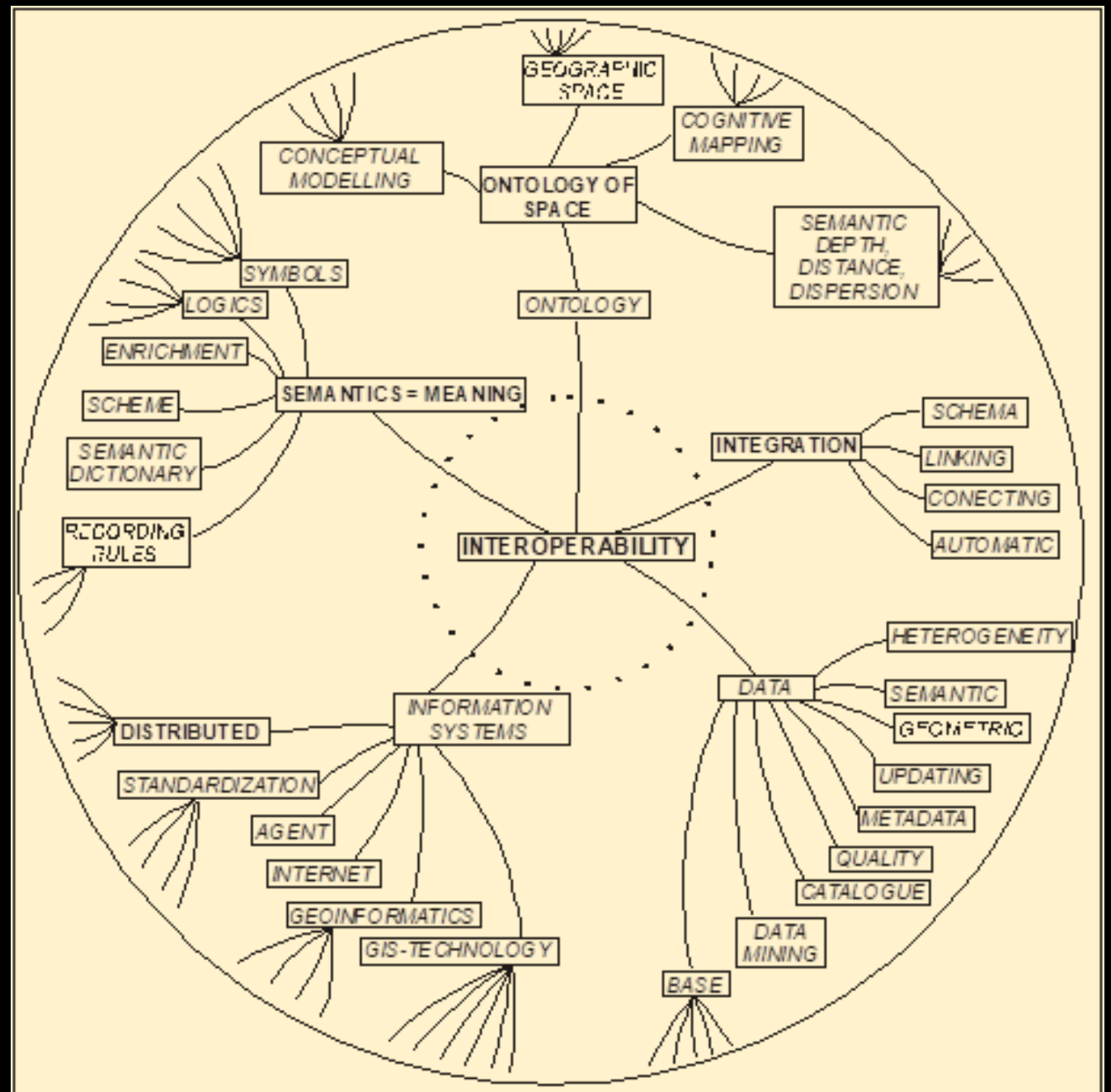


**Missing link between
spatiotemporal (historical) data and
AI (machine learning) usage**

**dr. Marjan Čeh , mag. Gregor Završnik
University of Ljubljana, Slovenia**

basic terms of interoperability



WHY?

GEOSPATIAL DATA computerized frameworks

NMCA AND STATE ARCHIVE

FLOW TO ARCHIVES AND BACK, OPEN?

SILOS – dispersed data

UN GGIM agenda 2030

INSPIRE and GREEN DEAL DATA SPACE

AI integration, LLM HALUCINATIONS - model's limited contextual understanding

More why's

WHAT?

ONTOLOGY IN PHILOSOPHY (Sowa, 2003):

„the categories of things that exist in domain“

ONTOLOGY IN AI Gruber (1993):

„an abstract, simplified view of human conceptualisation“

An integrated view of GIScience and cyberspace (Chen et al. 2023)

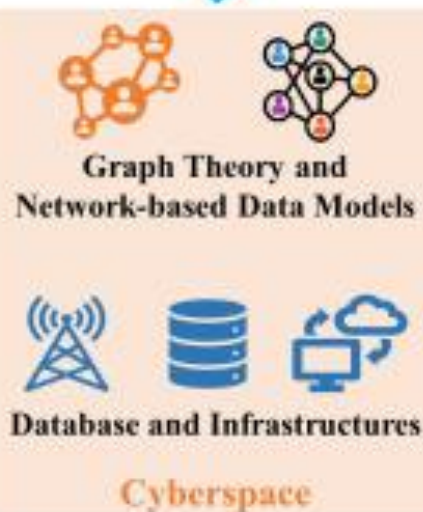
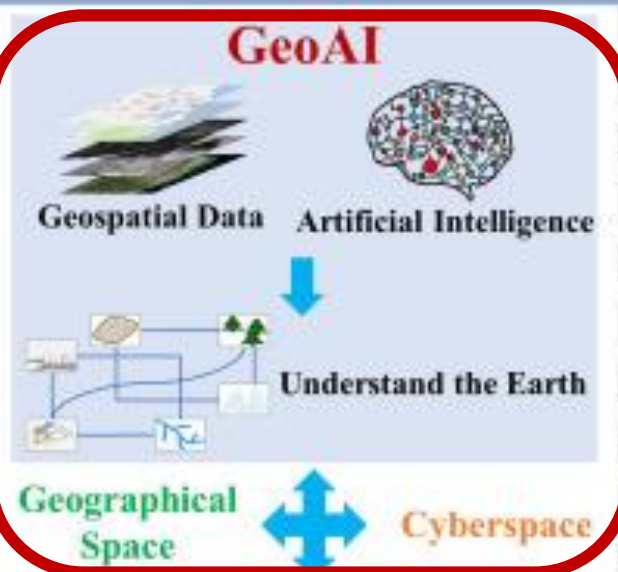
Data Generation

Data Modeling

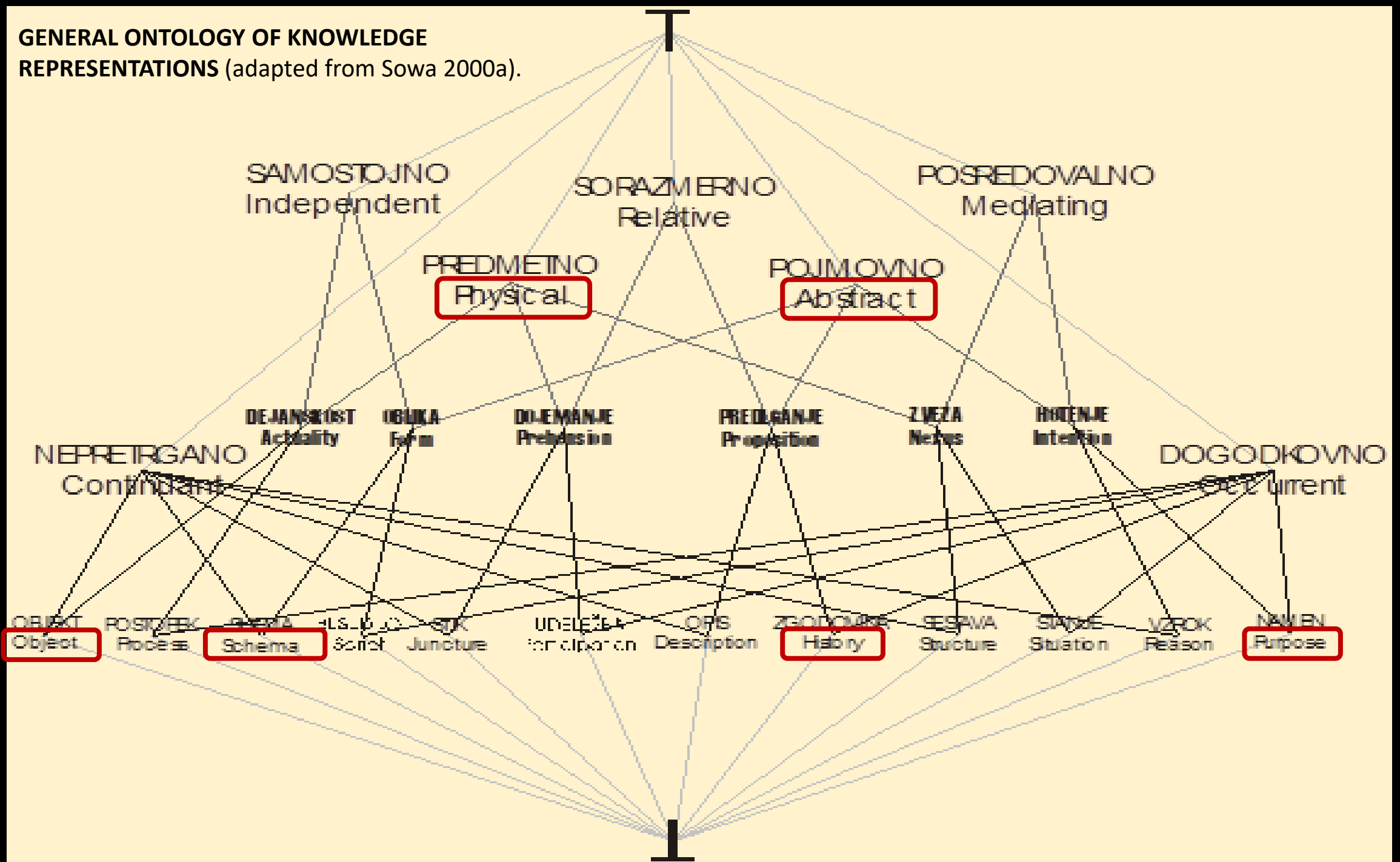
Methods

Application

Research Agenda

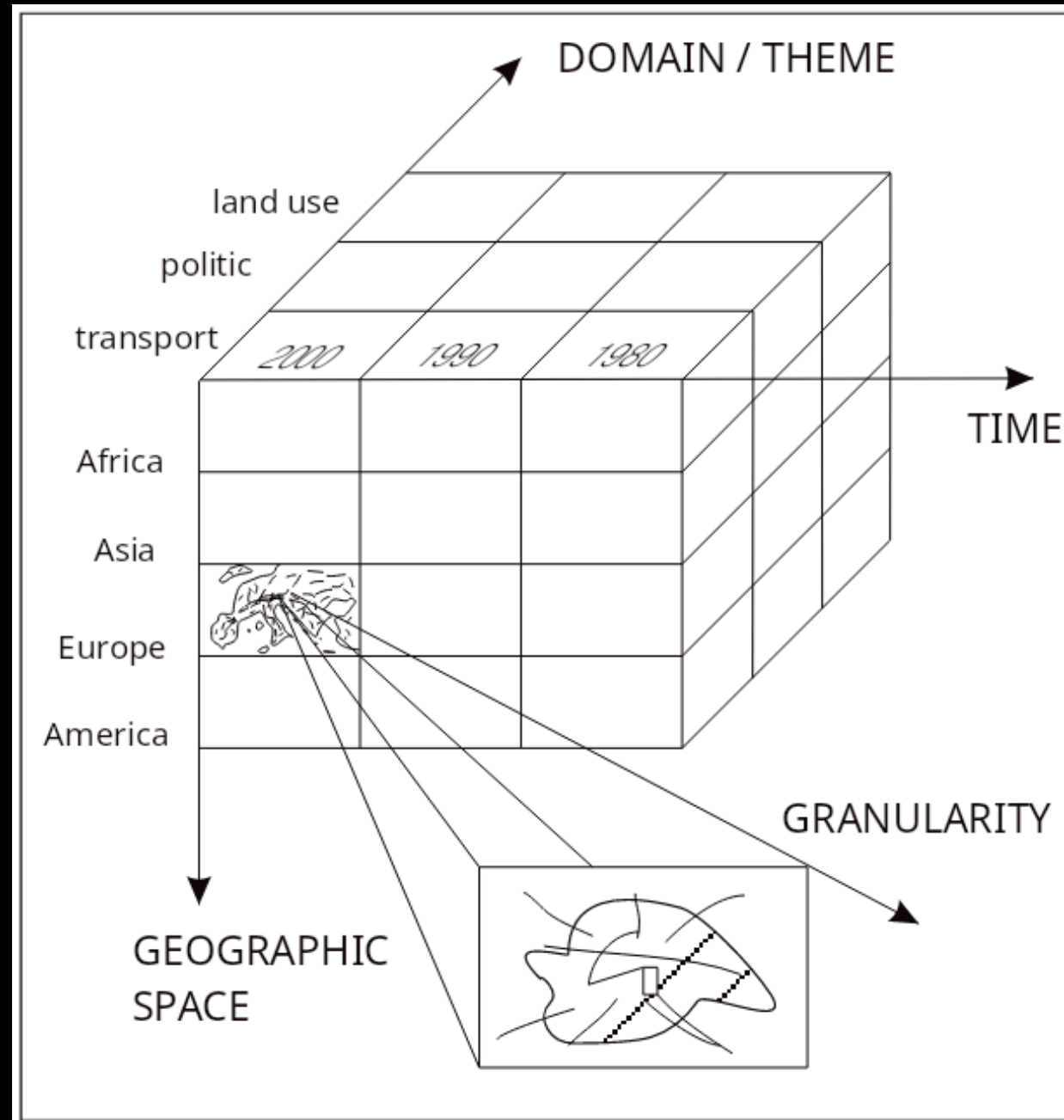


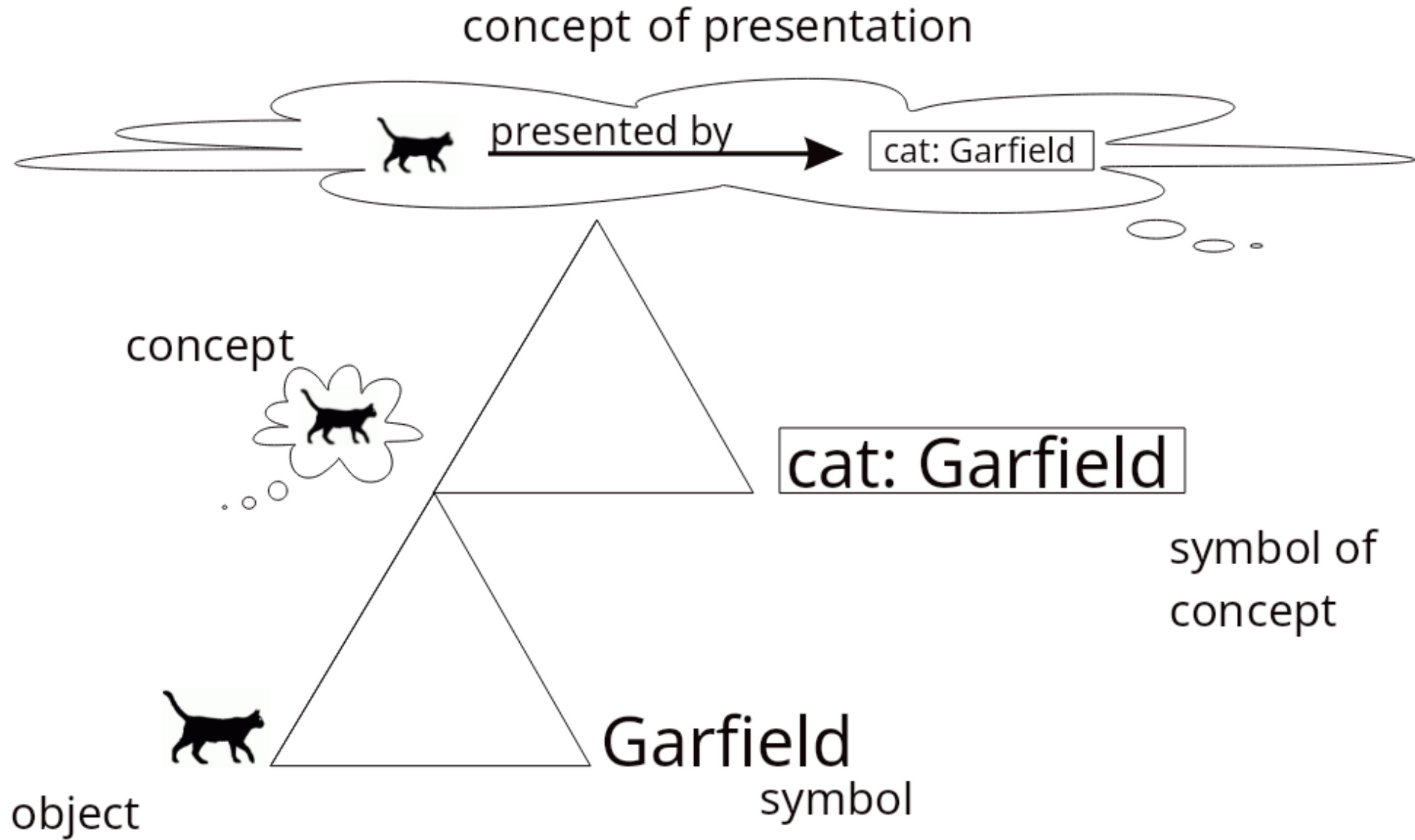
**GENERAL ONTOLOGY OF KNOWLEDGE
REPRESENTATIONS** (adapted from Sowa 2000a).



HOW?

Different dimensions of geographic data in the National Information Strategy for GeoSpatial Data (Abdelmoty et al. 1993)

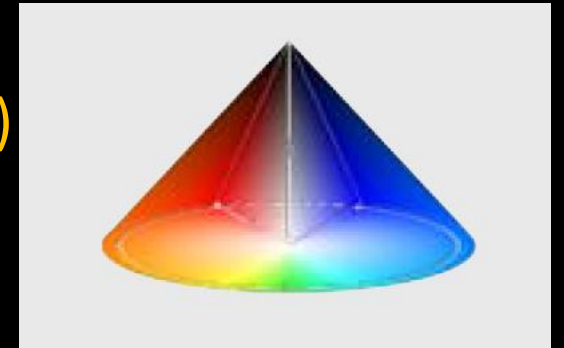
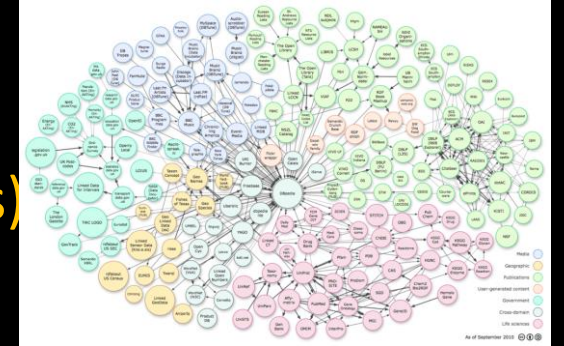




(1923) Ogden/Richards Triangle of meaning / semiotic triangle - problem of universals

SEMANTIC REFERENCE SYSTEMS (Kuhn, Janowicz 2008)

- Semantic reference **SPACE** (knowledge partitions labeled with symbols)
- Semantic **DATUM** (grounds to **PHISICALLY OBSERVABLE PHENOMENA**)
- Semantic **RELATIONS** (allow for calculation in semantic space: distance)



COMPARE MEANINGS - Quality indicator is **SIMILARITY**

- knowledge base

THEMATIC SEMANTIC REFERENCE SYSTEM

- Context vs. concept

Metadata

Place (relations)

- <https://schema.org/Place>

HIERARCHICAL NODALITY IN GEOGRAPHICAL TIME-SPACE

Philbrick (2016)

a HIERARCHY OF HUMAN FUNCTIONS

which are extensions of the

inside to outside **RELATIONSHIPS** of a **HUMAN SYSTEM MODEL**.

- **LOWER-ORDER (BASIC) FUNCTIONS (PURPOSE)** are represented by **RESIDENTIAL** building cover, **RETAIL** sales space, and **INDUSTRIAL** building cover.
- **HIGHER-ORDER (ADVANCED) FUNCTIONS (PURPOSE)** are shown for the last kilometer of **AGGREGATION IN The City**.

GEOGRAPHIC SPACE

SPATIAL PHENOMENA

APEARANCE

HUMAN ACTIVITES

**SPATIAL PHENOMENA
OF HUMAN ACTIVITES
IN GEOGRAPHIC SPACE**

PHISICAL (objects)

ABSTRACT (scheme)

PURPOUSE

BASIC

PHISICAL BASIC

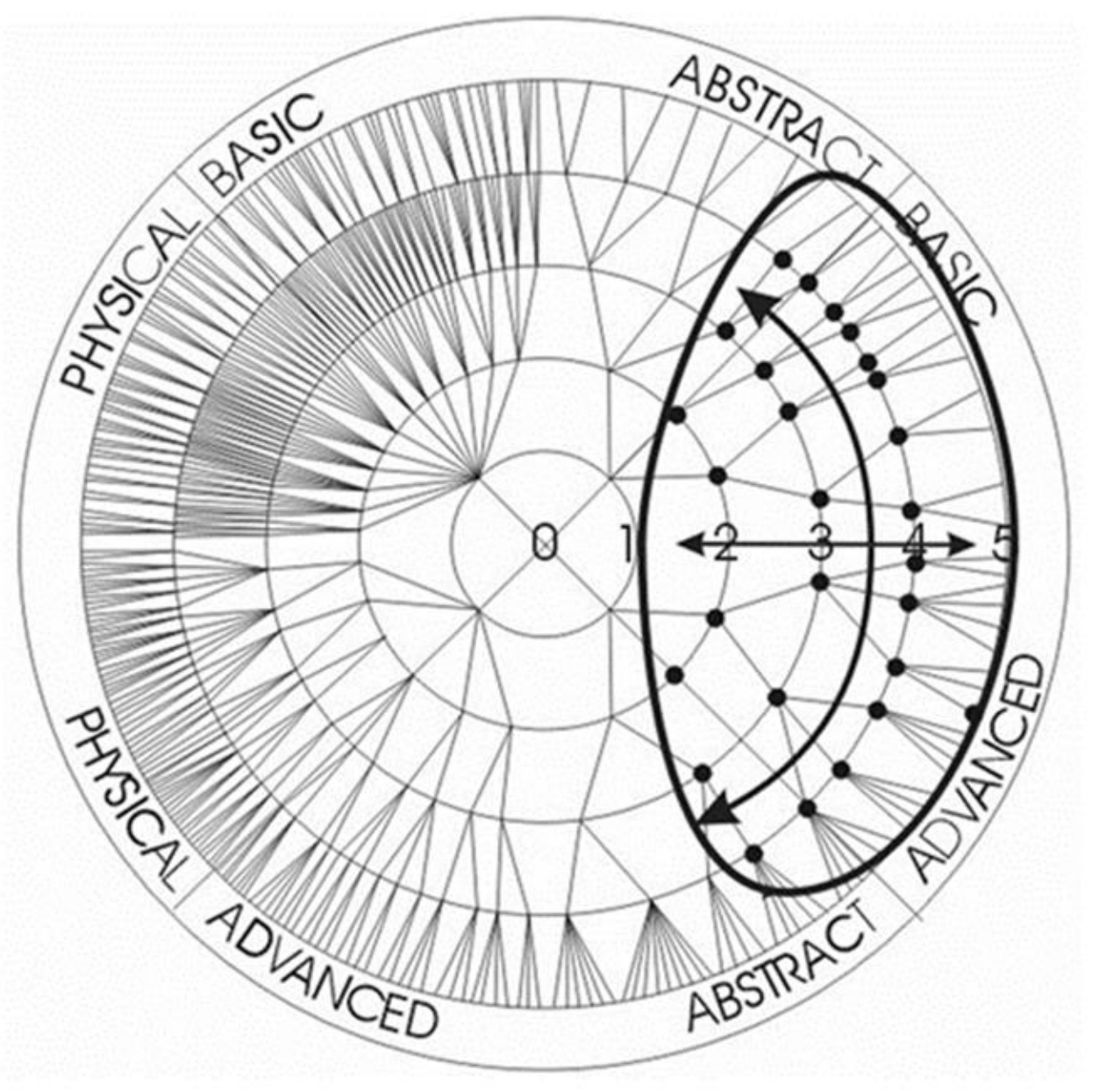
ABSTRACT BASIC

ADVANCED

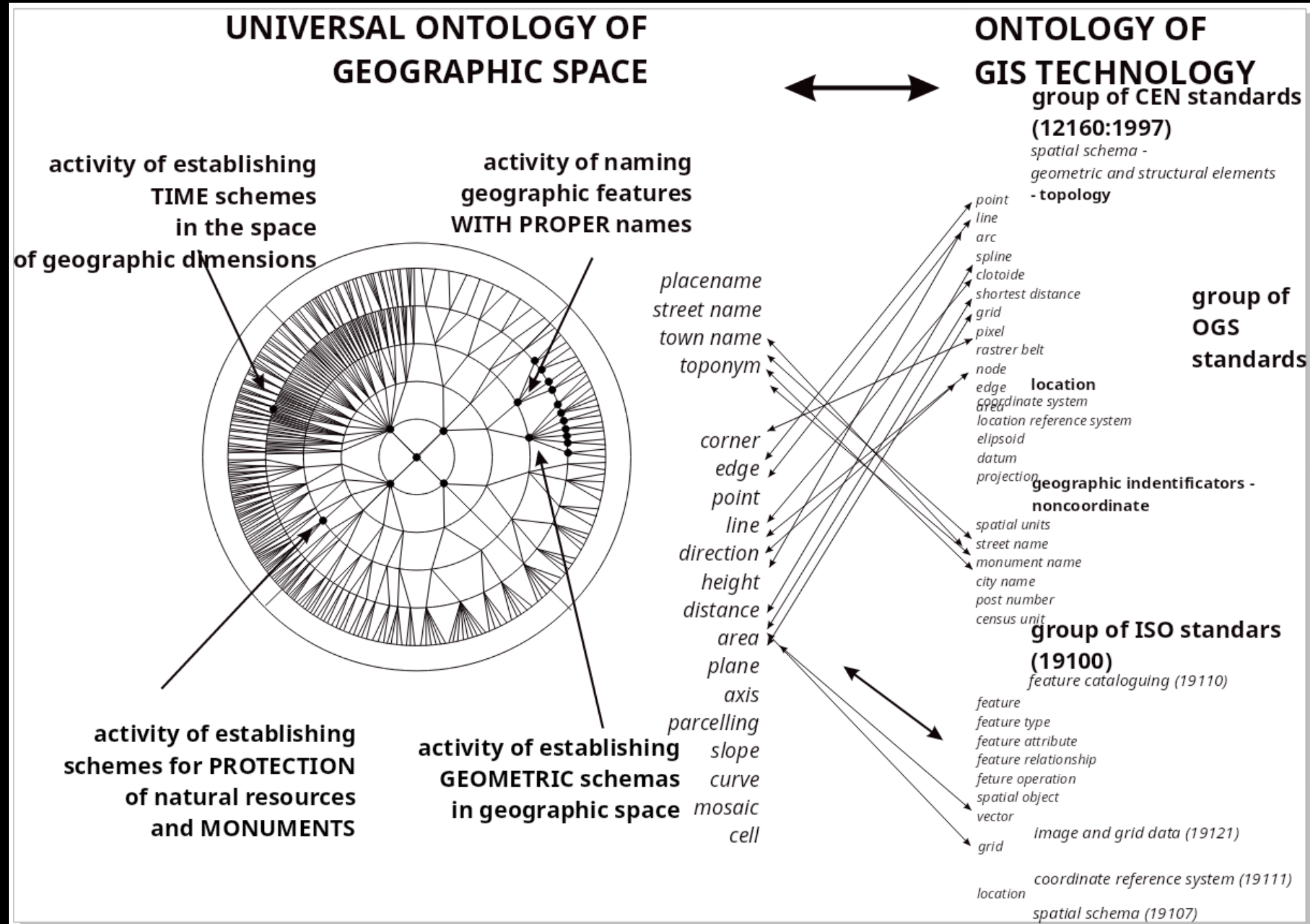
PHISICAL ADVANCED

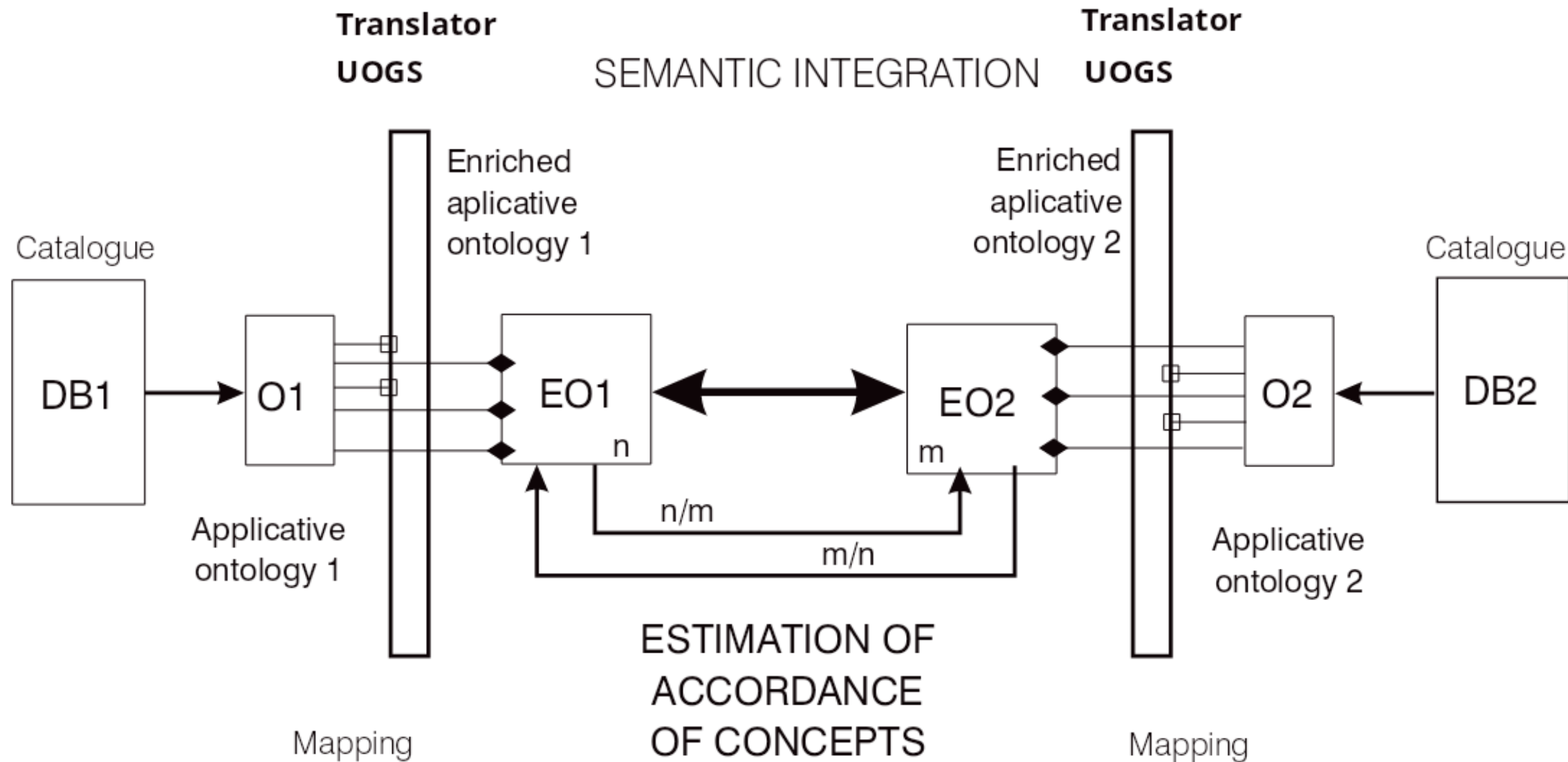
ABSTRACT ADVANCED

taksonomy



Semantic reference system





WHAT NEXT?

- Teaching AI



Surveying and
Mapping Authority
of the Republic of
Slovenia



Project: Developing guidelines to improve
semantic interoperability in spatial
database management and geoinformatics
in Slovenia

Slovenian research project V2-2295 (2022-2024)

Chair of Geoinformatics and RE Cadastres

GAP Analysis approach

A – What is there

- Datasets?
- Data model definitions?
- Comprehensive Metadata?
- Ontologies ??
- Vocabularies ??
- Data complexity ??

B – What should be there

- Standardized data models
- Shared vocabulary
- Metadata standards
- Ontologies and Schemas

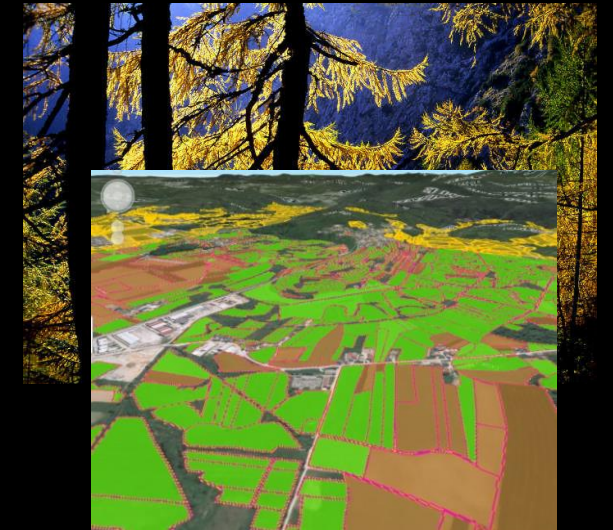
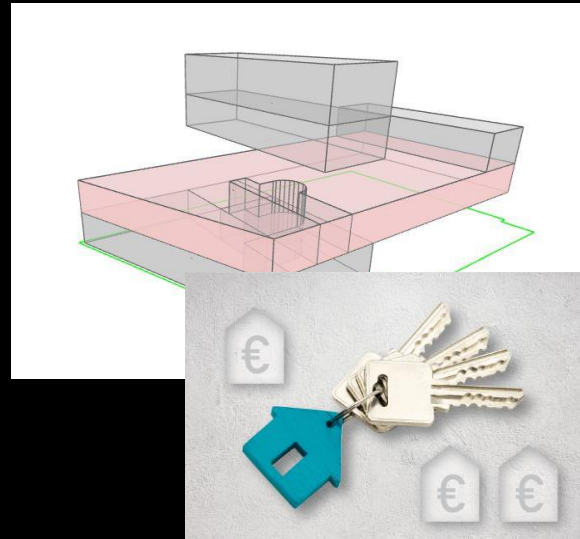
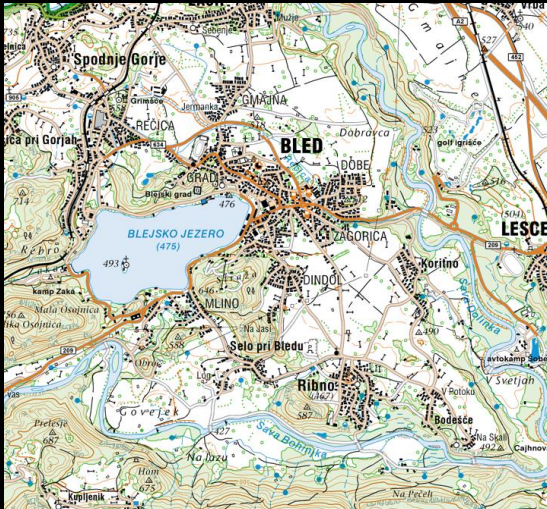
B - What should be there

A - What is there?

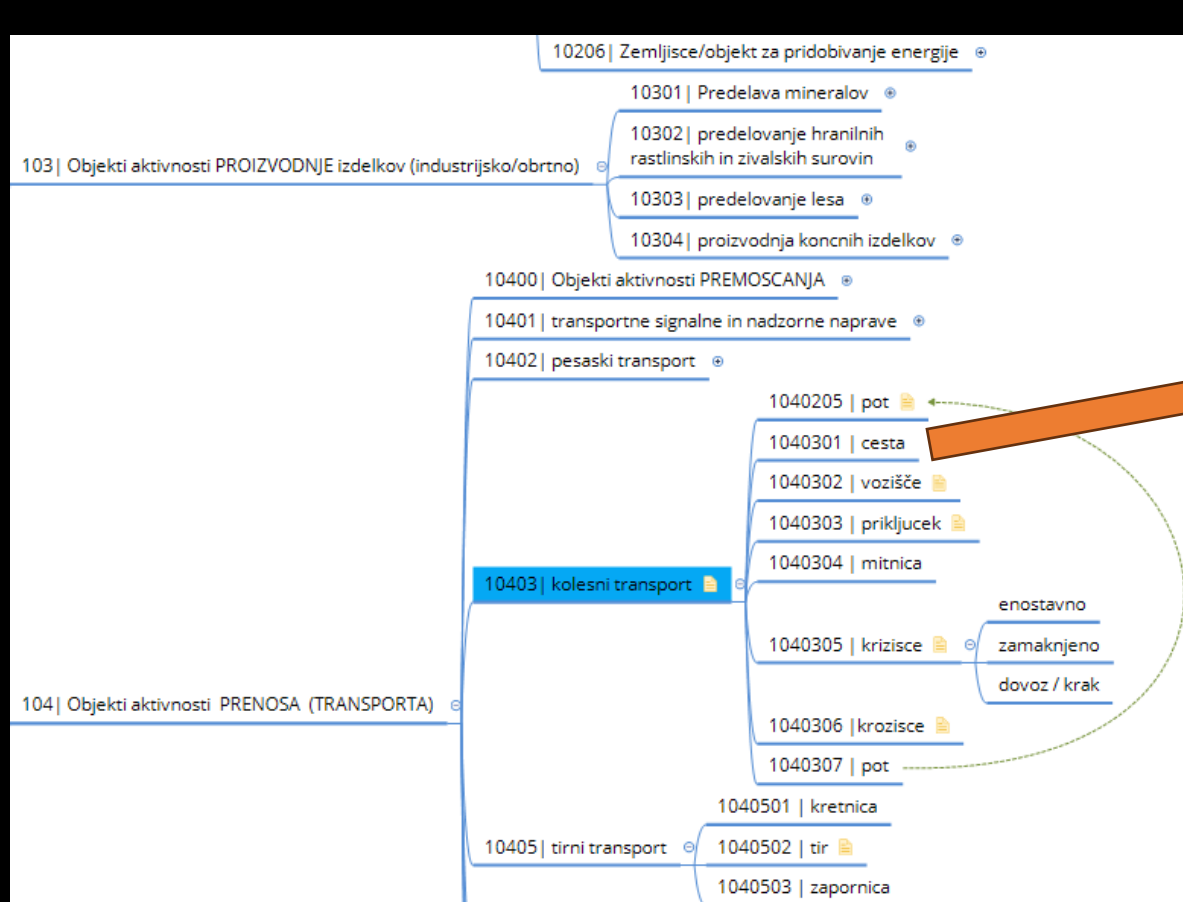
$$\text{GAP} = \text{B} - \text{A}$$

Scope of the analysis

- Topographic maps and datasets
- Building cadaster and Building value model
- Municipal infrastructure Datasets
- Agroicultural and forestry datasets



Mapping to the Universal ontology of Geographic Space



UOPGR	
Šifra	Opis
104	Objekti aktivnosti PRENOSA (TRANSPORTA)
10403	cestni transport
1040301	cesta

OBJEKтна SKUPINA	OBJEKT	POTDIP OBJEKTA	ATR1	ŠIFRA VRSTE OBJEKTA
PROMETNA INFRASTRUKTURA				1000
Ceste				1100
	Cesta ali pot (os ceste ali poti)			1101
		os ceste		
		križišče		
	Objekt cestne infrastrukture			1102
		most		

Current findings

- Different vocabularies for the same object type (ex. Building)
- Non-comprehensive metadata
- Lack of national semantic infrastructure
- Diverse Data Provenance
 - different levels of complexity
 - Variable data quality