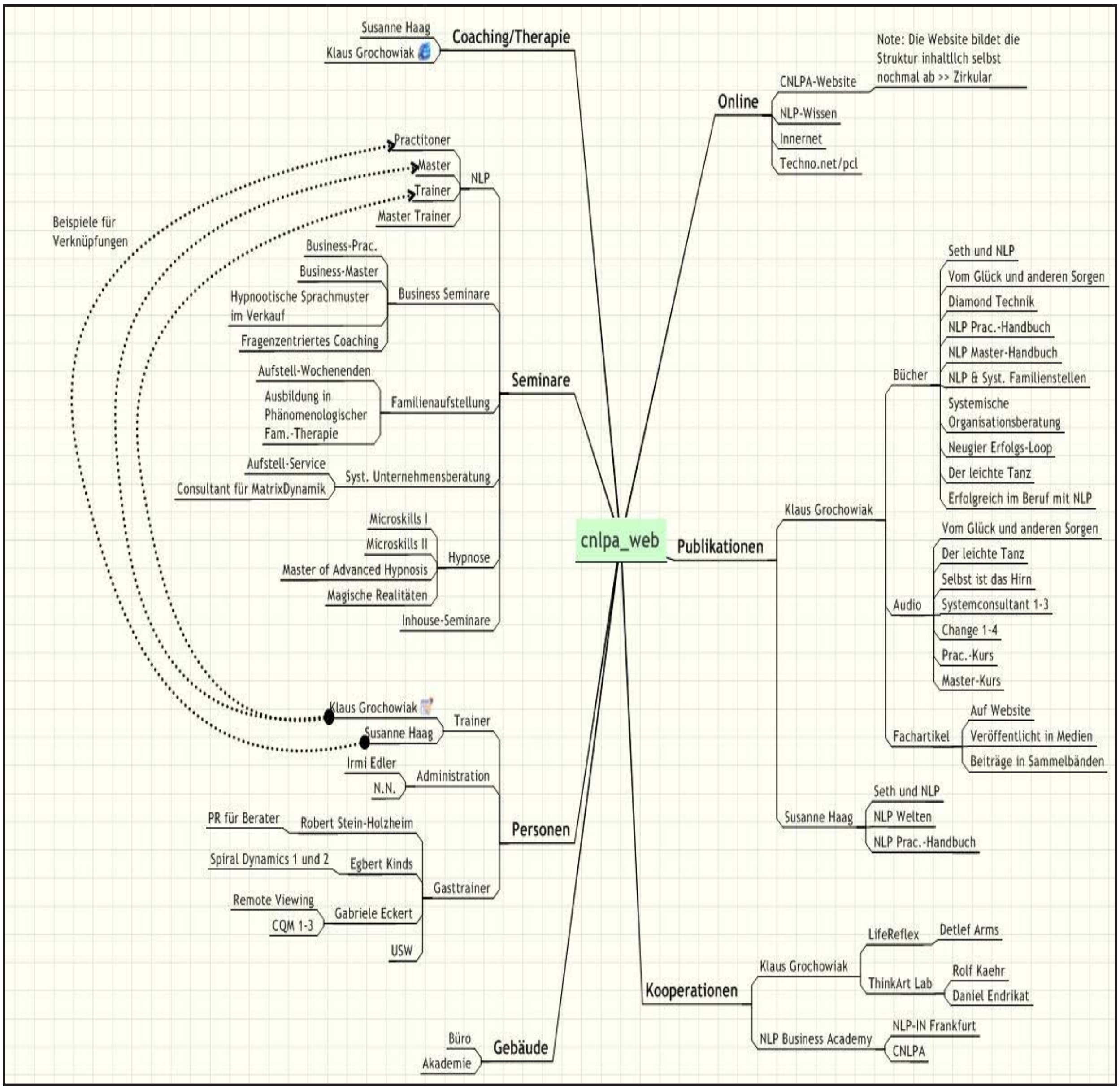
Constants are used to identify instances that may be commonly used with an ontology. In this section, each constant is grouped under its category.

Gender:
- Male
- Female

FACTS:
PERSONS: {Klaus, Susanne, Irmi, Robert, Egbert, ...}
Publication-TITLES
Publication-Dates
Seminar-Titles
Seminar-Dates
Seminar-Locations
Name-of-Cooperations-Partners

etc.

CNLPA-ontology as a Mindmap (Grochowiak, Stein)



2 CNLPA-ONTOLOGY-process

This modelling approach is focussing on the activities, behaviors, short *processes* of the organization CNLPA. Therefore, the base-ontology of SHOE has to be changed and augmented with processual categories allowing categoreis like Activity, Duration, Location and Personship as processes.

<HTML>
<HEAD>
Main Classes of Mindmap:

<DEF-CATEGORY NAME="Organization" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="Person" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="**Publication**" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="**Seminars**" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="**Cooperations**" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="**Buildings**" ISA="base.SHOEEntity">
The Mindmap modelling is presupposing facts and relations about chronological dates, linguistic strings and numbers etc. which are modelled in the base-ontology
<USE-ONTOLOGY ID="base-ontology" VERSION="1.0" PREFIX="base"
URL="http://www.cs.umd.edu/projects/plus/SHOE/base.html">

<!-- Here we indicate that this document is conformant with SHOE 1.0 -->

<META HTTP-EQUIV="SHOE" CONTENT="VERSION=1.0">

<TITLE> **Our CNLPA Ontology-process** </TITLE>
</HEAD>
<BODY>

<!-- Here we declare the ontology's name and version -->

<ONTOLOGY ID=**cnlpa-ontology-process**" VERSION="1.0">

<!-- Here we declare that we're borrowing from another ontology -->

<USE-ONTOLOGY ID="base-ontology" VERSION="1.0" PREFIX="base"
URL="http://www.cs.umd.edu/projects/plus/SHOE/base.html">

<!-- Here we lay out our category hierarchy -->

<DEF-CATEGORY NAME="**Activity**" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="**Duration**" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="**Locating**" ISA="base.SHOEEntity">
<DEF-CATEGORY NAME="**Personship**" ISA="base.SHOEEntity">

<DEF-CATEGORY NAME="**Publishing**" ISA="Activity">
<DEF-CATEGORY NAME="**Teaching**" ISA="Activity">
<DEF-CATEGORY NAME="**Cooperating**" ISA="Activity">

<DEF-CATEGORY NAME="**Advising**" ISA="Activity">
<DEF-CATEGORY NAME="**Coaching**" ISA="Activity">
<DEF-CATEGORY NAME="**Administrating**" ISA="Activity">
<DEF-CATEGORY NAME="**Ownership**" ISA="Activity">
<DEF-CATEGORY NAME="**Membership**" ISA="Activity">

<DEF-CATEGORY NAME="**Person**" ISA="**Personship**">

<DEF-CATEGORY NAME="**Housing**" ISA="Location">

<DEF-CATEGORY NAME="**permanent**" ISA="Duration">
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<DEF-CATEGORY NAME="**weekend**" ISA="Duration">
<DEF-CATEGORY NAME="**term**" ISA="Duration">

<DEF-CATEGORY NAME="**Cooperation**" ISA="Activity">

<DEF-CATEGORY NAME="**Zertificating**" ISA="Advising">

<DEF-CATEGORY NAME="**Publishing**" ISA="Person">
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<DEF-CATEGORY NAME="**printPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**audioPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**videoPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**webPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**researchPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**webPublication**" ISA="**Publishing**">
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<DEF-CATEGORY NAME="**Audio**" ISA="**audioPublication**">
<DEF-CATEGORY NAME="**Webpage**" ISA="**webPublication**">

<DEF-CATEGORY NAME="**Seminars**" ISA="**Teaching**">
<DEF-CATEGORY NAME="**Busines-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**Hypnosis-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**NLP-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**Family-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**In-House-Seminar**" ISA="**Seminar**">

<DEF-CATEGORY NAME="**Office**" ISA="Housing">
<DEF-CATEGORY NAME="**Office**" ISA="permanent">
<DEF-CATEGORY NAME="**Academy**" ISA="Housing">
<DEF-CATEGORY NAME="**Academy**" ISA="permanent">
<DEF-CATEGORY NAME="**Seminar-House**" ISA="Housing">
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<DEF-CATEGORY NAME="**Client**" ISA="**Coaching**">
<DEF-CATEGORY NAME="**Student**" ISA="**Teaching**">
<DEF-CATEGORY NAME="grad**Student**" ISA="**Zertificating**">
<DEF-CATEGORY NAME="**Trainer**" ISA="**Teaching**">
<DEF-CATEGORY NAME="**Office-Worker**" ISA="**Administrating**">

RULES:
<DEF-RELATION NAME="publicationAuthor">
<DEF-ARG POS="1" TYPE="Publishing">
<DEF-ARG POS="2" TYPE="Person">
</DEF-RELATION>

<DEF-RELATION NAME="advisor">
<DEF-ARG POS="1" TYPE="gradStudent">
<DEF-ARG POS="2" TYPE="Trainer">
</DEF-RELATION>

<DEF-RELATION NAME="member">
<DEF-ARG POS="1" TYPE="Membership">
<DEF-ARG POS="2" TYPE="Person">
</DEF-RELATION>

<DEF-RELATION NAME="age">
<DEF-ARG POS="1" TYPE="Person">
<DEF-ARG POS="2" TYPE=".NUMBER">
</DEF-RELATION>

<DEF-RELATION NAME="name">
<DEF-ARG POS="1" TYPE="base.SHOEEntity">
<DEF-ARG POS="2" TYPE=".STRING">
</DEF-RELATION>

</ONTOLOGY>
</BODY>
</HTML>

FACTS:
PERSON: {Klaus, Susanne, Irmi, Robert, Egbert, ...}
Publication-TITLES
Publication-Dates
Seminar-Titles
Seminar-Dates
Seminar-Locations
Name-of-Cooperations-Partners

etc.

3 CNLPA-ONTOLOGY-metapattern

<- The metapattern approach is a intermediary paradigm between the process and the contextural approach. It will be developed later.->

CNLPA:
ownership
personship
publishing
training
cauching
cooperating
administrating
advising

4 CNLPA-ONTOLOGY-polylogic

<HTML>
<HEAD>

<!-- Here we indicate that this document is conformant with SHOE 1.0 ; which surely is not the case at all!!-->

<META HTTP-EQUIV="SHOE" CONTENT="VERSION=1.0">

<TITLE> **Our CNLPA Ontology-polylogic** </TITLE>
</HEAD>
<BODY>

<!-- Here we declare the ontology's name and version -->

<**POLY**-ONTOLOGY ID=**cnlpa-ontology-polylogic**" VERSION="1.0">

<!-- Here we declare that we're borrowing from another ontology -->

<USE-ONTOLOGY ID="**contexture00**_base-ontology" VERSION="1.0" PREFIX="base"
URL="http://www.cs.umd.edu/projects/plus/SHOE/base.html">

<!-- Here we declare that we're borrowing from another ontology useful for **personal data**-->

<USE-ONTOLOGY ID="**contexture01**_personal-ont" VERSION="1.0" PREFIX="personal"
URL="http://www.cs.umd.edu/projects/plus/SHOE/onts/index.html#person">

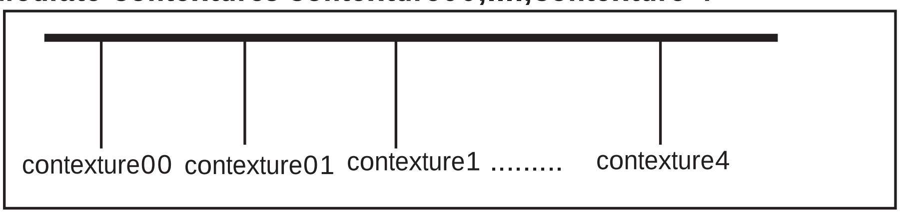
<!-- Here we we lay out our **poly-contextural** ontology -->

<USE-ONTOLOGY ID="**contexture1_activity-ont**" ---> Fictional!!
<USE-ONTOLOGY ID="**contexture2_duration-ont**" ---> Fictional!!
<USE-ONTOLOGY ID="**contexture3_location-ont**" ---> Fictional!!
<USE-ONTOLOGY ID="**contexture4_personship-ont**" ---> Fictional!!

< From object to process modelling, the poly-contextural modelling introduces a new step which goes beyond the process model. The used ontologies are not further organized vertically, but horizontally, building a heterarchic organization. This can only be considered as an analogy to what has to be done and not as polycontextural modelling as such. ->.

< As a consequence the SHOE's base-ontology, contexture00, is no longer in the functionality as a root, but put in parallel together with other neighboring ontologies, called contextures. The terminology <**contexture1_base**.SHOEEntity> is therefore quite fictional. >

<Mediate-Contextures Contexture00,....,Contexture 4>



```
!!! <!-- Here we lay out our poly-contextural-category HETERARHY --> !!!

<DEF-CONTEXTURE NAME="Activity" ISA="contexture1_base.SHOEEntity">
<DEF-CONTEXTURE NAME="Duration" ISA="contexture2_base.SHOEEntity">
<DEF-CONTEXTURE NAME="Locating" ISA="contexture3_base.SHOEEntity">
<DEF-CONTEXTURE NAME="Personship" ISA="contexture4_base.SHOEEntity">


<!-- Here we lay out our mono-contextural-category HIERARCHY of each contexture-->

<DEF-CATEGORY NAME="Publishing" ISA="contexture1_base.SHOEEntity">
<DEF-CATEGORY NAME="Teaching" ISA="contexture1_base.SHOEEntity">
<DEF-CATEGORY NAME="Cooperating" ISA="contexture1_base.SHOEEntity">
<DEF-CATEGORY NAME="Advising" ISA="contexture1_base.SHOEEntity">
<DEF-CATEGORY NAME="Coaching" ISA="contexture1_base.SHOEEntity">
<DEF-CATEGORY NAME="Administrating" ISA="contexture1_base.SHOEEntity">
<DEF-CATEGORY NAME="Ownership" ISA="contexture1_base.SHOEEntity">
<DEF-CATEGORY NAME="Membership" ISA="contexture1_base.SHOEEntity">

<DEF-CATEGORY NAME="Timing" ISA="contexture2_base.SHOEEntity">

<DEF-CATEGORY NAME="Housing" ISA="contexture3_base.SHOEEntity">

<DEF-CATEGORY NAME="Person" ISA="contexture4_base.SHOEEntity">
<DEF-CATEGORY NAME="male" ISA="Person">
<DEF-CATEGORY NAME="female" ISA="Person">

<DEF-CATEGORY NAME="permanent" ISA="Timing">
<DEF-CATEGORY NAME="temporary" ISA="Timing">
<DEF-CATEGORY NAME="weekend" ISA="Timing">
<DEF-CATEGORY NAME="term" ISA="Timing">

< Chair belongs at once to 3 different contoxtures and their ontologies!!
<DEF-CATEGORY NAME="CHAIR" ISA="Ownership">
<DEF-CATEGORY NAME="CHAIR" ISA="Person">
<DEF-CATEGORY NAME="CHAIR" ISA="Administrating">


<DEF-CATEGORY NAME="Zertificating" ISA="Advising">
<DEF-CATEGORY NAME="Practionar" ISA="Zertificating">
<DEF-CATEGORY NAME="Master" ISA="Zertificating">
<DEF-CATEGORY NAME="Trainer" ISA="Zertificating">
<DEF-CATEGORY NAME="MasterTrainer" ISA="Zertificating">

<DEF-CATEGORY NAME="Guest-Trainer" ISA="Teaching">

<DEF-CATEGORY NAME="Publishing" ISA="Person">
<DEF-CATEGORY NAME="unpublishedPublication" ISA="Publishing">
<DEF-CATEGORY NAME="publishedPublication" ISA="Publishing">
<DEF-CATEGORY NAME="Advertising" ISA="Publishing">
```

<DEF-CATEGORY NAME="**printPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**audioPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**videoPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**webPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**researchPublication**" ISA="**Publishing**">
<DEF-CATEGORY NAME="**webPublication**" ISA="**Publishing**">

<DEF-CATEGORY NAME="**Books**" ISA="**printPublication**">
<DEF-CATEGORY NAME="**Article**" ISA="**printPublication**">
<DEF-CATEGORY NAME="**Video**" ISA="**videoPublication**">
<DEF-CATEGORY NAME="**Audio**" ISA="**audioPublication**">
<DEF-CATEGORY NAME="**CNLPA-Web Site**" ISA="**webPublication**">
<DEF-CATEGORY NAME="**NLP Wissen**" ISA="**webPublication**">
<DEF-CATEGORY NAME="**Innernet**" ISA="**webPublication**">
<DEF-CATEGORY NAME="**Techno.net**" ISA="**webPublication**">

<DEF-CATEGORY NAME="**Seminars**" ISA="**Teaching**">
<DEF-CATEGORY NAME="**Busines-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**Managment-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**Hypnosis-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**NLP-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**Family-Seminar**" ISA="**Seminar**">
<DEF-CATEGORY NAME="**In-House-Seminar**" ISA="**Seminar**">

<DEF-CATEGORY NAME="**Office**" ISA="Housing">
<DEF-CATEGORY NAME="**Academy**" ISA="Housing">
<DEF-CATEGORY NAME="**Seminar-House**" ISA="Housing">

<DEF-CATEGORY NAME="**Furniture**" ISA="Housing">
<DEF-CATEGORY NAME="**Chair**" ISA="Furniture">
<DEF-CATEGORY NAME="**Table**" ISA="Furniture">

<DEF-CATEGORY NAME="**Client**" ISA="**Coaching**">
<DEF-CATEGORY NAME="**Student**" ISA="**Teaching**">
<DEF-CATEGORY NAME="**gradStudent**" ISA="**Zertificating**">
<DEF-CATEGORY NAME="**Trainer**" ISA="**Teaching**">
<DEF-CATEGORY NAME="**Office-Worker**" ISA="**Administrating**">
<DEF-CATEGORY NAME="**Cleaner**" ISA="**Administrating**">

<DEF-RENAME >
< specifies a local name for a concept from any extended ontology. >
<DEF-RENAME > CHAIR to Seat
<DEF-RENAME > CHAIR to AcademyHead
<DEF-RENAME > CHAIR to CoffeBar

RELATIONS:

< NOTE: In SHOE it is not possible to specify subsuming categories for a category defined in another ontology.

In contrast to the mono-contextural situation, the poly-ontological apprach has to mediate between different ontologies.

Therefore we can define some conditions in one contexture containing its own logic and also in another contexture containing its own other logic.>

< Intra-contextural relations (based on FOL) >
<DEF-RELATION NAME="publicationAuthor">
<DEF-ARG POS="1" TYPE="Publishing">
<DEF-ARG POS="2" TYPE="Person">
</DEF-RELATION>

<trans-contextural relations (based on poly-contextural logics)>
<This rule has to be transformed into a poly-contextural relation>

<DEF-RELATION NAME="publicationAuthor"> **between Contexture4 and Contexture1**
<DEF-ARG POS="1" TYPE="Publishing"> **of Contexture1**
<DEF-ARG POS="2" TYPE="Person"> **of Contexture4**
</DEF-RELATION>

<DEF-RELATION NAME="age">
<DEF-ARG POS="1" TYPE="Person"> of Contexture4
<DEF-ARG POS="2" TYPE=".NUMBER"> of Contexture0
</DEF-RELATION>

<DEF-RELATION NAME="name">
<DEF-ARG POS="1" TYPE="base.SHOEEntity"> of Contexture0
<DEF-ARG POS="2" TYPE=".STRING"> of Contexture0
</DEF-RELATION>

<DEF-RELATION NAME="tenured">
<DEF-ARG POS="1" TYPE="Trainer">
<DEF-ARG POS="2" TYPE=".TRUTH">
</DEF-RELATION>

<DEF-RELATION NAME="object-age">
<DEF-ARG POS="1" TYPE="Furniture"> of Contexture3
<DEF-ARG POS="2" TYPE=".NUMBER"> of Contexture0
</DEF-RELATION>

</ONTOLOGY>
</BODY>
</HTML>

FACTS in Contextures

person(Grochowiak)

male, female
permanent, temporary
weekend, term

Inference-RULES:

< -Inference rules have to be distributed over different contextures. There is not a single dominating inferenz rule ruling all contextures in the same sense. Distributed inferenz rules can even be differently defined, depending on the intra-contextural structure of the distributed ontology. ->

< - *Mono-contextural case:*>
<DEF-INFERENCE DESCRIPTION="Transitivity of Suborganizations">
<INF-IF>
<RELATION NAME="subOrganization">
<ARG POS="FROM" VALUE="x" USAGE="VAR">
<ARG POS="TO" VALUE="y" USAGE="VAR">
</RELATION>
and
<RELATION NAME="subOrganization">
<ARG POS="FROM" VALUE="y" USAGE="VAR">
<ARG POS="TO" VALUE="z" USAGE="VAR">
</RELATION>
</INF-IF>

< - *Poly-contextural case as an example* ->
poly-<DEF-INFERENCE DESCRIPTION="Transitivity of -sub-----">
poly-<INF-IF>
poly-<RELATION NAME=" sub-------">
Contexture1: <ARG POS="FROM" VALUE="x" USAGE="VAR">
Contexture1 and contexture2: <ARG POS="TO" VALUE="y" USAGE="VAR">
</RELATION>
et.et.et
poly-<RELATION NAME=" sub-----">
Contexture2: <ARG POS="FROM" VALUE="y" USAGE="VAR">
Contexture3: <ARG POS="TO" VALUE="z" USAGE="VAR">
</RELATION>
</INF-IF>

<- But without contradiction it could also be an intransitivity relation- >
<RELATION NAME=" sub-----">
Contexture2: <ARG POS="FROM" VALUE="z" USAGE="VAR">
Contexture3: <ARG POS="TO" VALUE="y" USAGE="VAR">
</RELATION>

QUERIES

Query-types
"mono-contextural search"
polycontextural parallel search

polycontextural multiple parallel search

Cluster questions and question clusters