Case

A Semantic Web based service of Church Art and Architechture

Reflections on Action Oriented Modelling of Domains

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Initial partners

- **Institute for Church Art and Architecture**, University of Jyväskylä
  - Research databases
  - Inventories from about 600 Lutheran churches
  - Image archives (partly digital)
- **Department of Practical Theology,** University of Helsinki
  - Digital image archive mainly of contemporary church architechture
- **KuvaKotimaa**
  - Commecial image bank

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Goals of project

- Build an **infrastructure** for **integration** of distributed data stored in heterogenous formats (image files, text files, databases)
- Enable **knowledge creation** using semantic web methods and tools
- Enable **knowledge** sharing and **collaboration** among researchers
- Create a **public service**

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Project status

- **First phase:** Proprietary application to maintain contents of research databases and image archive. Export capabilities to RDF-format. Commercial database and application server.
- **Second phase:** Complete turn-around to Open Source technologies. Development of semantic web enabled Open Source framework.
- **Current phase:** Ontology development with Protege-OWL
- **Next phase:** Use in research. Dissemination.

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Open Source tools

- Linux (Debian) environment
- Protégé-OWL for RDF/OWL modelling
- Sesame RDF/OWL-repository
- PostgreSQL database backend
- Python application development environment
- Wiki-farm for documentation and collaboration
- Tools for semantic annotation of text and images

Reasons for Python preference:

- More functionality with less lines of code
- More maintainable code
- Failover opion: Java

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Qualitative goals

Something like the Paris Metro:

- Complex
- Yet efficient, cheep and easy to use
- Scaled for the masses
- Produces a predictable outcome

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Different application strategies

- **Semantic Google**
  = semantically enhanced search engine
- **Semantic Encyclopaedia**
  = illustrated RDF/OWL-repository
- **Embedded Semantics**
  = ontology based data integration, knowledge creation and information sharing with high variety of application formats. Avoiding gridlocked projects.

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Trust based (paranoid) development

- Customers have to trust in the solutions they invest in. There have to be objective reasons for that trust. Our task is to find or create those reasons.

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The practice of paranoia

- Models and data are stored in XML as well as in backend databases. Data from backend databases are stored in normalized databases.
- Ideally automated synchronization with easy downgrade e.g. from OWL-DL to Owlim compatible code.
- From **Well Formed** to **Very Well Formed** models and storage

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Well vs. Very Well Formedness

Well Formed (WF)

- Machine readable

Very Well Formed (VWF)

- Machine readable
- Human readable
- Modular
- Separation of schema and data
- Semiautomatically and manually maintainable: sort, insert, update, delete

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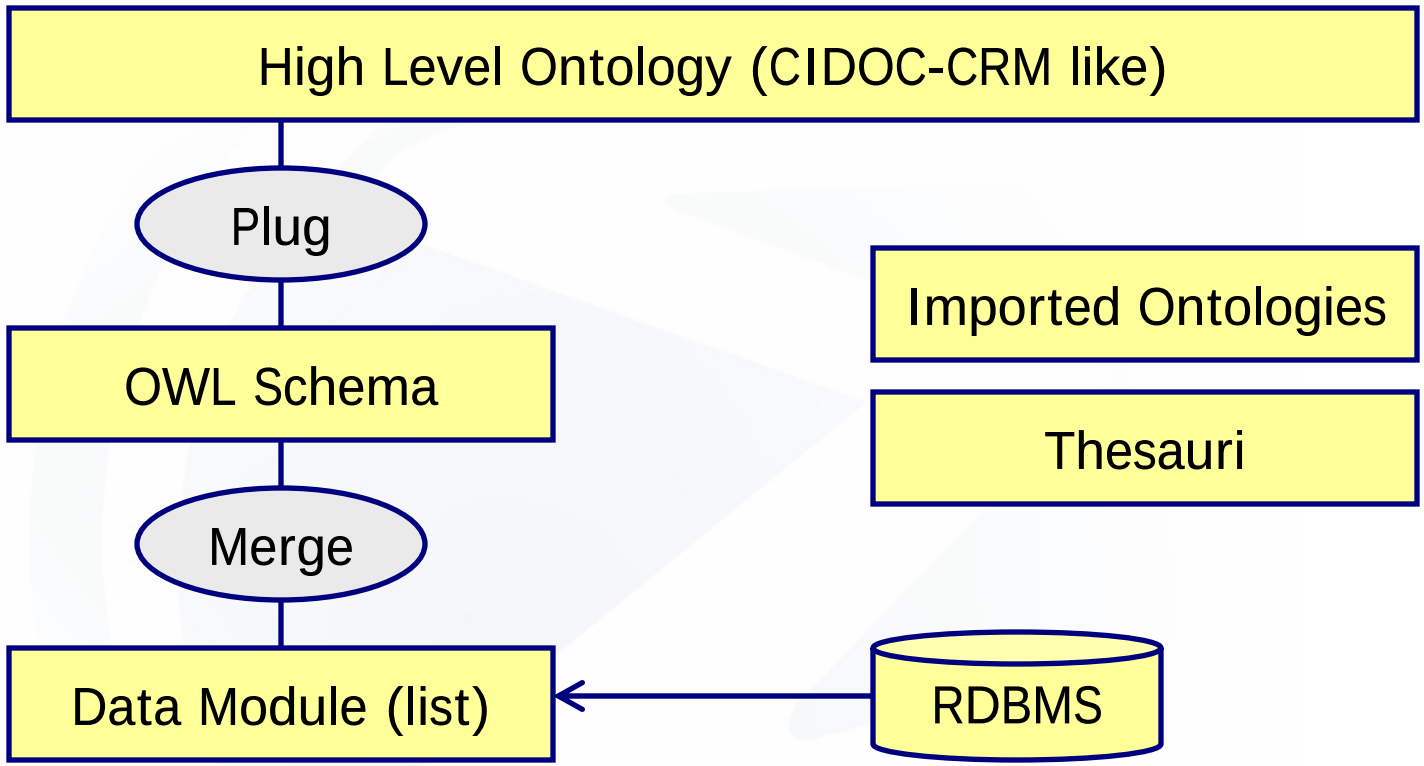
Pluggable ontologies



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First observations about ontologies

Seemed to reflect Aristotelian metaphysics

- Substance oriented
- About what is permanent in existence
- Operate with properties and classes
- Can be manipulated with logic
- Root class of OWL: **owl:Thing**

Heideggers re-evaluation of Aristoteles

- Existence is about beeing that is in a permanent state of becoming
- Heideggierian root class: **owl:Beeing-Becoming**

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How permanent are concepts?

Is stroke a disease?

N=30

YES	16
NO	14
+1 month	11 changed their minds

Is pumkin a fruit?

YES	16
NO	14
+1 month	8 changed their minds

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How concepts actually are formed

- Construction or automatic generation with the help of **distinguishing attributes**
- Creation from **thesauri**
- Based on **expert knowledge**
- Based on **prototypes**
- Generated from **exemplars** (based on frequency of configurations of attributes)
- Based on **behaviour** (evolutionary view)
- Encoded in the **neural architechture**

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Natural sources of ontologies

Knowledge about **living things** and **tools** are processed differently and in different palces of the brain

- Living things are processed visually
- Knowledge about tools are processed functionally (based on what they are used for)

Processing of information about persons

- WRUs = word recognition units
- FRUs = face recognition units
- NRUs = name recognition units
- PINs = person identity nodes
- SIUs = semantic information units

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Flashbulb memories

An exeptional event activates a special neural mechanism that renders exceptionally long lasting, accurate and vivid memories.

- Informant (source)
- Place where the news was heard
- The event itself
- Own emotional state
- Emotional state of others
- Consequece of the event

Constituents in descrebing an **episode**

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Types of long term memory

- **Semantic** Memory (knowledge about the world)
- **Episodic** memory (memories about ourselves)
- **Perceptual** representation system (sensory input)
- **Procedural** memory (how to do things)

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Episode as a frame in action oriented modeling

- An episide is not an event
- Events are parts of episodes
- Episodes contain a setting, events, actors, actions including speech, emotions, intentions, causes and consequences
- Gossip depicts episodes
- Episodes are the building blocks of our autobiographic memory and narratives

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Action oriented modeling

Ontologies should be about defining domains

- Domains are about dynamic processes occuring in specific settings and can be only partially modelled with **substance-oriented** concepts and categories (substantives & adjectives)
- These have to be complemented with **action-oriented** concepts and cathegories (verbs & adverbs)

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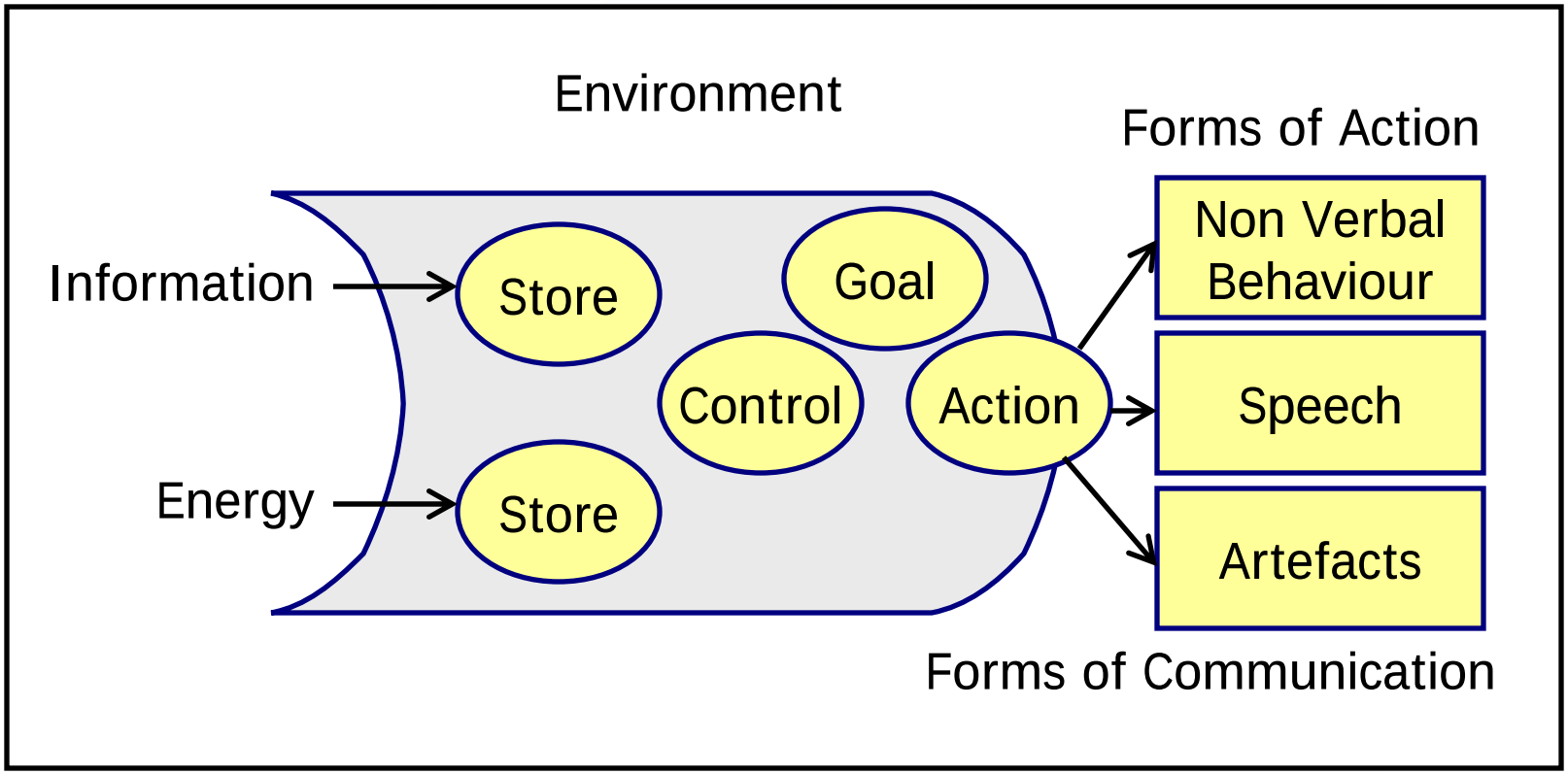
High level view of man



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RDF/OWL in modeling action

- With OWL it seems to be possible to model **transitive causal** as well as **intentional** chains

A → B → C

- OWL is oriented towards **definitions** and **reasoning**. Natural language is **declarative** and **descriptive**.

- Verbs can form ”kind-of” relations to form **action oriented class hierarchies** in ontologies, e.g. painting and sculpting are ”kinds-of” creating.

- Inverse functional properties works with verbs
  ”A knows B” – ”B is knownBy A”

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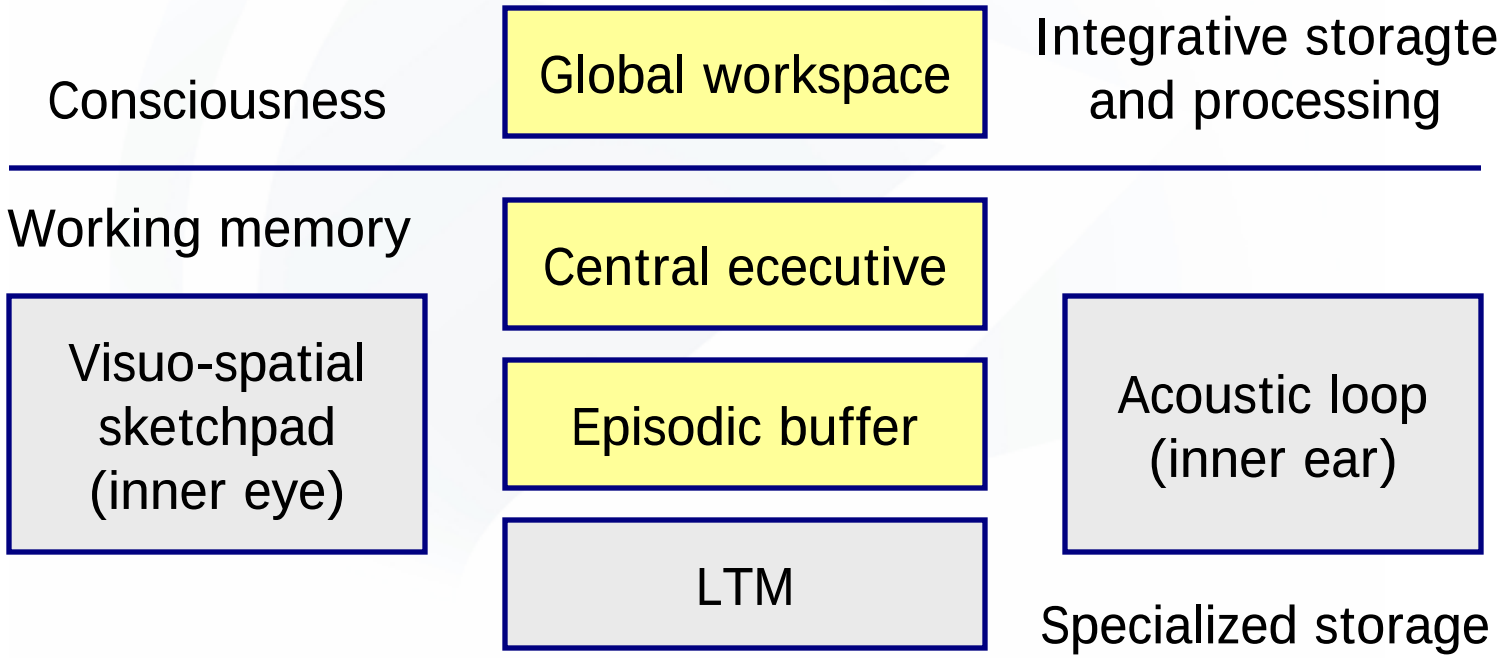
Integrative functions of mind

- Human information processing is **highly specialized**, but mind experiences things as a **whole**
- Ingegrative functions



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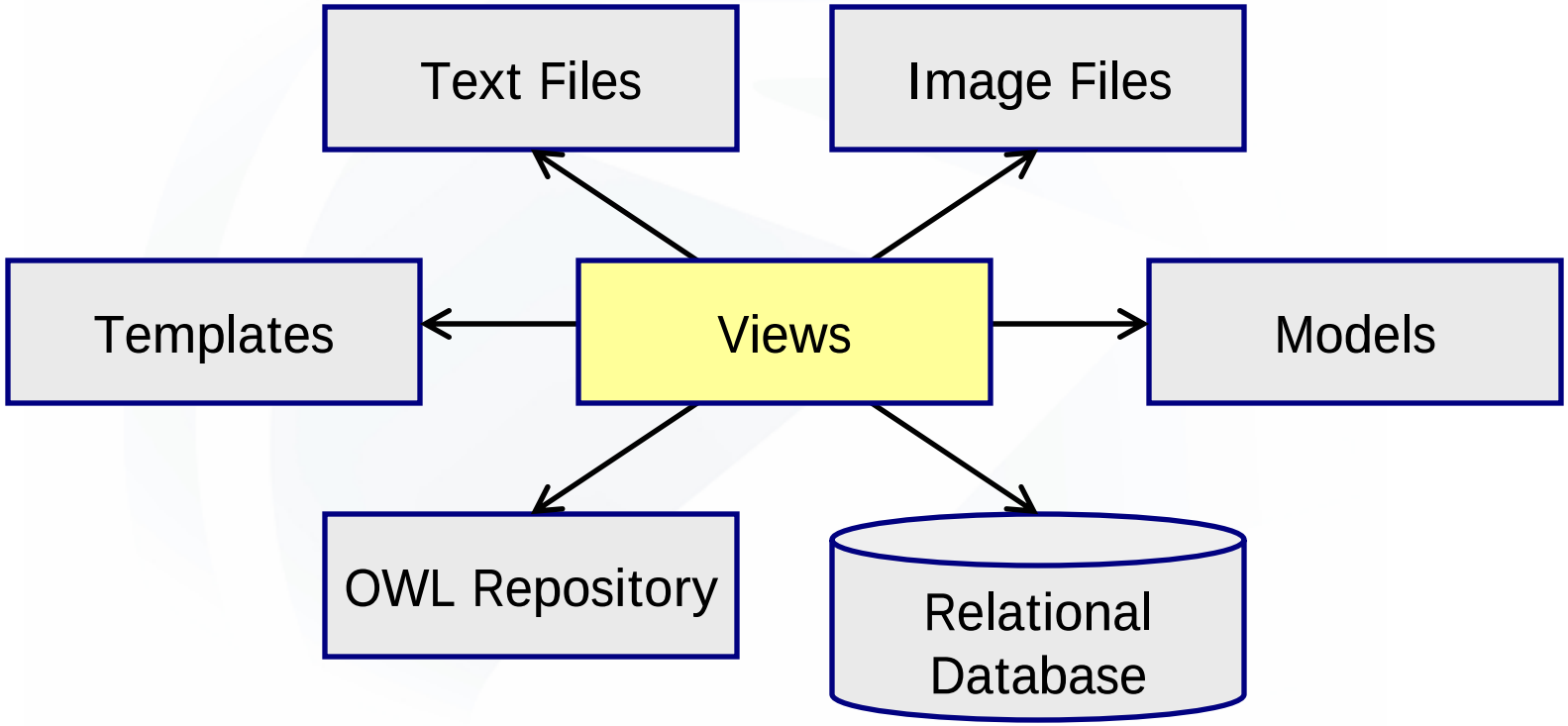
Analogy to mind in MVC-architechure



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