The Relevance of Ontologies in Biology and Medicine

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Display Summary Show 20 Sort by

448 in the last year

All: 1528 Review: 88

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1: Liu CC, Lin CC, Chen WS, Chen HY, Chang PC, Chen JJ, Yang PC. Related Articles, Links

CRSD: a comprehensive web server for composite regulatory signature discovery.
Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W571-7.
PMID: 16845073 [PubMed - in process]

2: Scheer M, Klawonn F, Munch R, Grote A, Hiller K, Choi C, Koch I, Schobert M, Hartig E, Klages U, Jahn D. Related Articles, Links

JProGO: a novel tool for the functional interpretation of prokaryotic microarray data using Gene Ontology information.
Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W510-5.
PMID: 16845060 [PubMed - in process]

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CARMAweb: comprehensive R- and bioconductor-based web service for microarray data analysis.
Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W498-503.
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4: Montaner D, Tarraga J, Huerta-Cepas J, Burguet J, Vaquerizas JM, Conde L, Minguez P, Vera J, Mukherjee S, Valls J, Pujana MA, Alloza E, Herrero J, Al-Shahrour F, Dopazo J. Related Articles, Links

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Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W486-91.
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5: Massjouni N, Rivera CG, Murali TM. Related Articles, Links

VIRGO: computational prediction of gene functions.
Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W340-4.
PMID: 16845022 [PubMed - in process]

6: Penkett CJ, Morris JA, Wood V, Bahler J. Related Articles, Links

YOGY: a web-based, integrated database to retrieve protein orthologs and associated Gene Ontology terms.
Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W330-4.
PMID: 16845020 [PubMed - in process]

7: Prieto C, De Las Rivas J. Related Articles, Links

APID: Agile Protein Interaction DataAnalyzer.
Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W298-302.
PMID: 16845013 [PubMed - in process]

8: Ye J, Fang L, Zheng H, Zhang Y, Chen J, Zhang Z, Wang J, Li S, Li R, Bolund L, Wang J. Related Articles, Links

WEGO: a web tool for plotting GO annotations.
Nucleic Acids Res. 2006 Jul 1;34(Web Server issue):W293-7.
PMID: 16845012 [PubMed - in process]

9: Mans JJ, Baker HV, Oda D, Lamont RJ, Handfield M. Related Articles, Links

Synergies in Medical Informatics and Bioinformatics

White Paper, June 2006

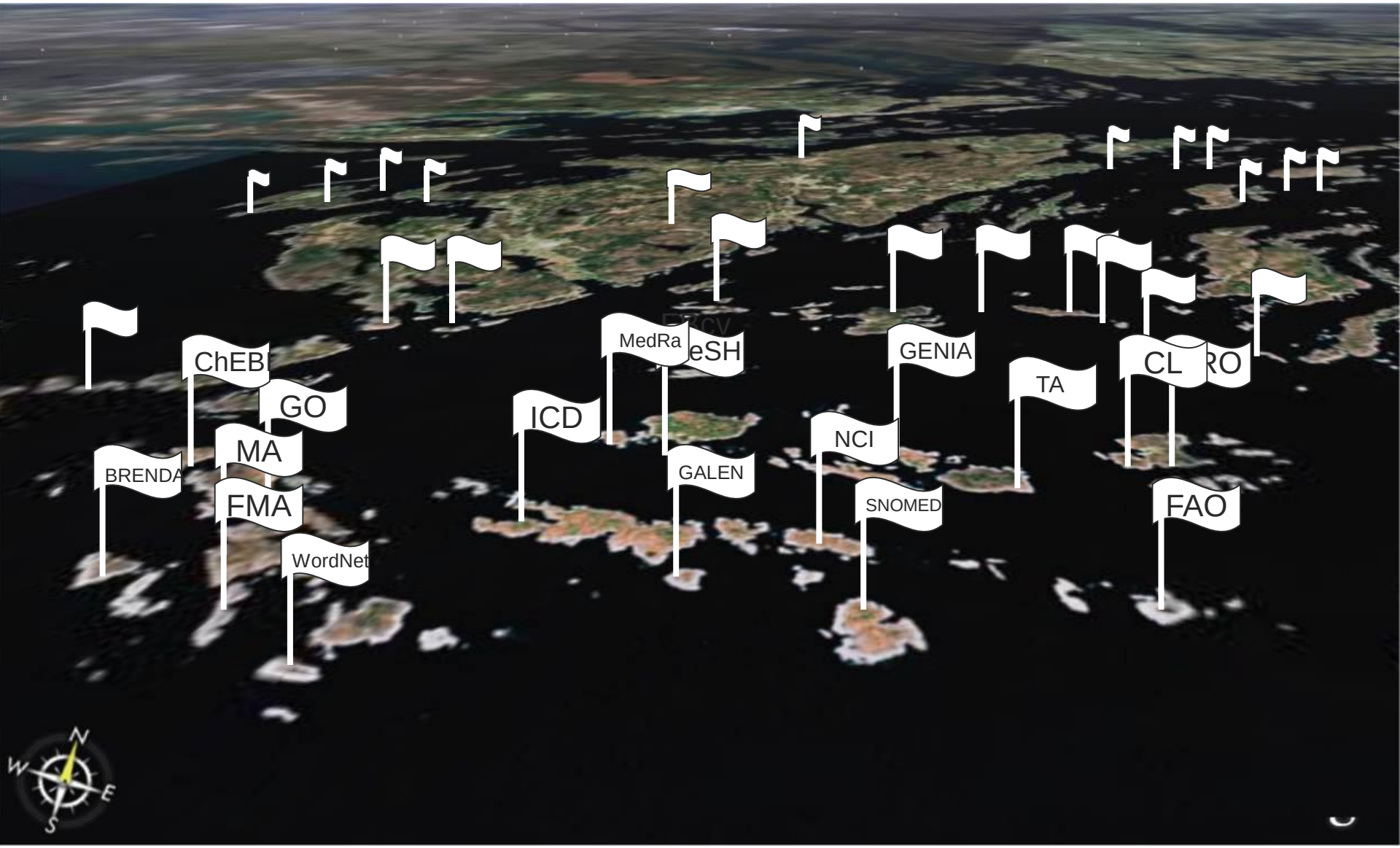
Identification of the "*Thirteen most highly prioritised areas*" :

1. *Medical Genetics Databases and Initiatives*
2. *Gene Expression Information in Medical Diagnostics & Prognostics*
3. *Modelling & Simulation of Biological Structures & Processes/Diseases*
4. *Data Integration from Biosensors & Med. Devices with clinical information systems*
5. *Integration of patient molecular data in Electronic Health Records*
6. *Systems for Clinical Decision Making*
7. *Semantic Interoperability and Ontologies in Biomedicine*
8. *Technologies for Biomedical Information Integration*
9. *Data Interoperability & Standards*
10. *Connecting Biobanks to large scale databases to enable data mining*
11. *Patient Risk Profiling and Lifestyle Management*
12. *Applied Pharmaceutical Research*
13. *Clinical and Ethical Issues related to biomedical data processing*

Content

- A cruise through the O-Space
- The "O-word": Terminological Clarification
- Purposes of Ontologies
- Mapping the O-Space
  - What is represented
  - How is it represented
- Practice of Good Ontology

A cruise through the archipelago of ontologies




MeSH
Medical Subject Headings

MeSH Tree Structures - 2006

Return to Entry Page

1. Anatomy [A]
2. Organisms [B]
   - Animals [B01] +
   - Algae [B02] +
   - Bacteria [B03] +
   - Viruses [B04] +
   - Fungi [B05] +
   - Plants [B06] +
   - Archaea [B07] +
   - Mesomycetozoea [B08] +
3. Diseases [C]
4. Chemicals and Drugs [D]
5. Analytical, Diagnostic and Therapeutic Techniques and Equipment [E]
6. Psychiatry and Psychology [F]
7. Biological Sciences [G]
8. Physical Sciences [H]
9. Anthropology, Education, Sociology and Social Phenomena [I]
10. Technology and Food and Beverages [J]
11. Humanities [K]
12. Information Science [L]
13. Persons [M]
14. Health Care [N]
15. Publication Characteristics [V]
16. Geographic Locations [Z]

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- Bacteria [B03]
  - Atypical Bacterial Forms [B03.110] +
  - Bacteria, Aerobic [B03.120]
  - Bacteria, Anaerobic [B03.130]
  - Bacteroidetes [B03.140] +
  - Biofilms [B03.150]
  - Blood-Borne Pathogens [B03.165]
  - Chlorobi [B03.250] +
  - Chloroflexi [B03.275] +
  - Cyanobacteria [B03.280] +
  - Endospore-Forming Bacteria [B03.300] +
  - Fusobacteria [B03.370] +
  - Gram-Negative Bacteria [B03.440] +
  - Gram-Positive Bacteria [B03.510]
    - Actinobacteria [B03.510.024] +
    - Gram-Positive Cocci [B03.510.400] +
    - Gram-Positive Endospore-Forming Bacteria [B03.510.415] +
    - Gram-Positive Rods [B03.510.460] +
  - Proteobacteria [B03.660] +
  - Spirochaetales [B03.851] +
  - Spores [B03.867] +
  - Sulfur-Reducing Bacteria [B03.900] +

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Link to NLM Cataloging Classification

Bacteria [B03]

Gram-Positive Bacteria [B03.510]

Gram-Positive Cocci [B03.510.400]

Staphylococcaceae [B03.510.400.790]

Staphylococcus [B03.510.400.790.750]

Staphylococcus aureus [B03.510.400.790.750.100]

Staphylococcus epidermidis [B03.510.400.790.750.343]

Staphylococcus haemolyticus [B03.510.400.790.750.400]

Staphylococcus hominis [B03.510.400.790.750.425]

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Link to NLM Cataloging Classification

National Library of Medicine - Medical Subject Headings

2006 MeSH

MeSH Descriptor Data

Return to Entry Page

MeSH Heading	Staphylococcus aureus
Tree Number	B03.510.400.790.750.100
Annotation	infection = STAPHYLOCOCCAL INFECTIONS & do not bother to coord with S. aureus unless particularly discussed (index IM); DF: STAPH AUREUS
Scope Note	Potentially pathogenic bacteria found in nasal membranes, skin, hair follicles, and perineum of warm-blooded animals. They may cause a wide range of infections and intoxications.
Allowable Qualifiers	CH CL CY DE EN GD GE IM IP ME PH PY RE UL VI
Entry Version	STAPH AUREUS
Previous Indexing	Staphylococcus (1966-1974)
Online Note	use STAPHYLOCOCCUS AUREUS to search MICROCOCCUS PYOGENES 1975-91; use STAPHYLOCOCCUS 1966-74
History Note	76; was MICROCOCCUS PYOGENES see under STAPHYLOCOCCUS 1963-75; MICROCOCCUS PYOGENES was see STAPHYLOCOCCUS AUREUS 1976-91
Unique ID	D013211

MeSH Tree Structures

Bacteria [B03]
- Gram-Positive Bacteria [B03.510]
  - Gram-Positive Cocci [B03.510.400]
    - Staphylococcaceae [B03.510.400.790]
      - Staphylococcus [B03.510.400.790.750]
        - Staphylococcus aureus [B03.510.400.790.750.100]
        - Staphylococcus epidermidis [B03.510.400.790.750.343]
        - Staphylococcus haemolyticus [B03.510.400.790.750.400]
        - Staphylococcus hominis [B03.510.400.790.750.425]

Return to Entry Page **Link to NLM Cataloging Classification**


GO
Gene Ontology

AmiGO

Search GO

Exact Match

Terms

Gene Symbol/Name

Anfrage senden

Advanced Query

Query By Sequence

Gene Product Filters

Species

All
A. thaliana
B. anthracis str. Am

Datasource ?

All
CGD
dictyBase

Evidence Code ?

All Curator Approved
IGI
IEP

Ontology Filter

All
Biological Process
Cellular Component
Molecular Function

Set Filters

XML

Flat File

Permalink

all : all (182213)

Graphi

- GO:0008150 : biological_process (129820)
- GO:0005575 : cellular_component (117701)
- GO:0003674 : molecular_function (123908)
- obsolete_biological_process : obsolete_biological_process (0)
- obsolete_cellular_component : obsolete_cellular_component (0)
- obsolete_molecular_function : obsolete_molecular_function (0)

Last updated: 2006-07-16

AmiGO

Search GO

Exact Match

Terms

Gene Symbol/Name

Anfrage senden

Advanced Query

Query By Sequence

Gene Product Filters

Species

All
A. thaliana
B. anthracis str. Am

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dictyBase

Evidence Code ?

All Curator Approved
IGI
IEP

Ontology Filter

All
Biological Process
Cellular Component
Molecular Function

Set Filters

XML

Flat File

Permalink

Graphi

- all : all (182213)
  - GO:0008150 : biological_process (129820)
    - GO:0000004 : biological process unknown (34192)
    - GO:0009987 : cellular process (80269)
    - GO:0007275 : development (13811)
    - GO:0040007 : growth (3307)
    - GO:0051704 : interaction between organisms (1454)
    - GO:0007582 : physiological process (82723)
    - GO:0043473 : pigmentation (98)
    - GO:0050789 : regulation of biological process (16097)
    - GO:0000003 : reproduction (4342)
    - GO:0050896 : response to stimulus (16018)
    - GO:0016032 : viral life cycle (308)
  - GO:0005575 : cellular_component (117701)
    - GO:0005623 : cell (86914)
    - GO:0044464 : cell part (86873)
    - GO:0008372 : cellular component unknown (26407)
    - GO:0031975 : envelope (2624)
    - GO:0031012 : extracellular matrix (671)
    - GO:0044420 : extracellular matrix part (376)
    - GO:0005576 : extracellular region (6190)
    - GO:0044421 : extracellular region part (4719)
    - GO:0031974 : membrane-enclosed lumen (4138)
    - GO:0043226 : organelle (63366)
    - GO:0044422 : organelle part (14198)
    - GO:0043234 : protein complex (12525)
    - GO:0045202 : synapse (235)
    - GO:0044456 : synapse part (101)
    - GO:0019012 : virion (151)
    - GO:0044423 : virion part (121)
  - GO:0003674 : molecular_function (123908)
    - GO:0016209 : antioxidant activity (504)
    - GO:0005488 : binding (35413)
    - GO:0003824 : catalytic activity (42468)
    - GO:0030188 : chaperone regulator activity (46)
    - GO:0042056 : chemoattractant activity (9)
    - GO:0045499 : chemorepellant activity (4)
    - GO:0031992 : energy transducer activity (0)
    - GO:0030234 : enzyme regulator activity (2307)
    - GO:0005554 : molecular function unknown (35361)
    - GO:0003774 : motor activity (556)
    - GO:0045735 : nutrient reservoir activity (49)
    - GO:0031386 : protein tag (18)
    - GO:0004871 : signal transducer activity (9415)
    - GO:0005198 : structural molecule activity (3727)
    - GO:0030528 : transcription regulator activity (8713)
    - GO:0045182 : translation regulator activity (770)
    - GO:0005215 : transporter activity (9520)
    - GO:0030533 : triplet codon-amino acid adaptor activity (1269)
  - obsolete biological process : obsolete biological process (0)

- GO:0043204 : perikaryon (1)
- GO:0009986 : cell surface (688)
- GO:0030312 : external encapsulating structure (834)
- GO:0044462 : external encapsulating structure part (380)
- GO:0042763 : immature spore (23)
- GO:0005622 : intracellular (70290)
- GO:0044424 : intracellular part (69594)
- GO:0031255 : lateral part of motile cell (0)
- GO:0031252 : leading edge (208)
- **GO:0016020 : membrane (21224)**
  - GO:0030673 : axolemma (4)
  - GO:0009941 : chloroplast envelope (90)
  - GO:0048475 : coated membrane (238)
  - GO:0012505 : endomembrane system (1706)
  - GO:0044425 : membrane part (15359)
  - **GO:0031090 : organelle membrane (3785)**
    - GO:0005789 : endoplasmic reticulum membrane (606)
    - GO:0010008 : endosome membrane (62)
    - GO:0031312 : extrinsic to organelle membrane (19)
    - GO:0020017 : flagellar membrane (1)
    - GO:0046860 : glycosome membrane (4)
    - **GO:0000139 : Golgi membrane (310)**
      - **GO:0030660 : Golgi-associated vesicle membrane (78)**
        - GO:0012507 : [illegible] (29)
        - GO:0012508 : Golgi to ER transport vesicle membrane (0)
        - GO:0012509 : inter-Golgi transport vesicle membrane (0)
        - GO:0012510 : trans-Golgi network transport vesicle membrane (45)
      - **GO:0031228 : intrinsic to Golgi membrane (77)**
        - GO:0030173 : integral to Golgi membrane (66)
    - GO:0046859 : hydrogenosomal membrane (0)
    - GO:0031300 : intrinsic to organelle membrane (311)
    - GO:0031903 : microbody membrane (102)
    - GO:0031966 : mitochondrial membrane (1447)
    - GO:0031965 : nuclear membrane (353)
    - GO:0019866 : organelle inner membrane (1296)
    - GO:0031968 : organelle outer membrane (260)
    - GO:0042170 : plastid membrane (63)
    - GO:0031095 : platelet dense tubular network membrane (0)
    - GO:0042651 : thylakoid membrane (406)
    - GO:0005774 : vacuolar membrane (294)

The lipid bilayer surrounding any of the compartments of the Golgi apparatus.


ICD
International Classification
of Diseases

Internationale Statistische Klassifikation der Krankheiten und verwandter Gesundheitsprobleme
10. Revision
Version 2006

German Modification

Vierstellige Ausführliche Systematik

Kapitelübersicht

Kapitel	Gliederung	Titel
I	A00-B99	Bestimmte infektiöse und parasitäre Krankheiten
II	C00-D48	Neubildungen
III	D50-D90	Krankheiten des Blutes und der blutbildenden Organe sowie bestimmte Störungen mit Beteiligung des Immunsystems
IV	E00-E90	Endokrine, Ernährungs- und Stoffwechselkrankheiten
V	F00-F99	Psychische und Verhaltensstörungen
VI	G00-G99	Krankheiten des Nervensystems
VII	H00-H59	Krankheiten des Auges und der Augenanhangsgebilde
VIII	H60-H95	Krankheiten des Ohres und des Warzenfortsatzes
IX	I00-I99	Krankheiten des Kreislaufsystems
X	J00-J99	Krankheiten des Atmungssystems
XI	K00-K93	Krankheiten des Verdauungssystems
XII	L00-L99	Krankheiten der Haut und der Unterhaut
XIII	M00-M99	Krankheiten des Muskel-Skelett-Systems und des Bindegewebes
XIV	N00-N99	Krankheiten des Urogenitalsystems
XV	O00-O99	Schwangerschaft, Geburt und Wochenbett
XVI	P00-P96	Bestimmte Zustände, die ihren Ursprung in der Perinatalperiode haben
XVII	Q00-Q99	Angeborene Fehlbildungen, Deformitäten und Chromosomenanomalien
XVIII	R00-R99	Symptome und abnorme klinische und Laborbefunde, die anderenorts nicht klassifiziert sir
XIX	S00-T98	Verletzungen, Vergiftungen und bestimmte andere Folgen äußerer Ursachen
XX	V01-Y98	Äußere Ursachen von Morbidität und Mortalität
XXI	Z00-Z99	Faktoren, die den Gesundheitszustand beeinflussen und zur Inanspruchnahme des Gesundheitswesens führen
XXII	U00-U99	Schlüsselnummern für besondere Zwecke

Kapitel I:

Bestimmte infektiöse und parasitäre Krankheiten
(A00-B99)

Kapitel II:

Neubildungen
(C00-D48)

C00-C97 Bösartige Neubildungen
- C00-C75 Bösartige Neubildungen an genau bezeichneten Lokalisationen, als primär festgestellt oder vermutet, ausgenommen lymphatisches, blutbildendes und verwandtes Gewebe
  - C00-C14 Lippe, Mundhöhle und Pharynx
  - C15-C26 Verdauungsorgane
  - C30-C39 Atmungsorgane und sonstige intrathorakale Organe
  - C40-C41 Knochen und Gelenkknorpel
  - C43-C44 Haut
  - C45-C49 Mesotheliales Gewebe und Weichteilgewebe
  - C50 Brustdrüse [Mamma]
  - C51-C58 Weibliche Genitalorgane
  - C60-C63 Männliche Genitalorgane
  - C64-C68 Harnorgane
  - C69-C72 Auge, Gehirn und sonstige Teile des Zentralnervensystems
  - C73-C75 Schilddrüse und sonstige endokrine Drüsen
- C76-C80 Bösartige Neubildungen ungenau bezeichneter, sekundärer und nicht näher bezeichneter Lokalisationen
- C81-C96 Bösartige Neubildungen des lymphatischen, blutbildenden und verwandten Gewebes, als primär festgestellt oder vermutet
- C97 Bösartige Neubildungen als Primärtumoren an mehreren Lokalisationen

D00-D09 In-situ-Neubildungen
D10-D36 Gutartige Neubildungen
D37-D48 Neubildungen unsicheren oder unbekannten Verhaltens [siehe Hinweis am Anfang der Krankheitsgruppe D37 D48]

Kapitel III:

Krankheiten des Blutes und der blutbildenden Organe sowie bestimmte Störungen mit Beteiligung des Immunsystems
(D50-D90)

D50-D53 Alimentäre Anämien
D55-D59 Hämolytische Anämien
D60-D64 Aplastische und sonstige Anämien
D65-D69 Koagulopathien, Purpura und sonstige hämorrhagische Diathesen
D70-D77 Sonstige Krankheiten des Blutes und der blutbildenden Organe
D80-D90 Bestimmte Störungen mit Beteiligung des Immunsystems

Kapitel IV:

Inkl.: Mittelohr
Exkl.: Mesotheliom (C45.-)

C30.- **Bösartige Neubildung der Nasenhöhle und des Mittelohres**

C30.0 **Nasenhöhle**
Conchae nasales
Naseninnenraum
Nasenknorpel
Nasenseptum
Vestibulum nasi
Exkl.: Bulbus olfactorius (C72.2)
Haut der Nase (C43.3 , C44.3)
Hinterrand des Nasenseptums und der Choanen (C11.3)
Nase o.n.A. (C76.0)
Nasenbein (C41.02)

C30.1 **Mittelohr**
Cellulae mastoideae
Innenohr
Tuba auditiva [Eustachio]
Exkl.: Gehörgang (äußerer) (C43.2 , C44.2)
Haut des (äußeren) Ohres (C43.2 , C44.2)
Knöcherner Gehörgang (Meatus) (C41.01)
Ohrknorpel (C49.0)

C31.- **Bösartige Neubildung der Nasennebenhöhlen**

C31.0 **Sinus maxillaris [Kieferhöhle]**
Antrum maxillare [Highmore-Höhle]

C31.1 **Sinus ethmoidalis [Siebbeinzellen]**

C31.2 **Sinus frontalis [Stirnhöhle]**

C31.3 **Sinus sphenoidalis [Keilbeinhöhle]**

C31.8 **Nasennebenhöhlen, mehrere Teilbereiche überlappend**
[Siehe Hinweis 5 am Anfang dieses Kapitels]

C31.9 **Nasennebenhöhle, nicht näher bezeichnet**

C32.- **Bösartige Neubildung des Larynx**

C32.0 **Glottis**
Lig. vocale [echtes Stimmband] o.n.A.
Ventriculus laryngis

C32.1 **Supraglottis**
Aryepiglottische Falte, laryngeale Seite
Epiglottis (suprahyoidaler Anteil) o.n.A.
Hintere (laryngeale) Fläche der Epiglottis
Plica vestibularis

Word NET

WordNet Search - 2.1

Return to WordNet Home

Glossary - Help

SEARCH DISPLAY OPTIONS: (Select option to change) Change

Enter a word to search for: tongue Search WordNet

WARNING: The search exceeded the result limit, so the following list is valid but incomplete. Only the top levels of the list are displayed.

KEY: "S:" = Show Synset (semantic) relations, "W:" = Show Word (lexical) relations

Noun

- S: (n) **tongue**, lingua, glossa, clapper (a mobile mass of muscular tissue covered with mucous membrane and located in the oral cavity)
- S: (n) natural language, **tongue** (a human written or spoken language used by a community; opposed to e.g. a computer language)
- S: (n) **tongue**, knife (any long thin projection that is transient) *"tongues of flame licked at the walls"; "rifles exploded quick knives of fire into the dark"*
- S: (n) **tongue** (a manner of speaking) *"he spoke with a thick tongue"; "she has a glib tongue"*
- S: (n) spit, **tongue** (a narrow strip of land that juts out into the sea)
- S: (n) **tongue** (the tongue of certain animals used as meat)
- S: (n) **tongue** (the flap of material under the laces of a shoe or boot)
- S: (n) clapper, **tongue** (metal striker that hangs inside a bell and makes a sound by hitting the side)

Verb

- S: (v) **tongue** (articulate by tonguing, as when playing wind instruments)
- S: (v) **tongue** (lick or explore with the tongue)

Return to WordNet Home

WordNet Search - 2.1

Return to WordNet Home

Glossary - Help

SEARCH DISPLAY OPTIONS: (Select option to change) Change

Enter a word to search for: lingua Search WordNet

WARNING: The search exceeded the result limit, so the following list is valid but incomplete. Only the top levels of the list are displayed.

KEY: "S:" = Show Synset (semantic) relations, "W:" = Show Word (lexical) relations

Noun

- S: (n) tongue, **lingua**, glossa, clapper (a mobile mass of muscular tissue covered with mucous membrane and located in the oral cavity)
  - *part meronym*
    - S: (n) tastebud, taste bud, gustatory organ (an oval sensory end organ on the surface of the tongue)
  - *direct hypernym* / *inherited hypernym* / *sister term*
    - S: (n) organ (a fully differentiated structural and functional unit in an animal that is specialized for some particular function)
    - S: (n) articulator (a movable speech organ)
  - *part holonym*
    - S: (n) mouth, oral cavity, oral fissure, rima oris (the opening through which food is taken in and vocalizations emerge) *"he stuffed his mouth with candy"*
    - S: (n) throat, pharynx (the passage to the stomach and lungs; in the front part of the neck below the chin and above the collarbone)
  - ***derivationally related form***
    -
    -
    - W: (adj) lingual [Related to: lingua] (pertaining to or resembling or lying near the tongue) *"lingual inflammation"; "the lingual surface of the teeth"*
    - W: (adj) lingual [Related to: lingua] (consisting of or related to language) *"linguistic behavior"; "a linguistic atlas"; "lingual diversity"*

Return to WordNet Home

SNOMED Clinical Terms

CLUE - SNOMED CT(UK 0507-uk[Release]) [Registered user: DemonstrationUser95@CLUE5.demo]

File Edit Navigate Subsets Restrict Language View Tools Help

ConceptId 54329005

Description Id 90302019

acute myocardial infarction of anterior wall

clinical finding

Search infarction — Words - any order

Refined search

- adrenal infarction
- thyroid infarction
- cerebral infarction
- cardiac infarction
- myocardial infarction
- impending infarction

Details of 'acute myocardial infarction of anterior wall' — Distributed Relationships

ConceptStatus **Current**

Descriptions

- acute myocardial infarction of anterior wall (disorder)
- acute myocardial infarction of anterior wall
- acute anterior myocardial infarction

Fully defined by...

- Is a
  - acute myocardial infarction
- Course
  - acute
- *Group*
  - Associated morphology
    - acute infarct
  - Finding site
    - structure of anterior myocardium

Qualifiers

- Onset
  - sudden onset
  - gradual onset
- Severity
  - severities
- Episodicity
  - Episodicities

Legacy codes

- *SNOMED:* D3-15110
- *CTV3ID:* Xa0YL

Hierarchy for 'myocardial infarction' — Subtype hierarchy

- injury of anatomical site
- structural disorder of heart
- myocardial necrosis
- myocardial disease
  - myocardial infarction
    - acute myocardial infarction
      - acute anteroapical infarction
      - acute anteroapical myocardial infarction
      - acute anteroseptal myocardial infarction
        - acute non-Q wave infarction - anteroseptal
        - acute Q wave infarction - anteroseptal
      - acute infarction of papillary muscle
      - acute myocardial infarction NOS
      - acute myocardial infarction of anterior wall
      - acute myocardial infarction of anterolateral wall
        - acute non-Q wave infarction - anterolateral
        - acute Q wave infarction - anterolateral
      - acute myocardial infarction of atrium
      - acute myocardial infarction of inferior wall
        - acute myocardial infarction of inferoposterior wall
        - acute non-Q wave infarction - inferior
        - acute Q wave infarction - inferior
      - acute myocardial infarction of inferolateral wall
        - acute non-Q wave infarction - inferolateral
        - acute Q wave infarction - inferolateral
      - acute myocardial infarction of lateral wall
        - acute myocardial infarction of apical-lateral wall
        - acute myocardial infarction of basal-lateral wall
        - acute myocardial infarction of high lateral wall
        - acute non-Q wave infarction - lateral
        - acute Q wave infarction - lateral
      - acute myocardial infarction of posterolateral wall
      - acute myocardial infarction of septum
      - acute myocardial infarction with rupture of ventricle
      - acute non-Q wave infarction
      - acute non-ST segment elevation myocardial infarction

Start | C:\Progr... | C:\WIN... | Protégé ... | Jasc Pai... | 2 Wind... | Google ... | CLUE ...

Content

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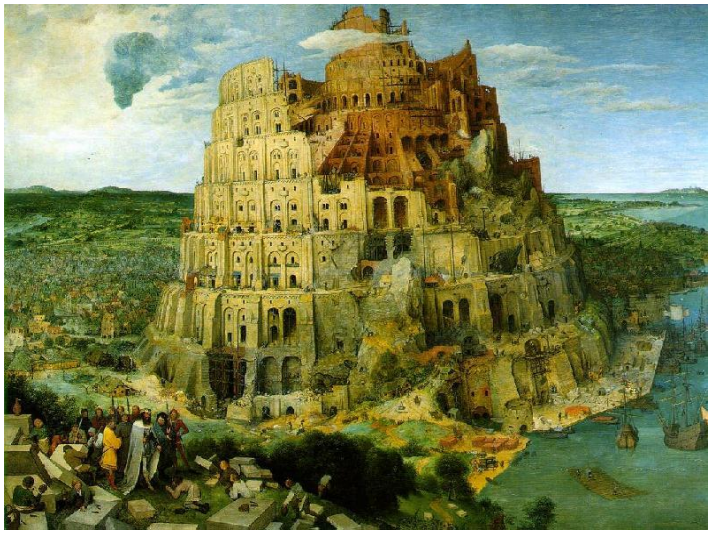
ONTOLOGY: Unresolved Terminological Confusion…

- Artifacts for ordering domain entities, relating word meanings or providing semantic reference
  - Vocabularies
  - Terminologies
  - Thesauri
  - Concept Systems
  - Classifications
  - Ontologies



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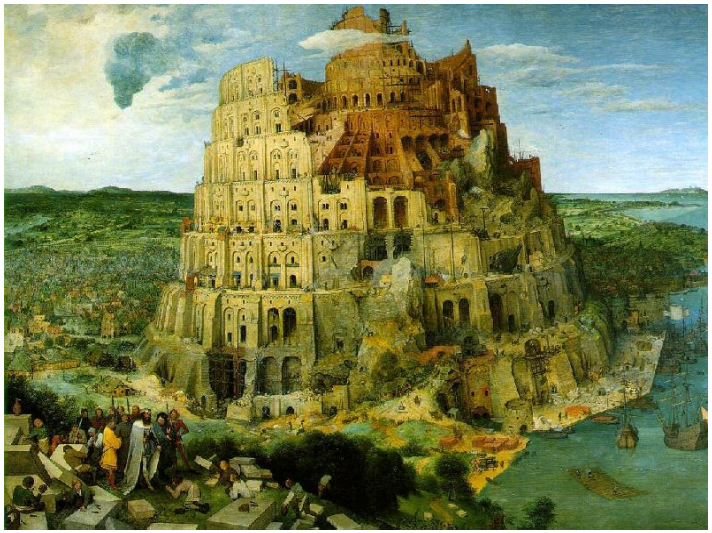

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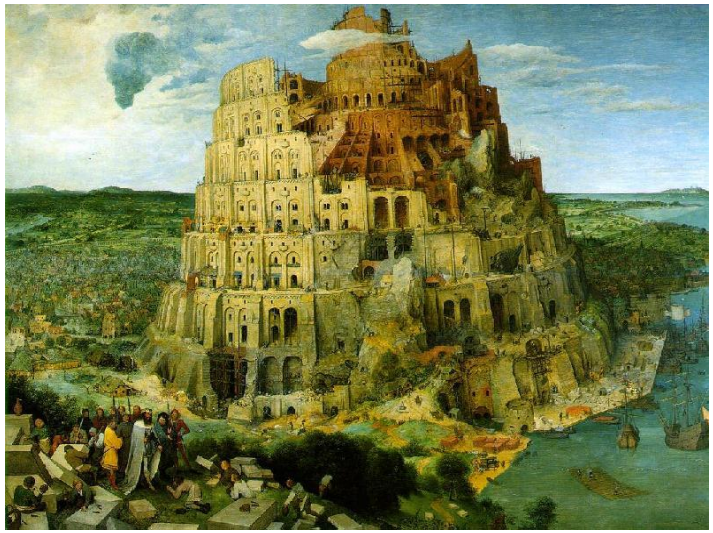


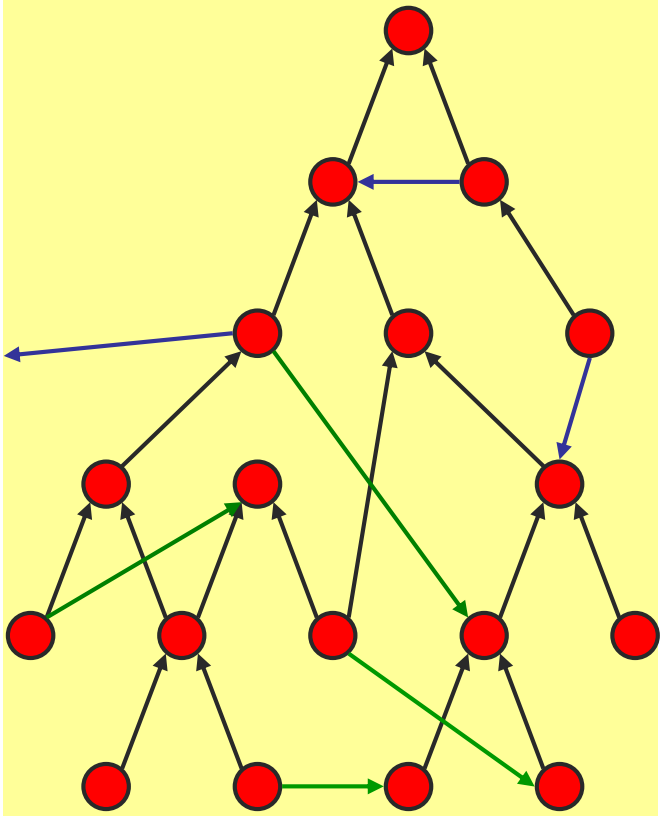
ONTOLOGY: Unresolved Terminological Confusion…

- Different scientific traditions:
  Biology, Medicine, Philosophy, Logic, Linguistics, Library and Information Science, Computer Science, Cognitive Science

- Different philosophical schools of thinking: Platonism, Aristotelian Realism, Conceptualism, Relativism, Idealism, Postmodernism, Constructivism, Nominalism, Tropism,…

Ontologies / Terminological Systems come in different flavors

Nodes and Links

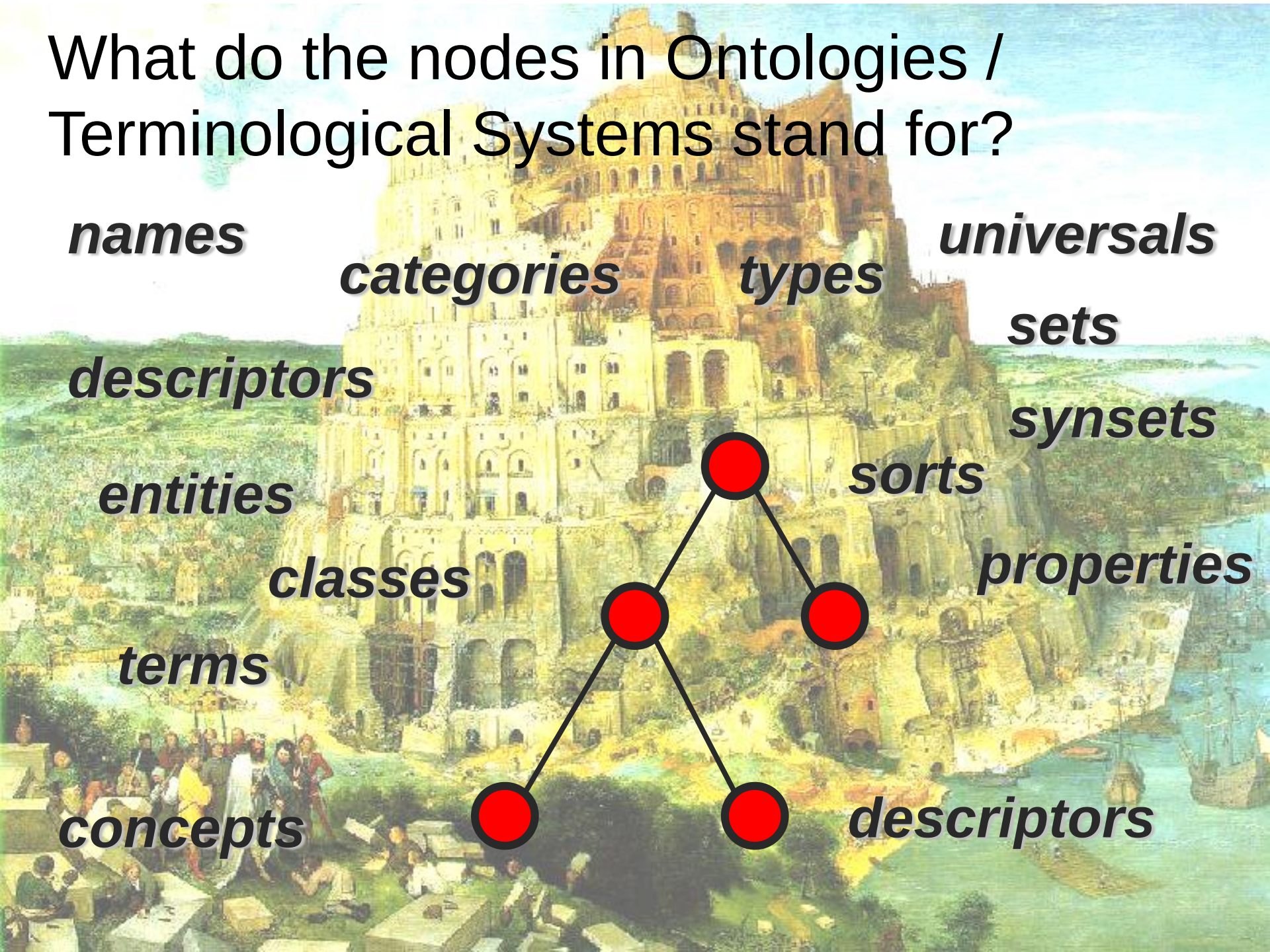


(In)formal Definitions

domain or region of DNA [GENIA]: *A substructure of DNA molecule which is supposed to have a particular function, such as a gene, e.g., c-jun gene, promoter region, Sp1 site, CA repeat. This class also includes a base sequence that has a particular function.*

ExtractionOfForeignBodyFromStomachByIncision ***≡***
RemovalOfForeignBodyFromDigestiveSystem ∏
RemovalOfForeignBodyFromStomach ∏
IncisionOfStomach ∏
∃ has-part.(∃ Method.RemovalAction ∏
∃ DirectMorphology.ForeignBody) ∏
∃ has-part.(∃ Method.IncisionAction ∏
∃ ProcedureSite.stomachStructure)

What do the nodes in Ontologies / Terminological Systems stand for?



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Purposes of Ontologies: General

- Semantic Interoperability
- Terminology control
- Knowledge extraction
- Knowledge management
- Natural Language Processing
- Document retrieval
- Formal reasoning about knowledge structures

Purposes of Ontologies: Medicine

- Support of clinical coding (diagnoses, procedures):
  - Accounting
  - Health Statistics
- Support of Biomedical Science:
  - Interoperability between heterogeneous databases
  - Indexing of biomedical literature

Purposes of Ontologies: Biology

- Data and information retrieval and analysis
- Semantic Annotation of Genes, Proteins in terms of localization, pathways, functions..
- Intelligent text mining of literature abstracts: "Bibliomics"

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Mapping the space of Ontology

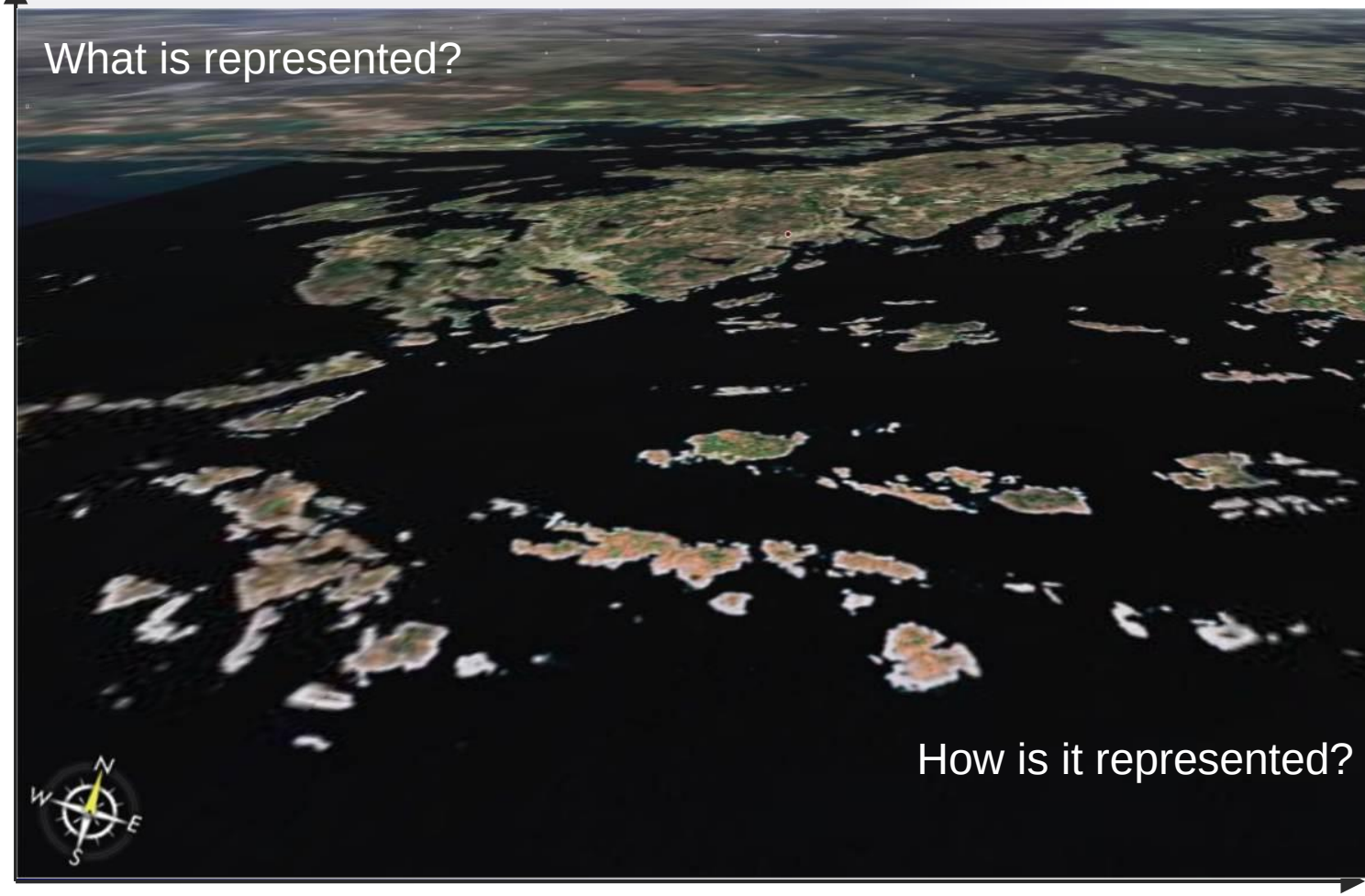
- instead of providing a definition…

Mapping the space of Ontology

Representation of arbitrary propositions

Representation of term meanings

Representation restricted to real world entities



Axiomatic Theory | Conceptual Schema | Thesaurus | Taxonomy | Glossary | Catalog

Gunnar Klein & Barry Smith: ontology.buffalo.edu/concepts/ConceptsandOntologies

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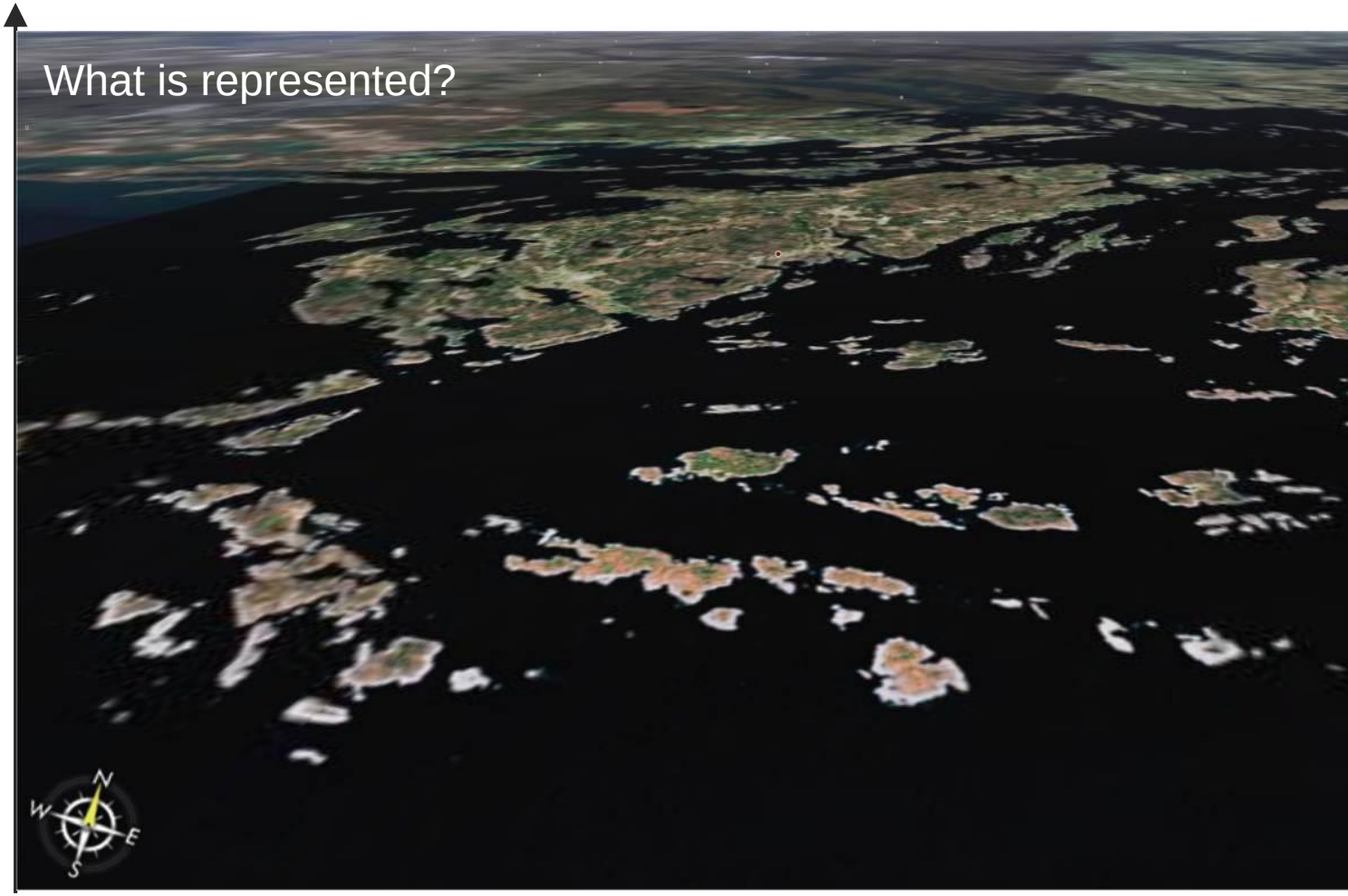

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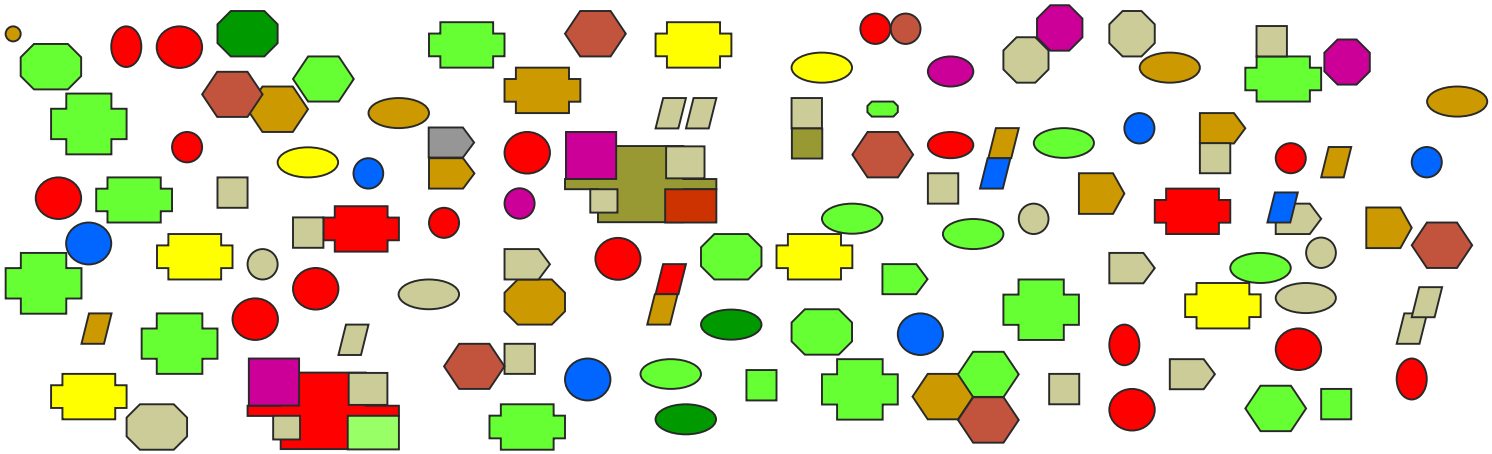
Intelligent Minds

Natural Language

Mind Independent Reality



Individual Entities (Instances, Particulars)

Intelligent Minds

Natural Language

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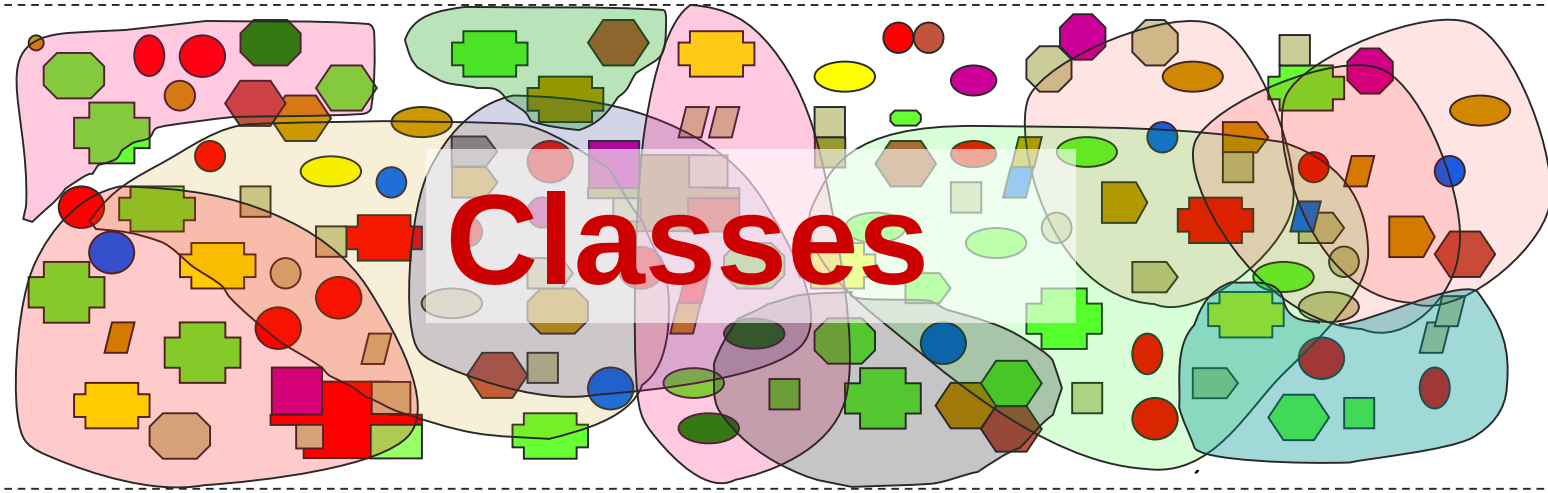

Individual Entities (Instances, Particulars)

Mapping the space of Ontology: Realist perspective

Representation of arbitrary propositions

Representation of term meanings

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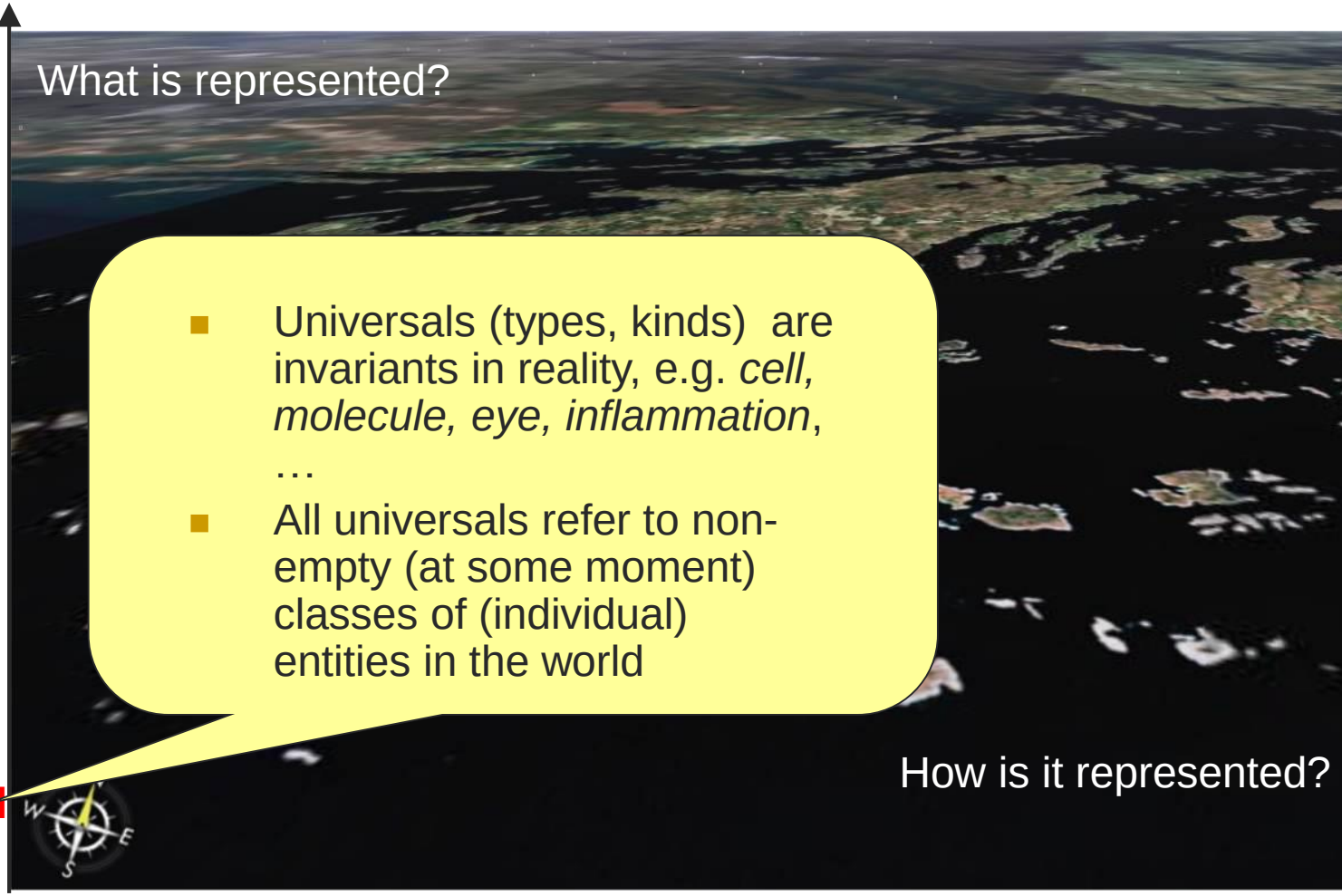

- Universals (types, kinds) are invariants in reality, e.g. *cell, molecule, eye, inflammation*, …
- All universals refer to non-empty (at some moment) classes of (individual) entities in the world

Gunnar Klein & Barry Smith:
ontology.buffalo.edu/concepts/ConceptsandOntologies

Mapping the space of Ontology Conceptualist perspective

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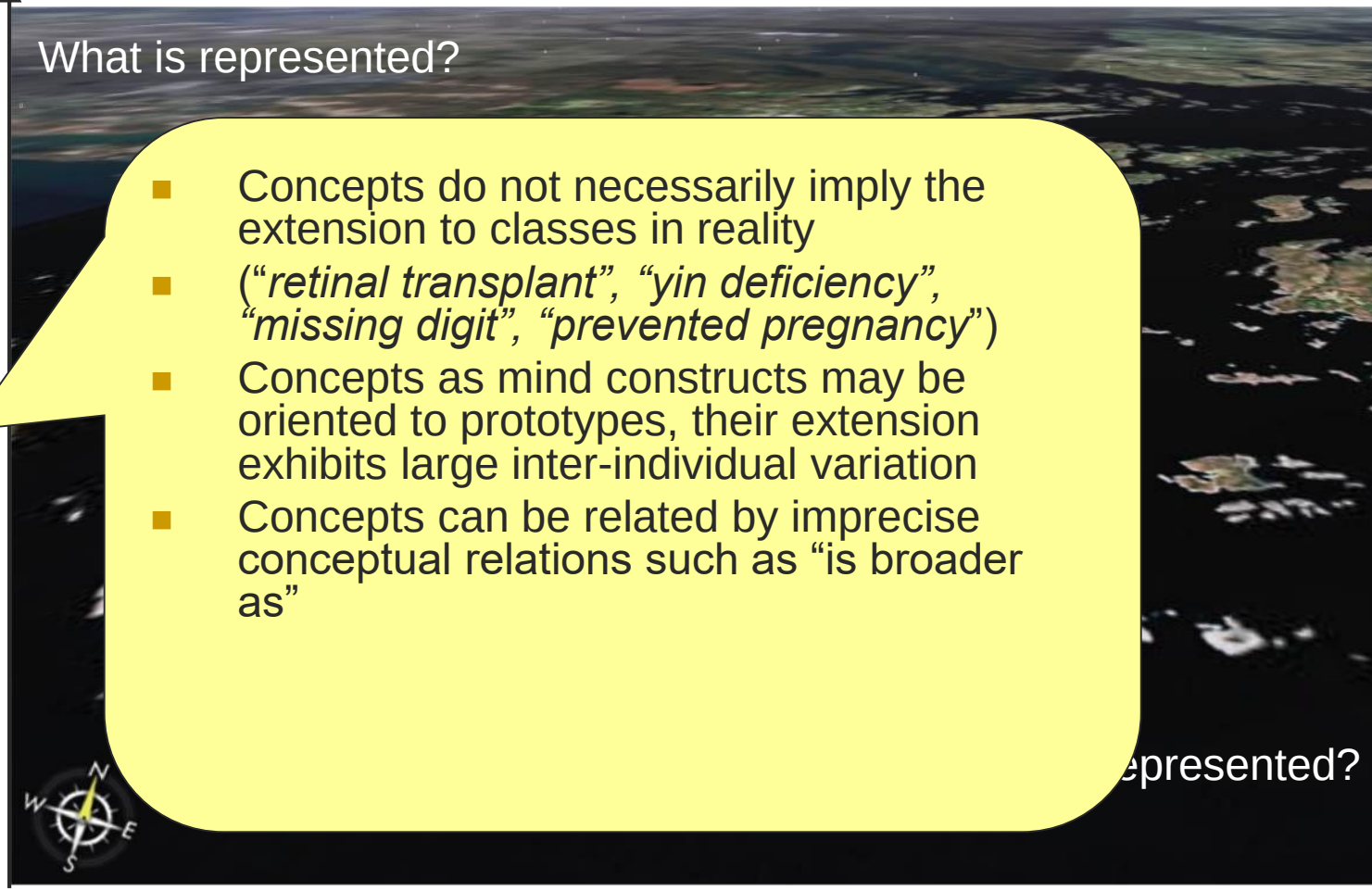

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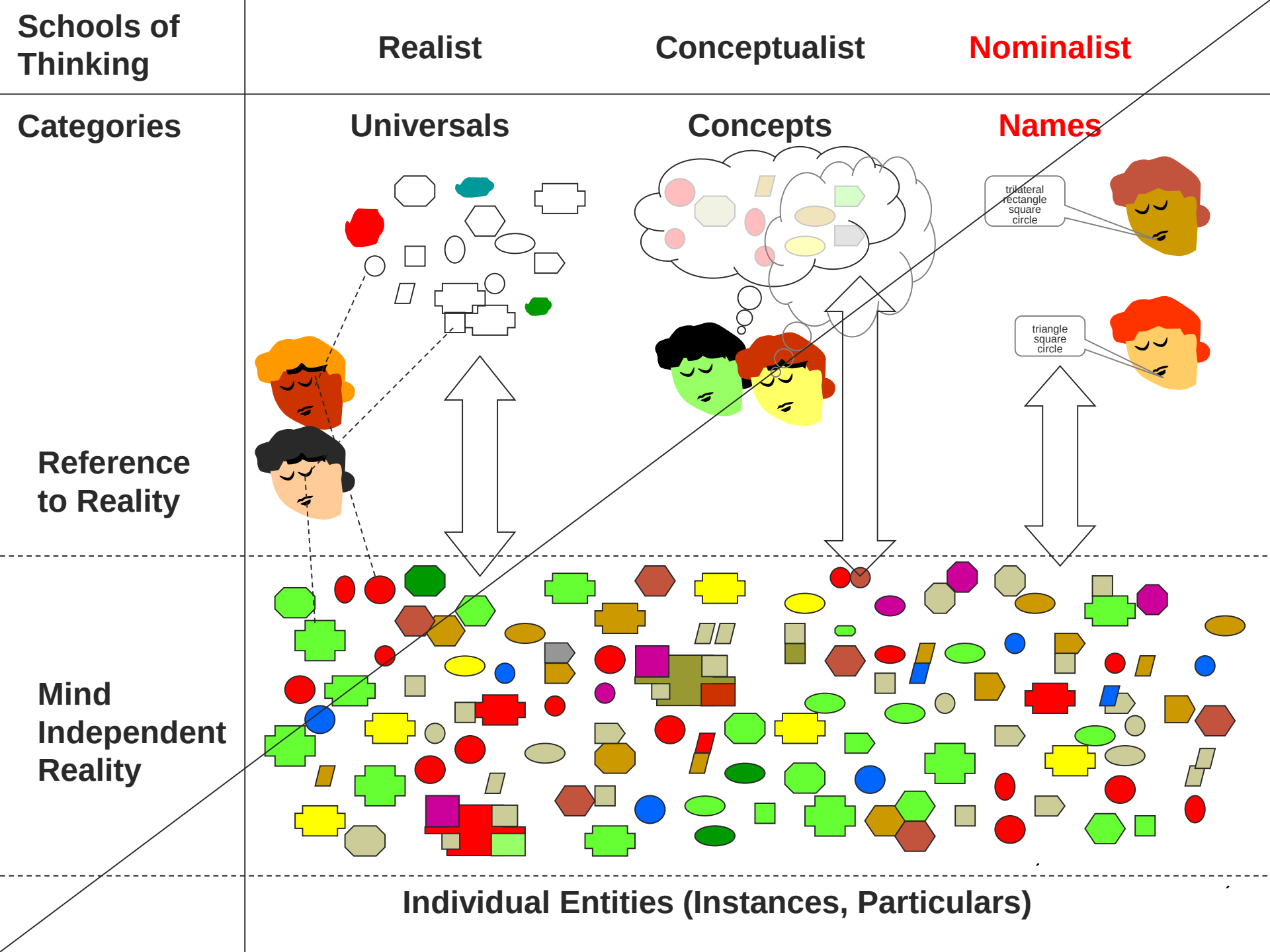
Schools of Thinking
Realist
Conceptualist
Nominalist
Categories
Universals
Concepts
Names
trilateral
rectangle
square
circle
triangle
square
circle
Reference to Reality
Mind Independent Reality
Individual Entities (Instances, Particulars)

Mapping the space of Ontology Nominalist perspective

Representation of arbitrary propositions

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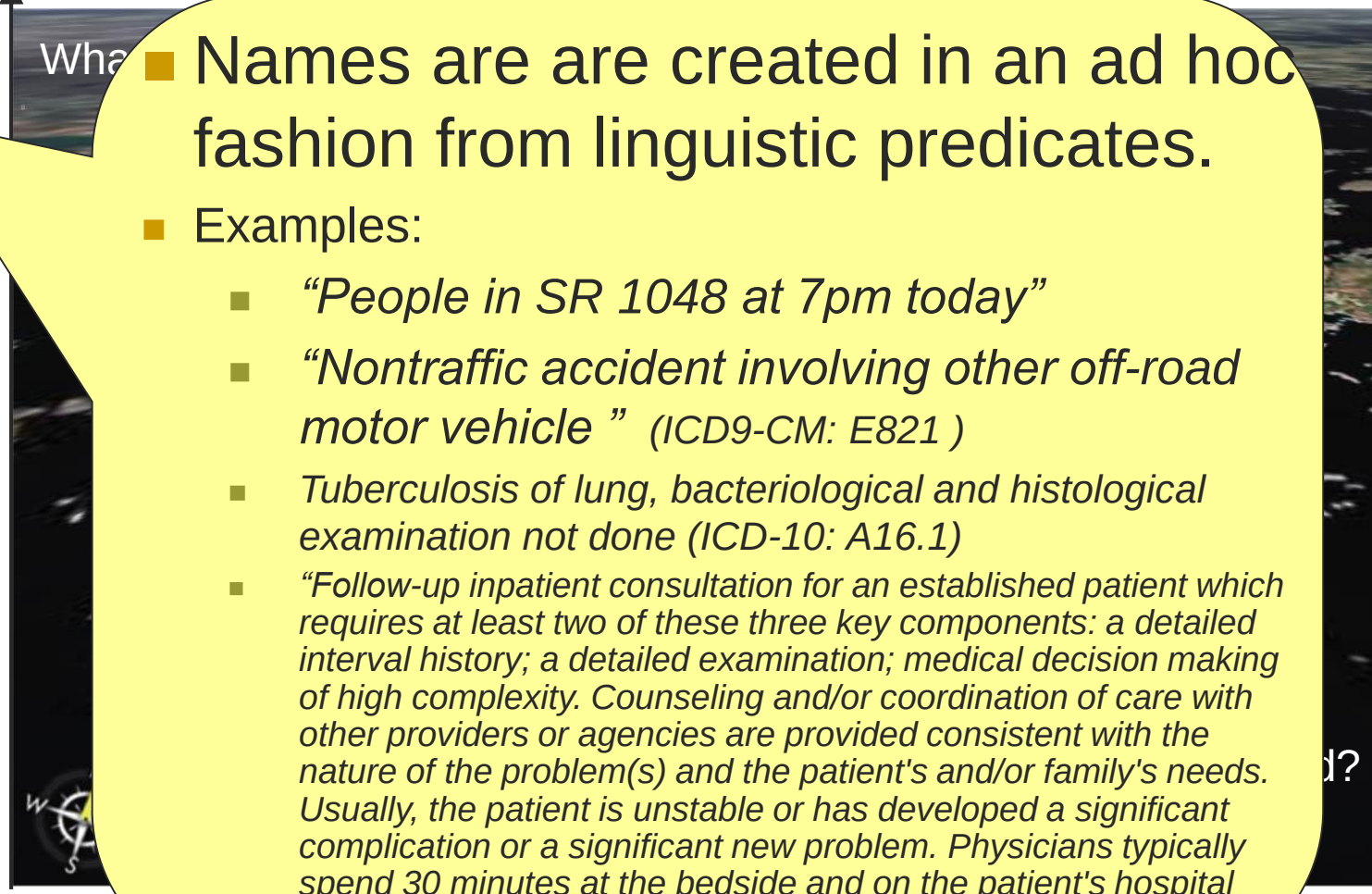

- Names are are created in an ad hoc fashion from linguistic predicates.
- Examples:
  - *"People in SR 1048 at 7pm today"*
  - *"Nontraffic accident involving other off-road motor vehicle "* *(ICD9-CM: E821)*
  - *Tuberculosis of lung, bacteriological and histological examination not done (ICD-10: A16.1)*
  - *"Follow-up inpatient consultation for an established patient which requires at least two of these three key components: a detailed interval history; a detailed examination; medical decision making of high complexity. Counseling and/or coordination of care with other providers or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the patient is unstable or has developed a significant complication or a significant new problem. Physicians typically spend 30 minutes at the bedside and on the patient's hospital floor or unit."*
    (Current Procedural Terminology Code: HCPT06)

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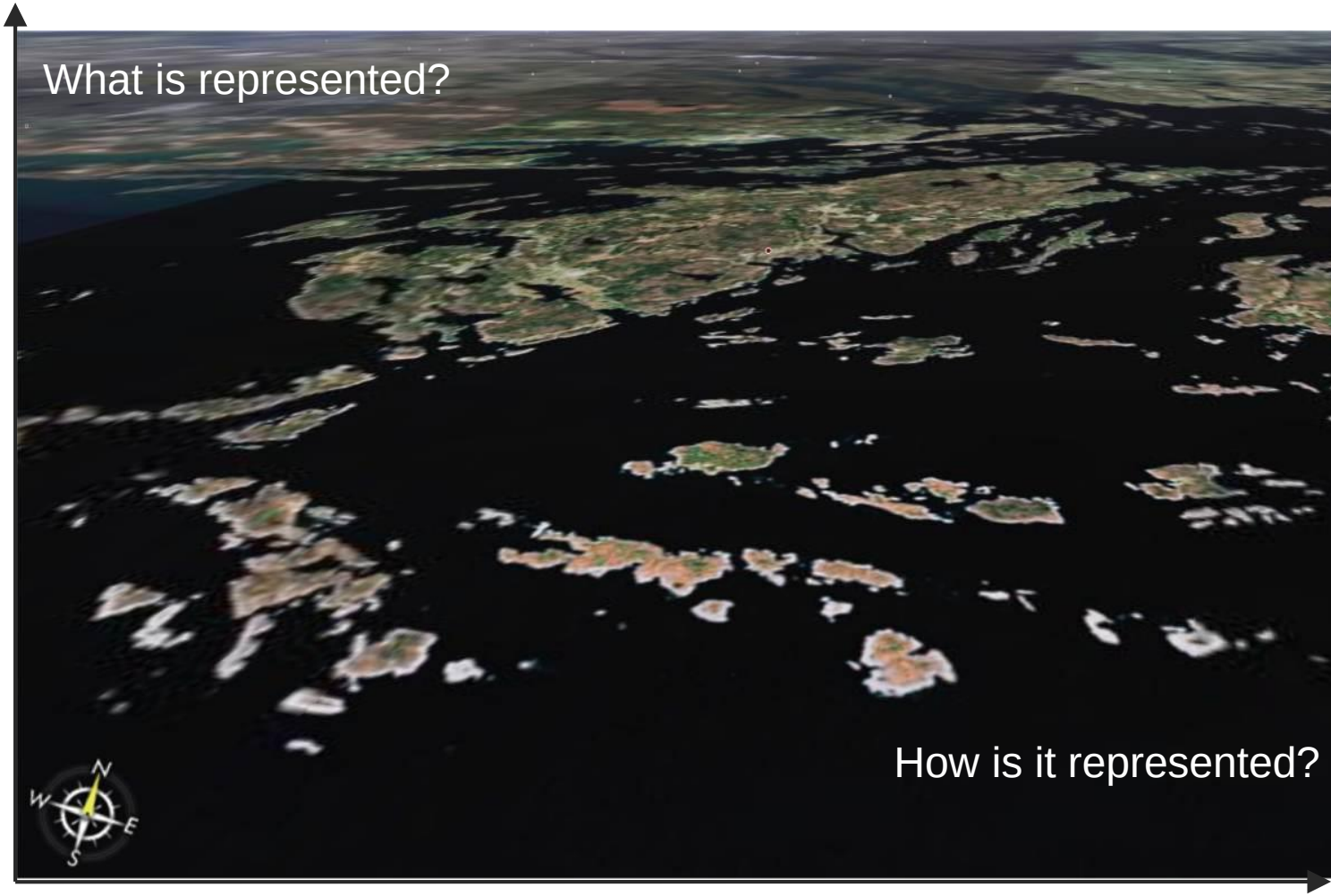

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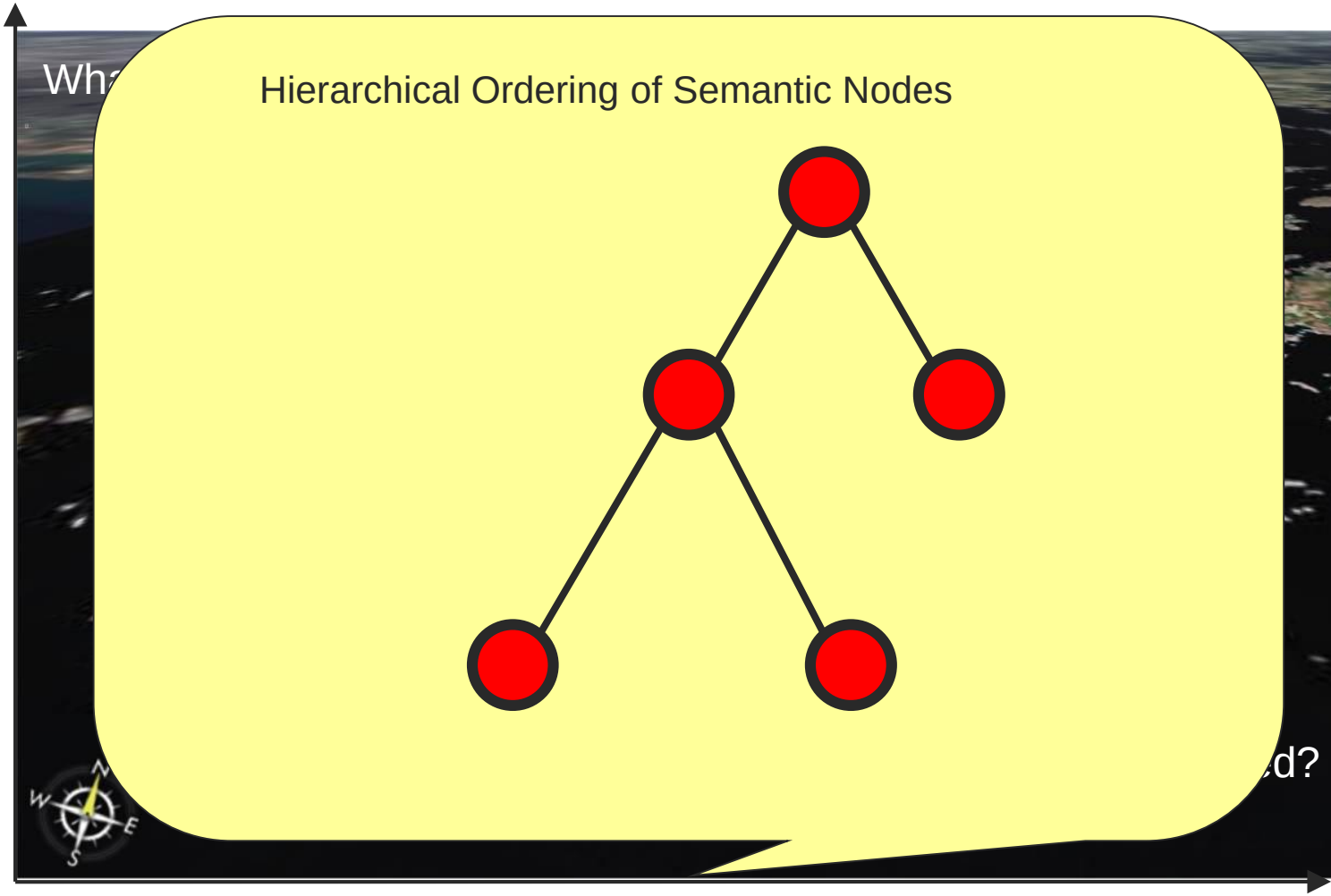

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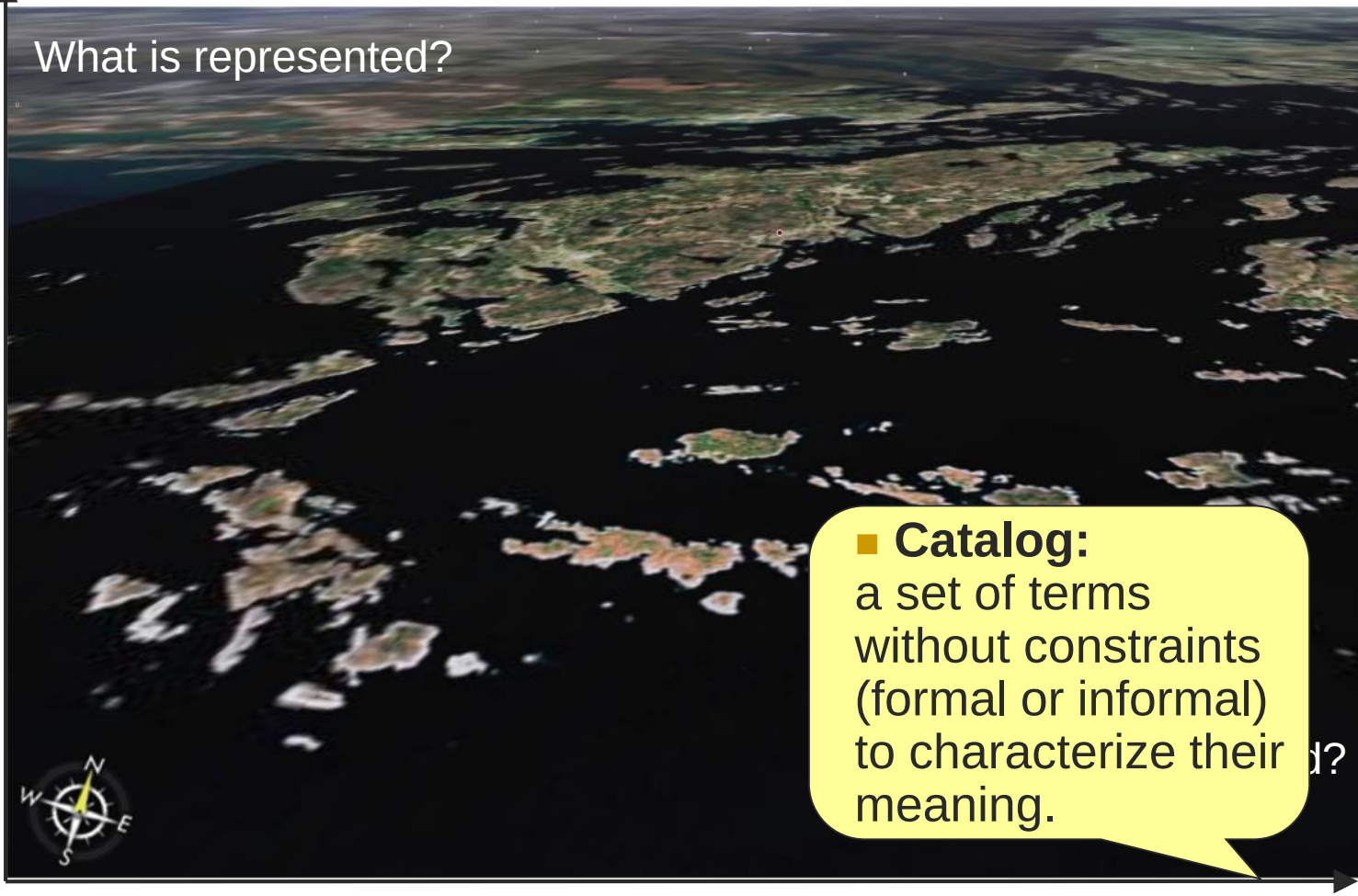

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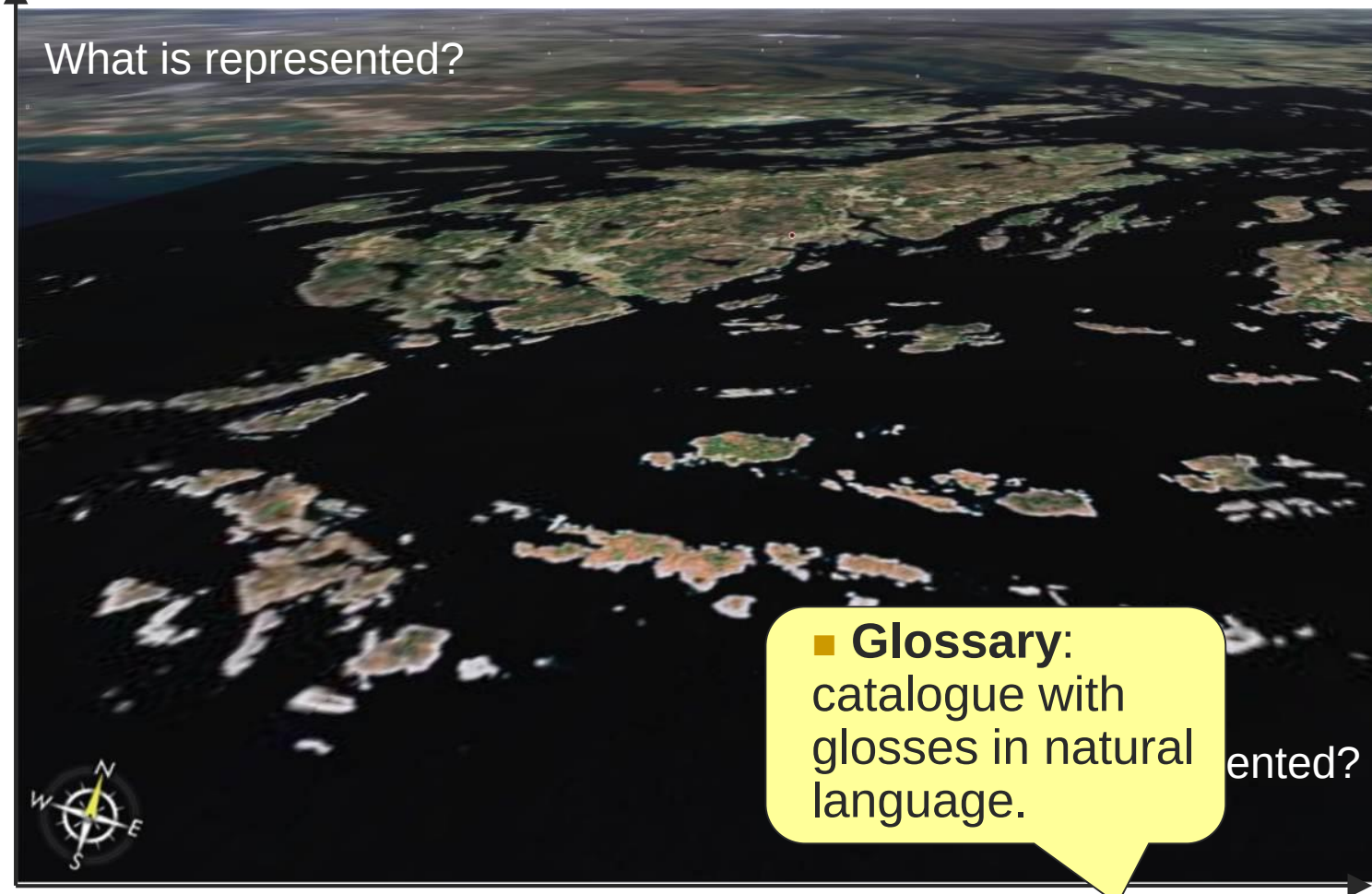

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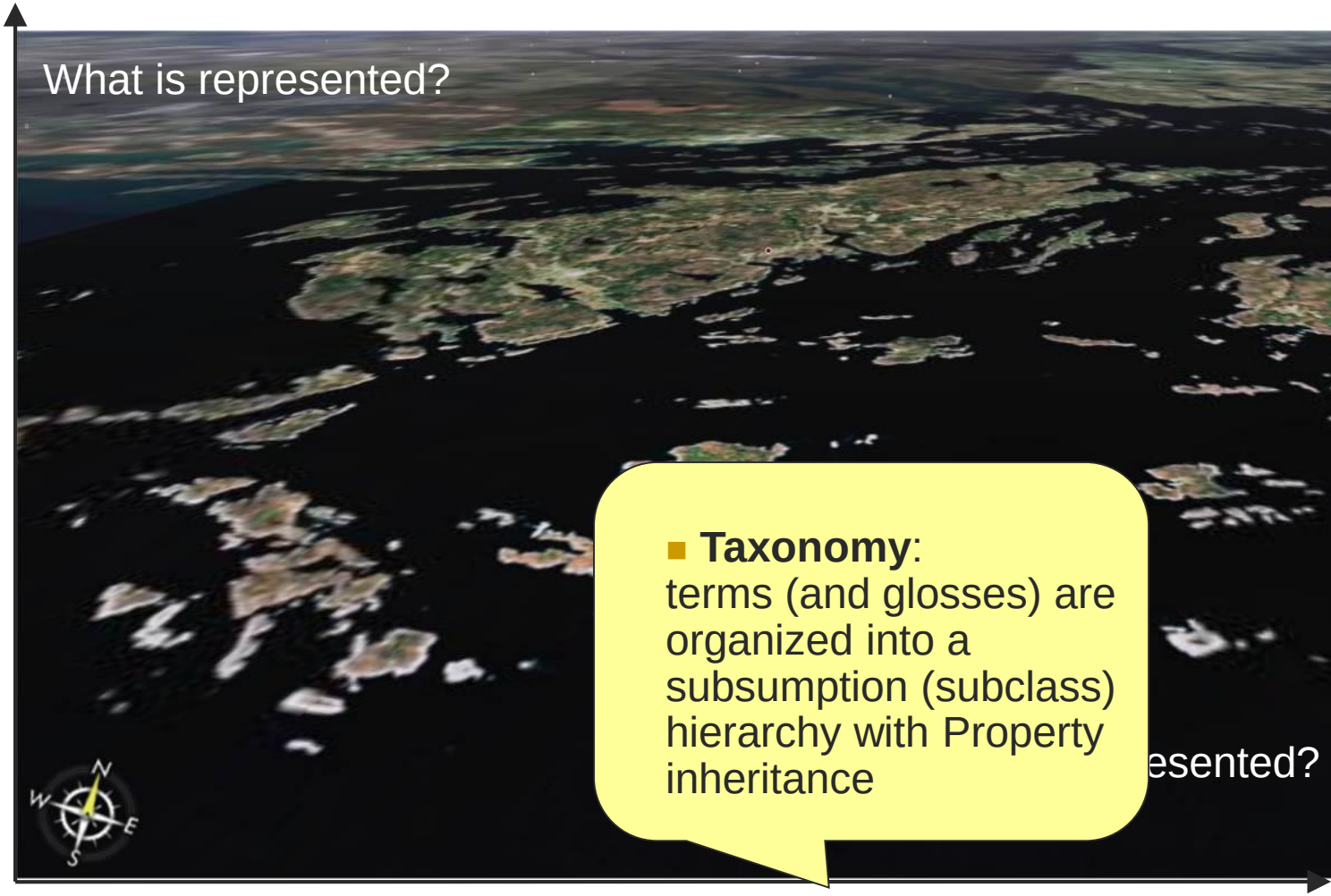
Mapping the space of Ontology Taxonomy



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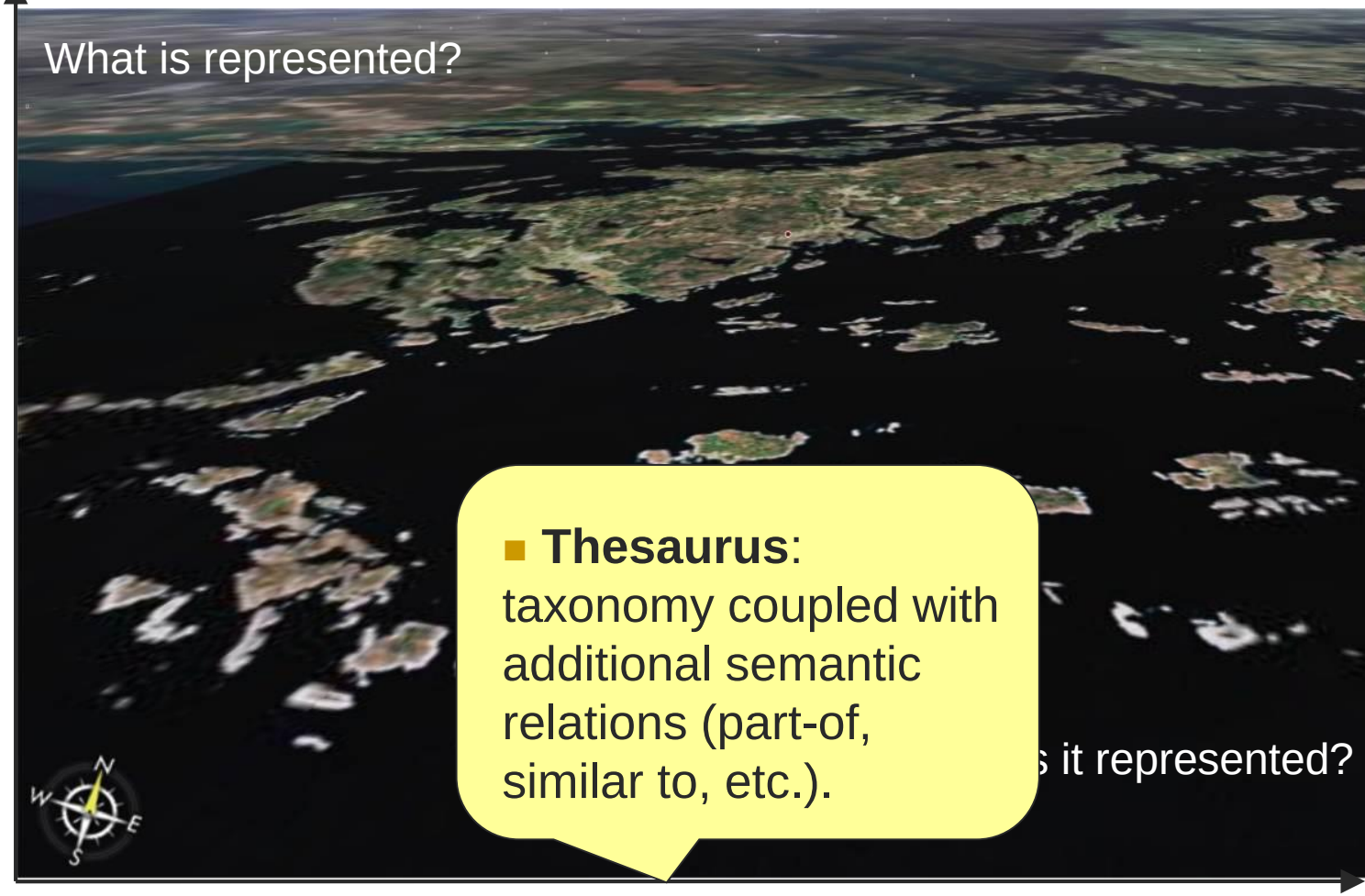

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Mapping the space of Ontology Conceptual Schemas

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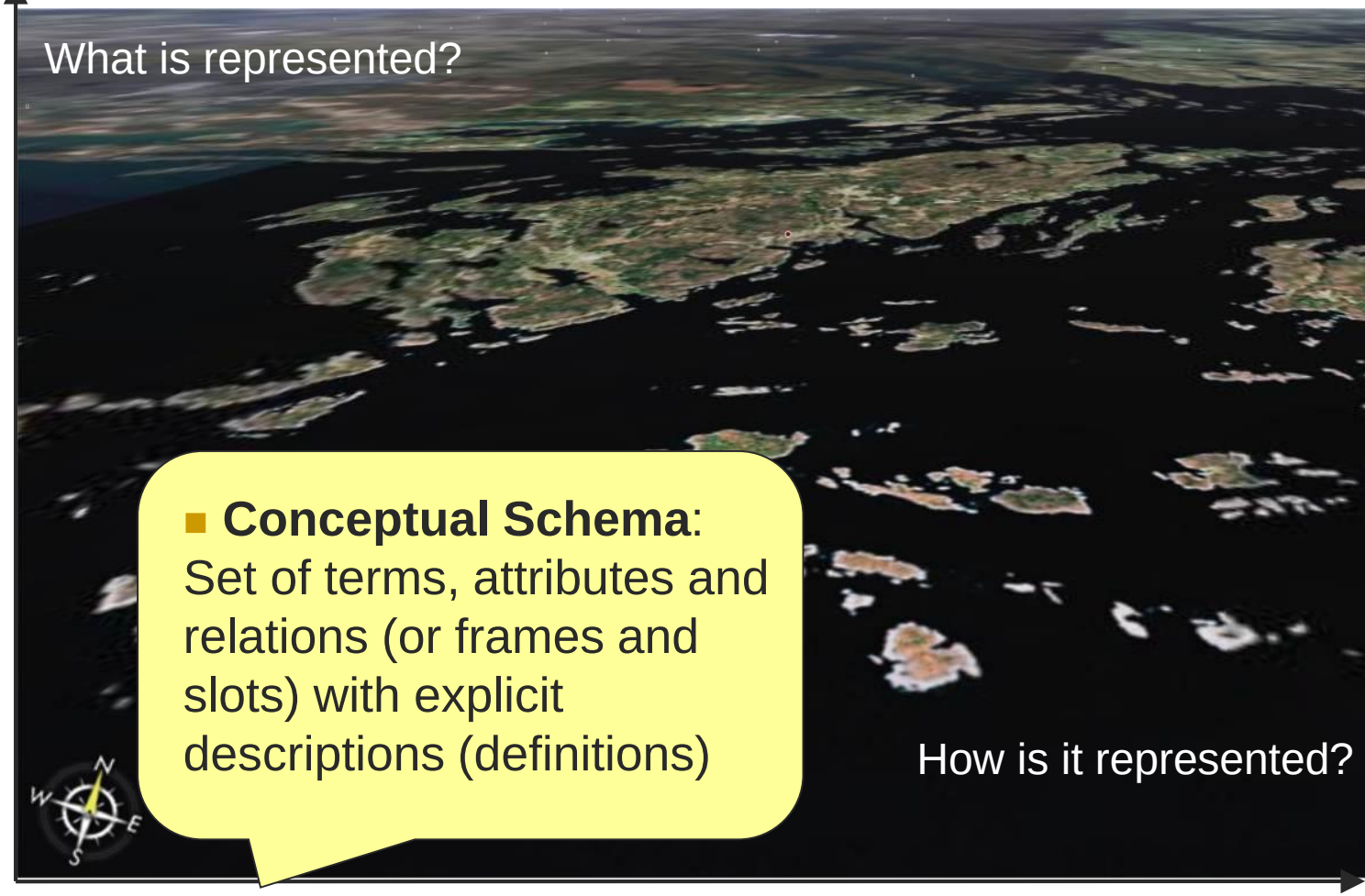

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Mapping the space of Ontology Axiomatic Theories

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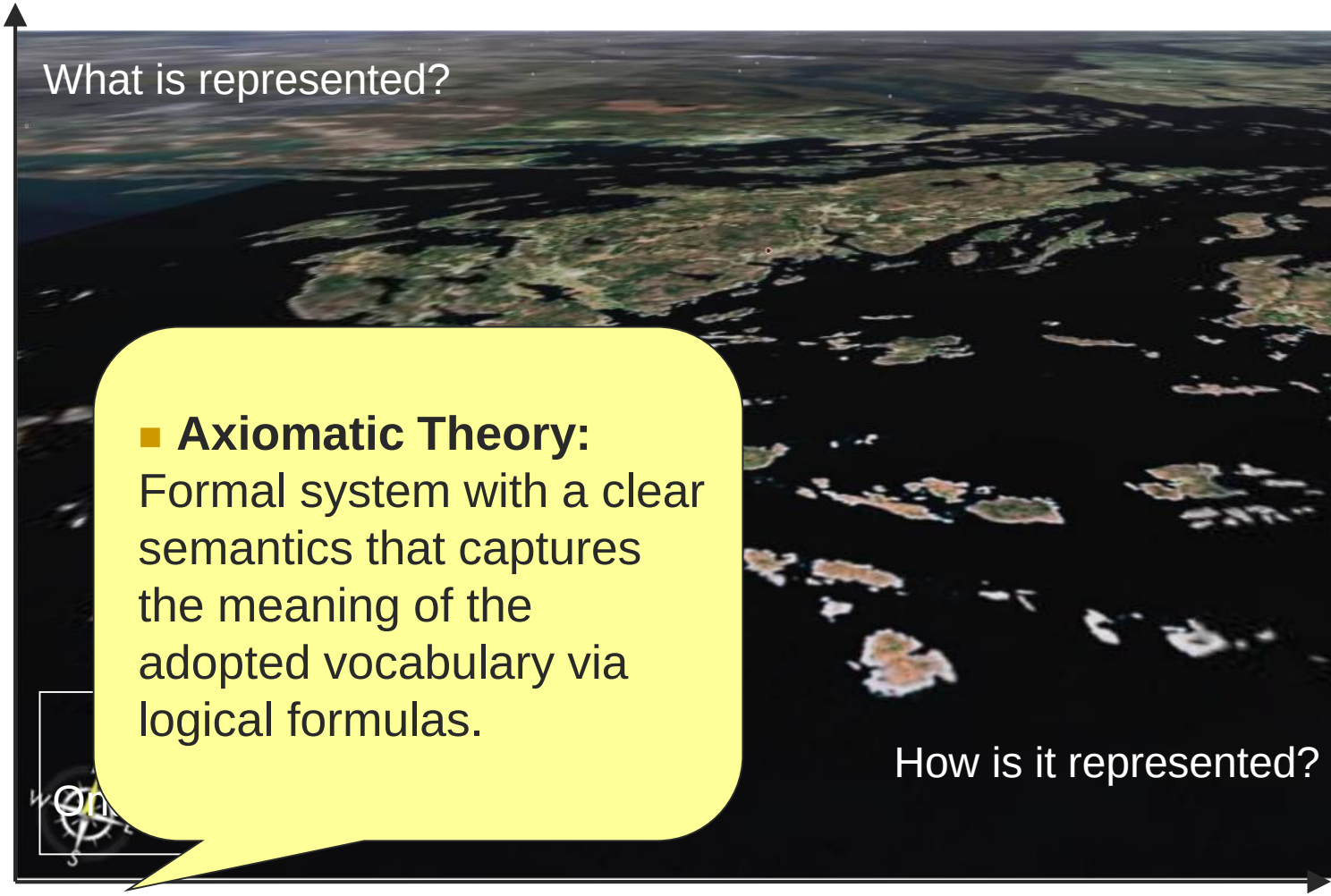

- **Axiomatic Theory:** Formal system with a clear semantics that captures the meaning of the adopted vocabulary via logical formulas.

Gunnar Klein & Barry Smith: ontology.buffalo.edu/concepts/ConceptsandOntologies

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Mapping the space of Ontology: Notions of Ontology

Representation of arbitrary propositions

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Axiomatic Theory | Conceptual Schema | Thesaurus | Taxonomy | Glossary | Catalog

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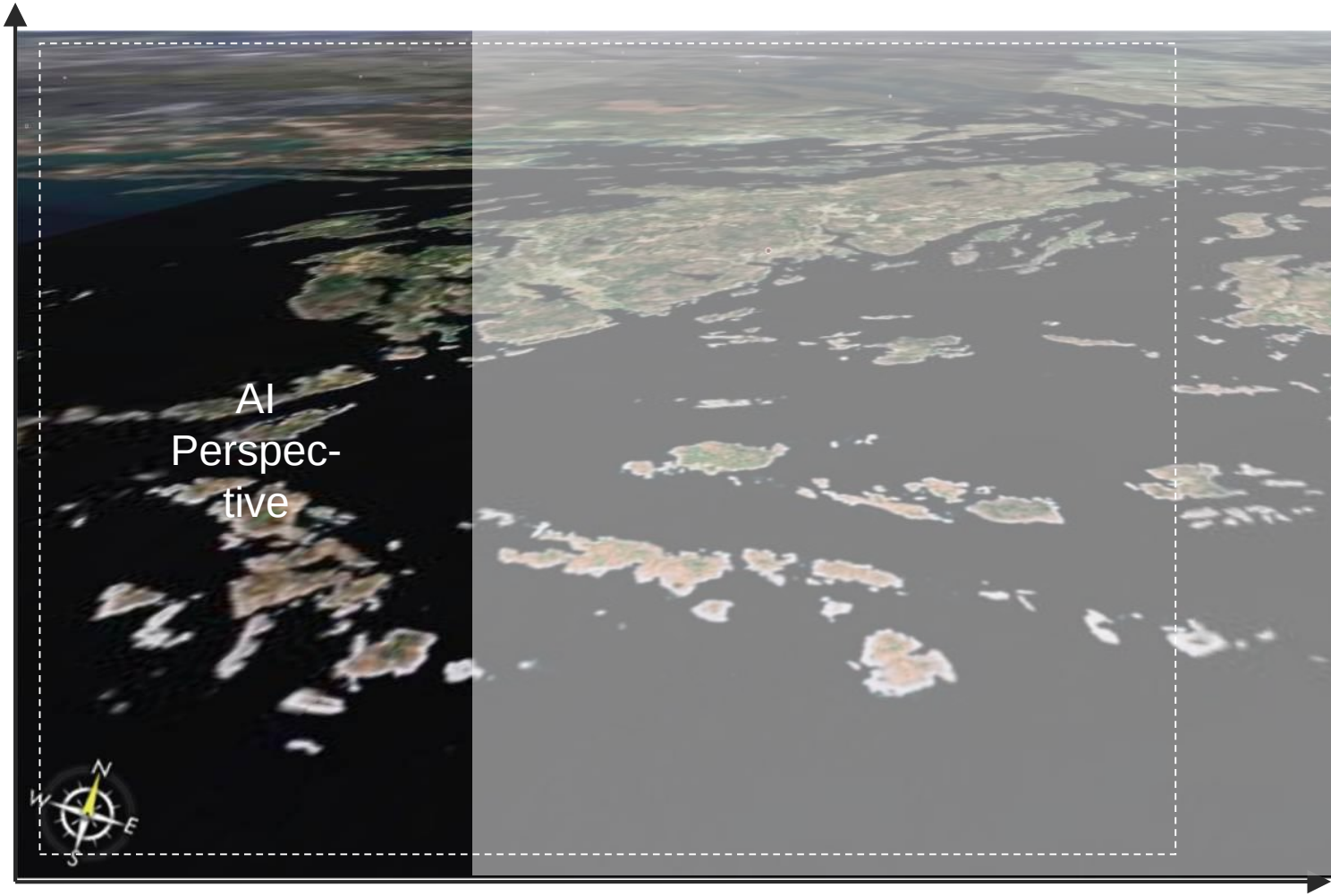

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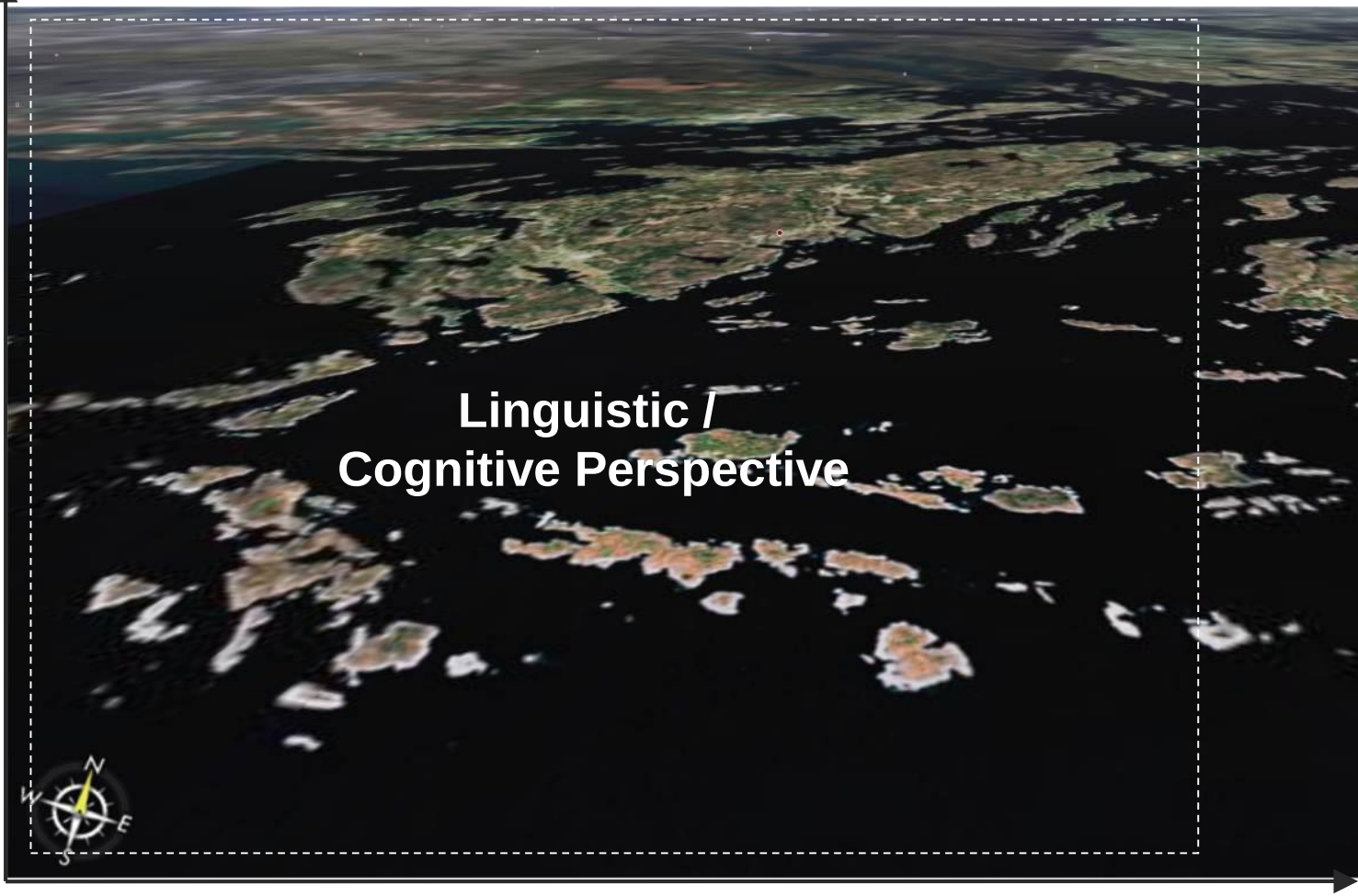

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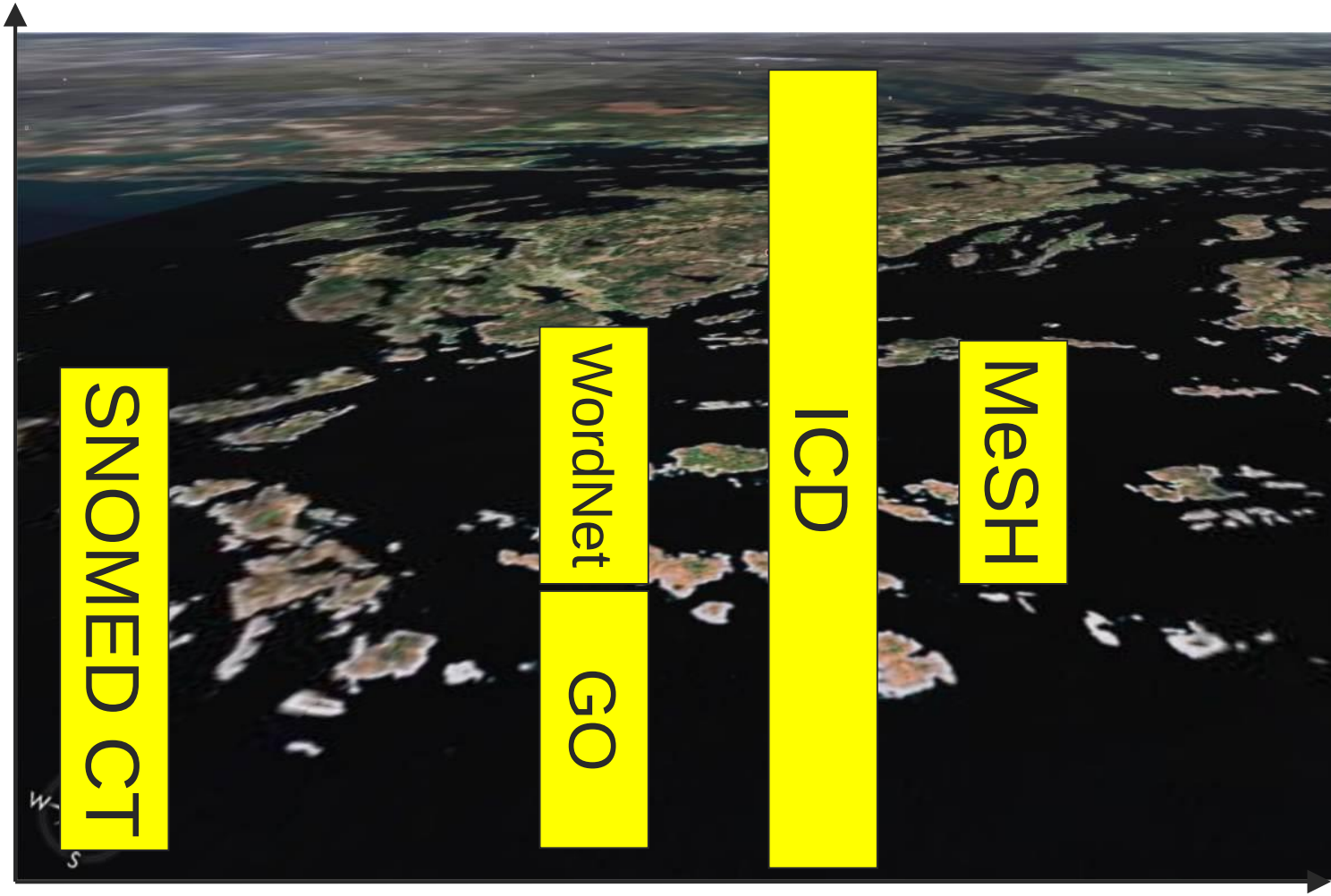
Mapping the space of Ontology: Biomedical Vocabularies



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Don't mix up universals (Concepts, Classes) with individuals (Instances)

- *subclass-of (Motor Neuron, Neuron)* (FMA, OpenGALEN)
- *is-a (Motor Neuron, Neuron)*
- *instance-of (Motor Neuron, Neuron)* (FlyBase)

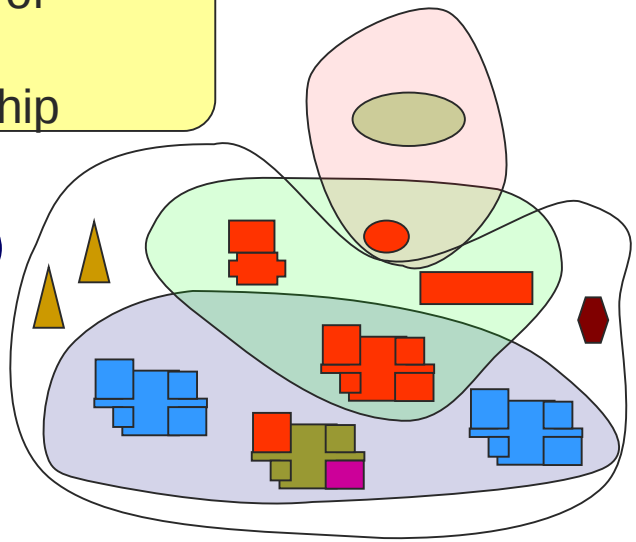
is-a = subclass-of:

Taxonomic Subsumption

instance-of Class Membership

But:

- *instance-of (my Hand, Hand)*
- *instance-of (this amount of insulin, Insulin)*
- *instance-of (Germany, Country)*
- not: *instance of (Heart, Organ)*
- not: *instance of (Insulin, Protein)*



Don’t use superclasses to express roles

- *is-a (Fish, Animal)*
- *is-a (Fish, Food)* ??

- *is-a (Acetylsalicylic Acid, Salicylate)*
- *is-a (Acetylsalicylic Acid, Analgetic Drug)* ??

Be aware of the “rigidity” of classes

Partition the ontology by principled upper level categories

Example: DOLCE's Upper Ontology

Endurant (Continuant)
- *Physical*
  - Amount of matter
  - Physical object
  - Feature
- *Non-Physical*
  - Mental object
  - Social object
- …

Perdurant (Occurrent)
- *Static*
  - State
  - Process
- *Dynamic*
  - Achievement
  - Accomplishment

Quality
- *Physical Qualities*
  - Spatial location
  - …
- *Temporal Qualities*
  - Temporal location
  - …
- *Abstract Qualities*
  - …

Abstract
- *Quality region*
  - Time region
  - Space region
  - Color region

Source: S. Borgo ISTC-CNR

Be aware of ambiguities

- "Institution" (NCIT) may refer to
  1. (abstract) institutional rules
  2. (concrete) things instituted
  3. act of instituting sth.
- "Tumor"
  1. evolution of a tumor as a disease process
  2. having a tumor as a pathological state
  3. tumor as a physical object
- "Gene"
  1. a (physical) sequence of nucleotides on a DNA chain
  2. a collection of (1)
  3. A piece of information conveyed by (1)

Use semantically precise Basic Relations

First version of the OBO Relation Ontology

Foundational relations

is_a

part_of

Spatial relations (connecting one entity to another in terms of relations between the spatial regions they occupy)

located_in

contained_in

adjacent_to

Temporal relations (connecting entities existing at different times)

transformation_of

derives_from

preceded_by

Participation relations (connecting processes to their bearers)

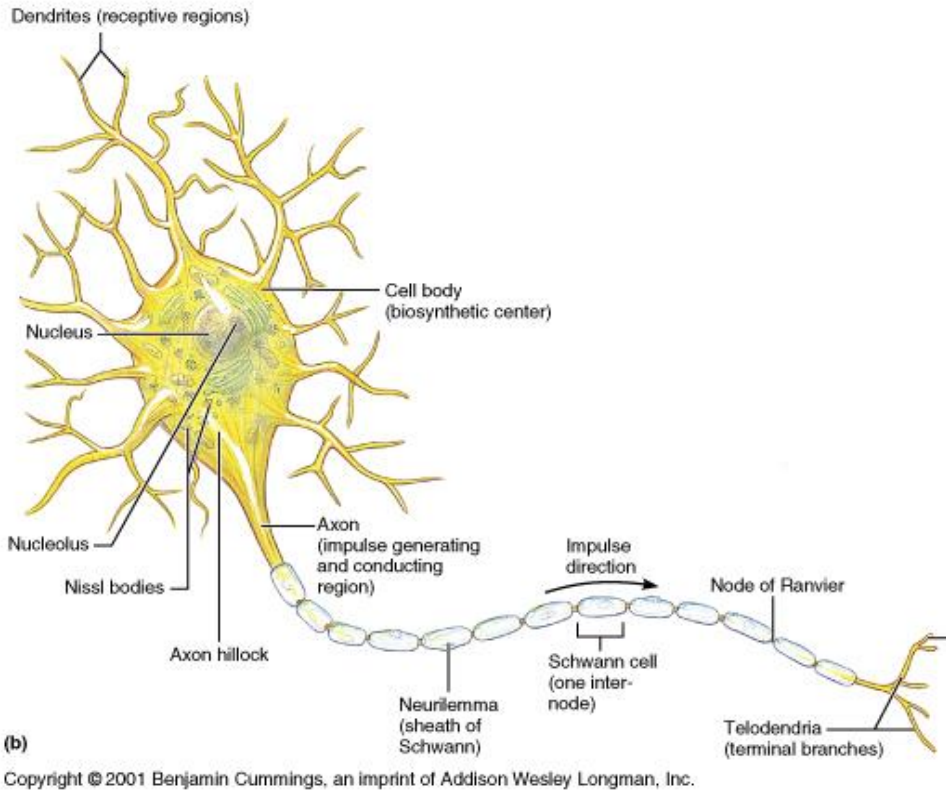
has_participant

has_agent

Barry Smith, Werner Ceusters, Bert Klagges, Jacob Köhler, Anand Kumar, Jane Lomax, Chris Mungall, Fabian Neuhaus, Alan L Rector and Cornelius Rosse. Relations in biomedical ontologies. *Genome Biology*, 6(5), 2005.

Nontaxonomic Relations between Classes are ambiguous !

- *has-part(Cell, Axon)* (Gene Ontology)
  - Do cells without axons exist ?
  - Do axons without cells exist ?
- *has-part(Neuron, Axon)* (FMA)
  - Does every neuron has an axon?



Nontaxonomic Relations between Classes are ambiguous !

A, B are classes, $inst\text{-}of$ = class membership

rel: relation between instances Rel: relation between classes

$$Rel\ (A, B) =_{def}$$

$$\exists x: inst\text{-}of\ (x, A) \wedge inst\text{-}of\ (y, B) \wedge rel\ (x, y) \quad \textbf{OR}$$

$$\forall\, x: inst\text{-}of(x, A) \rightarrow \exists\, y: inst\text{-}of\ (y, B) \wedge rel\ (x, y) \quad \textbf{OR}$$

$$\forall\, x: inst\text{-}of(x, A) \rightarrow \exists\, y: inst\text{-}of\ (y, B) \wedge rel\ (x, y) \quad \textbf{AND}$$

$$\forall\, y: inst\text{-}of(y, B) \rightarrow \exists\, x: inst\text{-}of\ (x, A) \wedge rel\ (x, y)$$

Nontaxonomic Relations between Classes are ambiguous !

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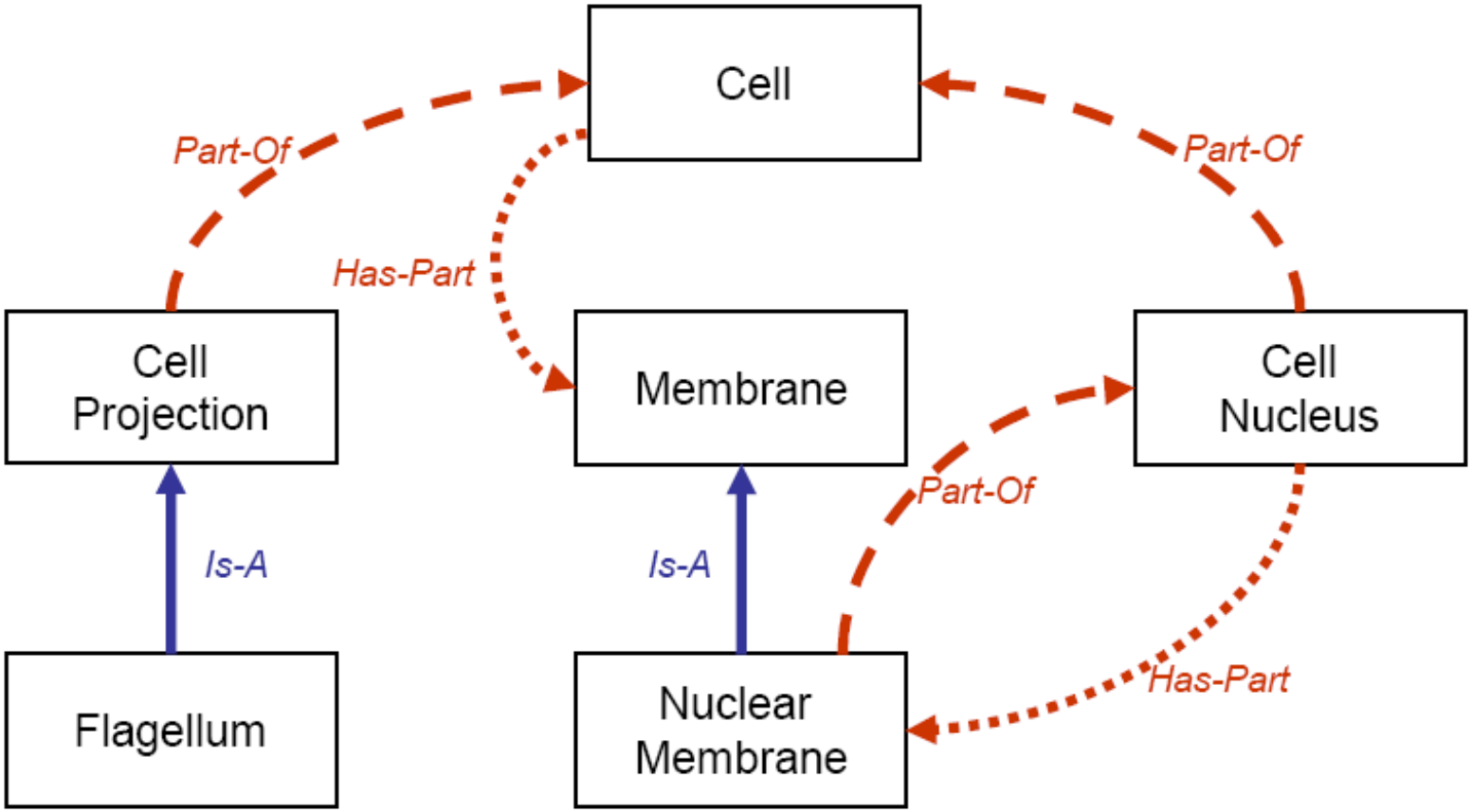
$$\forall y: inst\text{-}of(y, B) \rightarrow \exists x: inst\text{-}of\ (x, A) \wedge rel\ (x, y)$$

Example: Part-of and Has-Part between Classes



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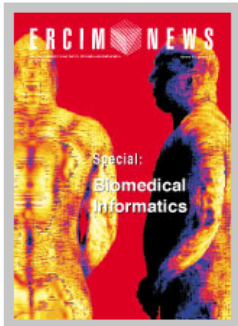

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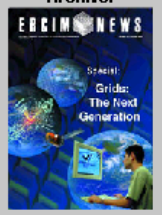

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SemanticMining - A Network of Excellence in the Field of Biomedical Informatics

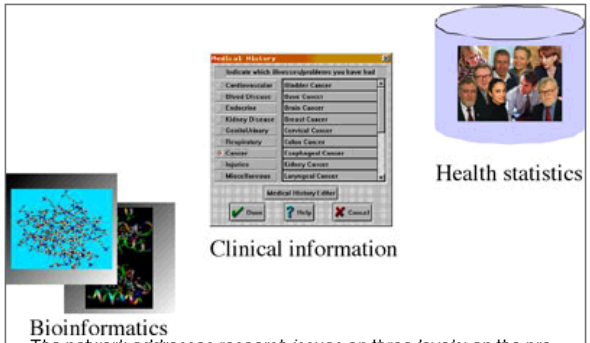
by Hans Åhlfeldt

The objective of the Network of Excellence entitled Semantic Interoperability and Data Mining in Biomedicine [SemanticMning] funded by the European Sixth Framework Programme, is to establish Europe as the international scientific leader in medical and biomedical informatics.

The long-term goal of the network will be the development of generic methods and tools supporting the critical tasks of the field; data mining, knowledge discovery, knowledge representation, abstraction and indexing of information, semantic-based information retrieval in a complex and high-dimensional information space, and knowledge-based adaptive systems for provision of decision support for dissemination of evidence based medicine.

The general objective of a Network of Excellence (NoE) is to bridge gaps in the European research infrastructure and to facilitate cross-fertilisation between scientific disciplines. Traditionally academic departments in the domain have their roots either in computer science, system engineering (including a variety of engineering disciplines) or in a medical or clinical context. The proposed network is composed of partners from these scientific areas, all bringing their experience and in-depths knowledge together into a common framework. An important aspect of this is the merging of medical or clinical informatics and bioinformatics including the new fields of genomics and proteomics.

Another bridging activity addressed by this NoE is knowledge transfer and co-operation between academia and organisations and SMEs in the health and welfare sector, including standardisation bodies and the different public and private institutions involved in health care delivery and management. The national institutes and organisations responsible for policy making and quality management with a regulatory and normative function will have an important role to play in the network. We believe that co-operation between these organisations and those involved in research departments needs to be strengthen, both in the early phase of research programme identification and in the later phases of implementation and large-scale evaluation of results and impact. The bridging activities between different levels of the health care system are exemplified in the figure.



The network addresses research issues on three levels; on the pre-clinical level of bioinformatics (functional genomics, proteomics etc.), on the clinical level of primary and secondary health care (hospital information systems, electronic health records etc.), and on the level of health statistics (population-based statistics, epidemiological surveying etc.). The identified areas of research share the basic problem of semantic interoperability, which means that semantics is preserved in

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aneurIST

Integrated biomedical informatics for the management of cerebral aneurysms

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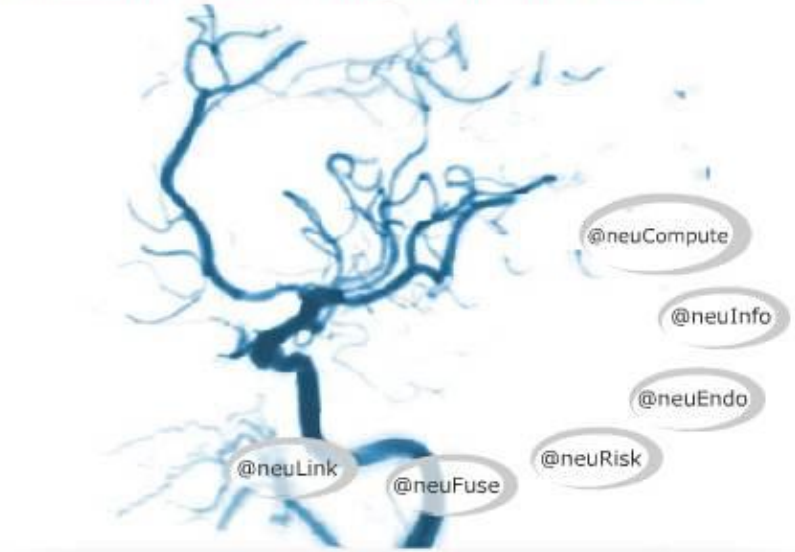
Welcome to @neurIST, a European initiative to integrate biomedical informatics in the management of cerebral aneurysms



LATEST NEWS

- @neurIST website officially launched (July 7, 2006)
- ANSYS officially announced joining european @neurIST project (June 15, 2006) [+]
- An outstanding project: @neurIST, published in Pulsations (June 2006) [+]
- @neurIST Project Board meets in Bonn (May 31, 2006)
- More News [+]

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BOOTStrep (Bootstrapping Of Ontologies and Terminologies STrategic REsearch Project) is funded in the EC´s 6th Framework Programme. The project will pull together already existing biological fact databases as well as various terminological repositories and implement a text analysis system which continuously increases their coverage by analysing biological documents.

Impact

Biological knowledge, up until now, is scattered in heterogeneous database formats and locked in unstructured natural language documents. The intended integration of biological knowledge in a homogeneous conceptual framework will ease access to this fragmented knowledge and substantially increase its usability for R & D purposes, e.g., in the European bio-tech and pharmaceutical industry.

BOOTStrep's main innovations

Knowledge integration and reuse in the biology domain are the main goals of the BOOTStrep project. The resources and text mining tools developed within the project are expected to boost the performance in various bio application tasks. In particular, BOOTStrep aims at:

- exploiting already existing terminological resources (thesauri, classification systems, etc.) and combining them within a common, standardized conceptual representation framework,. Based on this domain-specific background knowledge advanced natural language technologies are employed for the analysis of biological documents in order to fill conceptual gaps in these resources by automatically acquiring new terms, concepts and relations,
- creating, incrementally maintaining and continuously updating a repository of biological facts based on employing a comprehensive bio-lexicon and a standards-based formal bio-ontology for text analysis. Facts are extracted from biological documents in a fully automatic way, they are subsequently filtered and validated for novelty, redundancy, contradiction, etc.,
- developing resources and resource-building NLP tools for text-based knowledge harvesting in order to support information extraction and text mining in the biology domain,
- allowing multilingual public access to continuously updated and validated biological fact repositories.

Administrative details

BOOTStrep (FP6 - 028099) is a Specific Targeted Research Project (STREP) of the European Union's 6th Framework Programme, Thematic Priority 2 (Information Society Technologies) within the fourth call of the programme. It addresses the strategic objective "Semantic-based Knowledge and Content Systems".
The project started on April 1, 2006 and will end on March 31, 2009. The overall budget is 3.6 million euro. Six partners from four European countries (Germany, U.K., Italy, France) and one Asian partner from Singapore are involved in the project.

Thank you for your attention