The CEN ISO Standard Categorial Structure as a Top-Level Set of Constraints for Ontology Disambiguation

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CAST: a tool to disambiguate Terminological systems

- 1 Introduction
- 2 CEN ISO Categorial structures
- 3 Categorial structure for Patient Safety
  - Description
  - CAST ULO comparison
  - Alignment with Upper Level Ontology (ULO)
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- 5 Discussion CAST and ULO to disambiguate healthcare terminologies

CEN EN 1828 Categorial structure for terminological systems of surgical procedures

1. a list of semantic categories

   surgical deed, human anatomy, lesion, device

2. the goal of the terminological system represented by the categorial structure

3. the list of semantic links between semantic categories authorised with their associated semantic categories

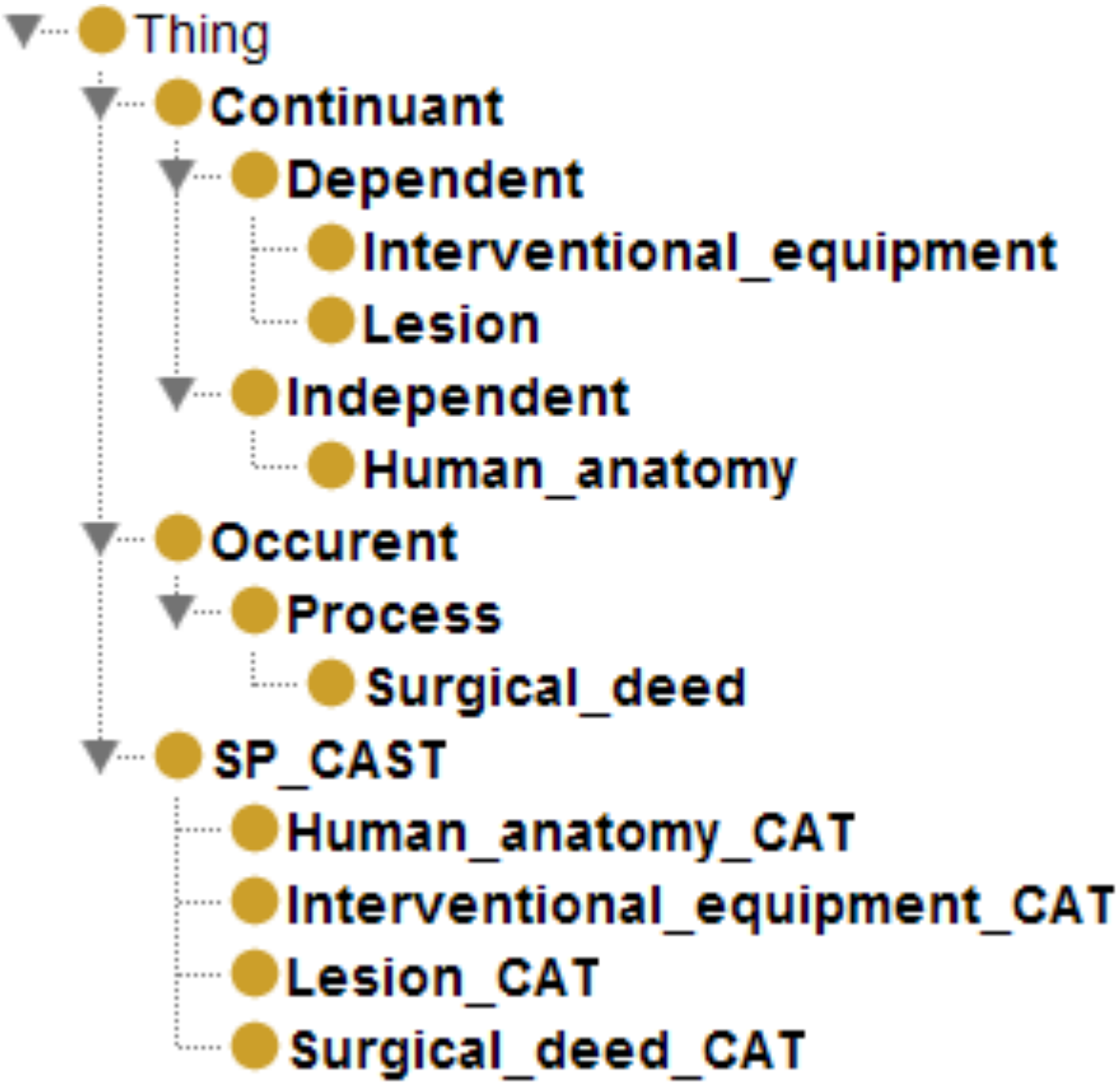
   (ex: hasObject, hasSite, hasMeans, hasSubsurgicaldeed)

4. the minimal constraints

- **Minimal constraints (1)**
- **1** Each surgical procedure terminology phrase shall, as a minimum, denote a **surgical deed** and have the semantic link '**hasObject**'.
- **2** Each surgical procedure terminology phrase shall refer to the **category human anatomy** in relation with the semantic link **'hasObject'** or **'hasSite'**. It can also have both.
- **3** The surgical procedure terminology phrase shall refer to the category **lesion** when the surgical deed is applied to a modified human anatomy structure without mention of the disease cause of the lesion.

- **Minimal constraints (2)**
- **4** Each surgical procedure terminological phrase may need more than one surgical deed. One surgical deed shall be chosen as a main deed and the others as subprocess deeds related to the main deed by the semantic link **hasSubsurgicaldeed'** .
- **5.5** Each surgical procedure sub-process terminological phrase shall as a minimum, include the reference to a **surgical deed**, the semantic link **'hasObject'** (4.4.1) and of the category **human anatomy** in relation with the semantic links **'hasObject'** (4.4.1) or **'hasSite'** (4.4.2)

SURGICAL PROCEDURES CAST



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Patient Safety (PS) history: starting point Conceptual framework

Initial stakeholders

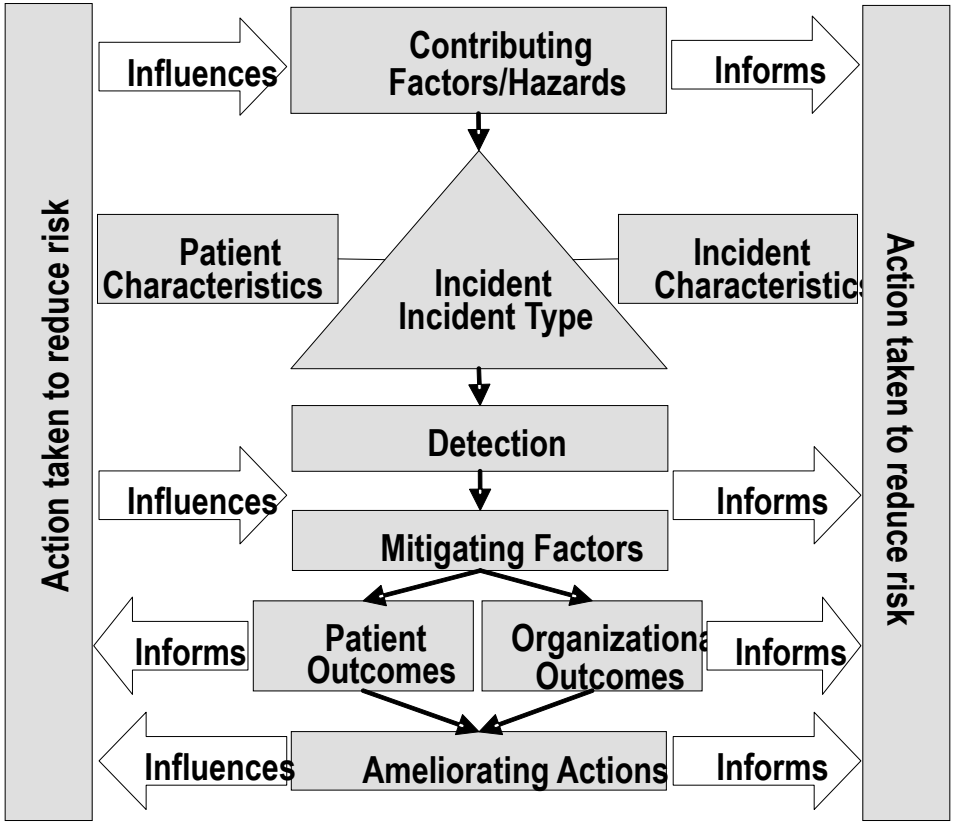
- National Reporting and Learning System (U.K.),
- Advanced Incident Management System (Australia),
- Eindhoven/PRISMA-Medical Classification Model (The Netherlands),
- Patient Safety Event Taxonomy (U.S.).

WHO reports for an International Classification for Patient Safety (ICPS) .

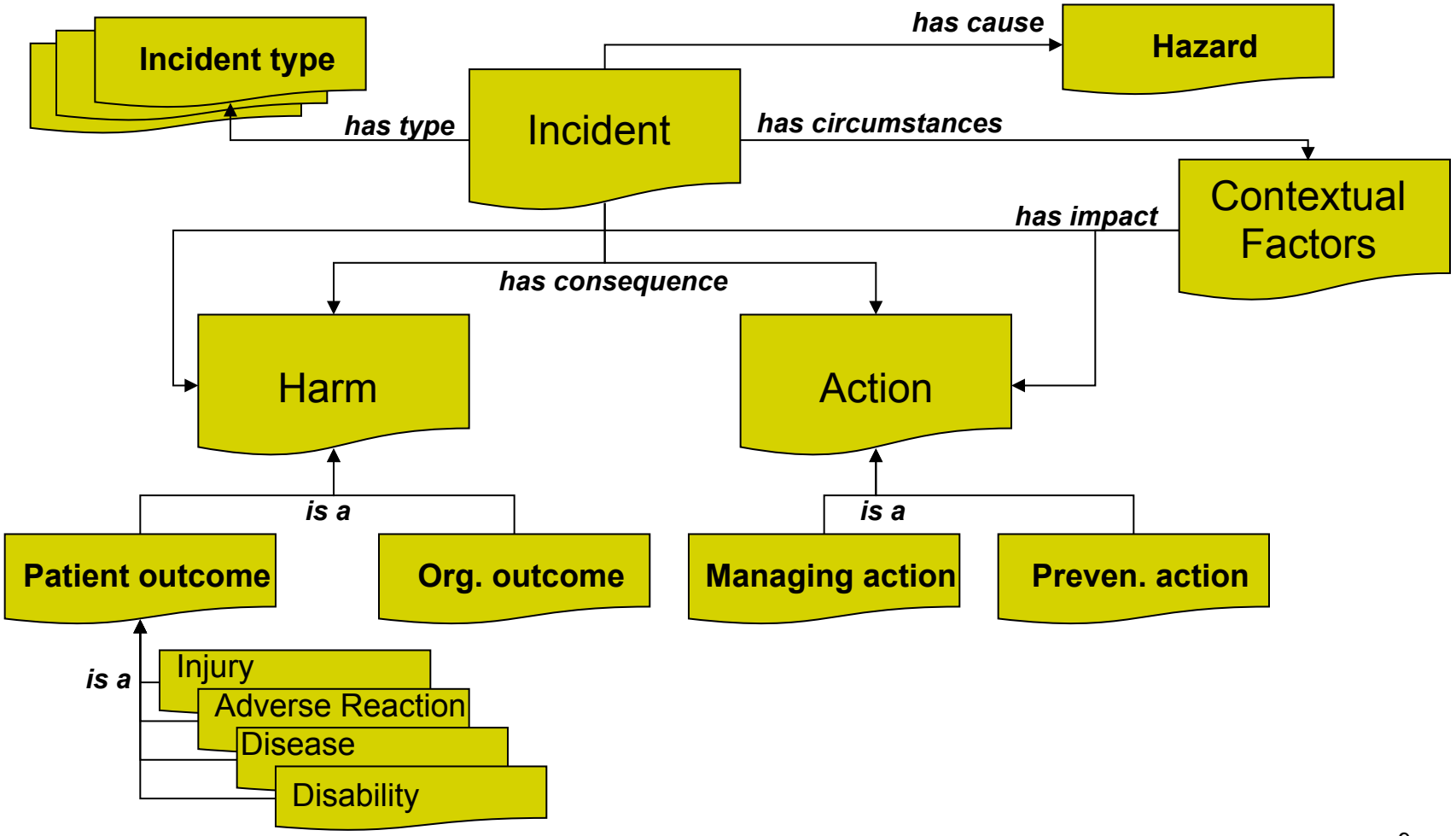
Its development includes:

- a list of terms and 'key concepts'
- two healthcare incident type examples (from APSF)
- a conceptual framework

But this CF "*enjoys a broad domain coverage*" and a "*lack of formal rigor*" (W.C)



Results : a complex domain with vagueness and overlap with other healthcare terminologies



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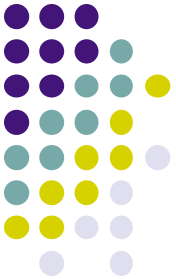

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CAST Upper Level Ontology comparisons

- BFO : holistic top-level ontological framework (Smith, 2011) http://www.ifomis.org/bfo

- BioTop(lite): domain ontology for biomedicine (Beisswanger, 2007), linked to BFO, containing relations and axioms http://purl.org/biotop/

Results: similar and different

- CAST categories: disjoint classes, e.g. *Human Anatomy* and *Deed* subclassOf *Nothing*.
- CAST Semantic links: object properties with domain and range restrictions, **has_means**: OWL object properties
- *Deed* subclassOf **has_object** some *Thing*
- or more complex (4.2):

Deed subclassOf ((**has_object** some *HumanAnatomy*) **or** (**has_site** some *HumanAnatomy*))

Results similar and different

- OWL object properties are exclusively relations between individuals
- the links in the CAST hold between classes.
- “No subclassing without inheritance” principle not systematically followed
- No equivalence with principles of upper level ontologies

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Alignement method (2)

- The mapping was based on the OWL-DL versions of both ontologies. It used taxonomic subsumption ("is-a") `(A subclassOf B)`, and equivalence `(A equivalentTo B)`.
- The mappings were considered complete after a few iterations when we have ensured that no violation of domains and ranges were made.

Results Alignement CAST/ULO (1)

	PS-CAST	BFO (link type)	BioTop (link type)
Classes	Incident	Process (subclass)	Process (subclass)
	Incident_Type	Disposition (subclass)	Disposition (subclass)
	Circumstance	Process OR Independent Continuant (subclass)	Condition (subclass)
	Care_Setting	Site (subclass)	Material Object (subclass)
	Detection	Process (subclass)	Action (subclass)
	Person	Role (equivalent class)	Role (equivalent class)
	Harm	Process (subclass)	Condition (subclass)
	Anatomy	Independant Continuant (subclass)	(StructuredBiologicalEntity OR ImmaterialObject) (subclass)
	…	…	…
Properties	has_Cause	-	causedBy (equivalent relation)
	has_Consequence	-	causes (equivalent relation)
	has_Incident_Type	-	hasRealization (subrelation)
	has_Means	-	processually-RelatedTo (subrelation)
	has_Location	-	hasLocus (equivalent relation)
	…	-	…

Results: Alignment CAST ULO (2)

- PS-CAST classes defined rather by functional than by ontological criteria.
  - *Circumstance* ambiguity mapping "*PSCAST:Circumstance*" mapped to a disjunctive entity "*bfo:Process* or *bfo:IndependentContinuant* or "*bfo: Dependent Continuant Disposition*".or in BioTop, processual, material, dispositional
  - *Incident* and *Incident_Type* The distinction between *Incident* and *Incident_Type* proved difficult. Solution "*Incident_Type*" is a dispositional one, i.e. an *Incident_Type* is a realizable entity which can be realized by a corresponding *Incident*.

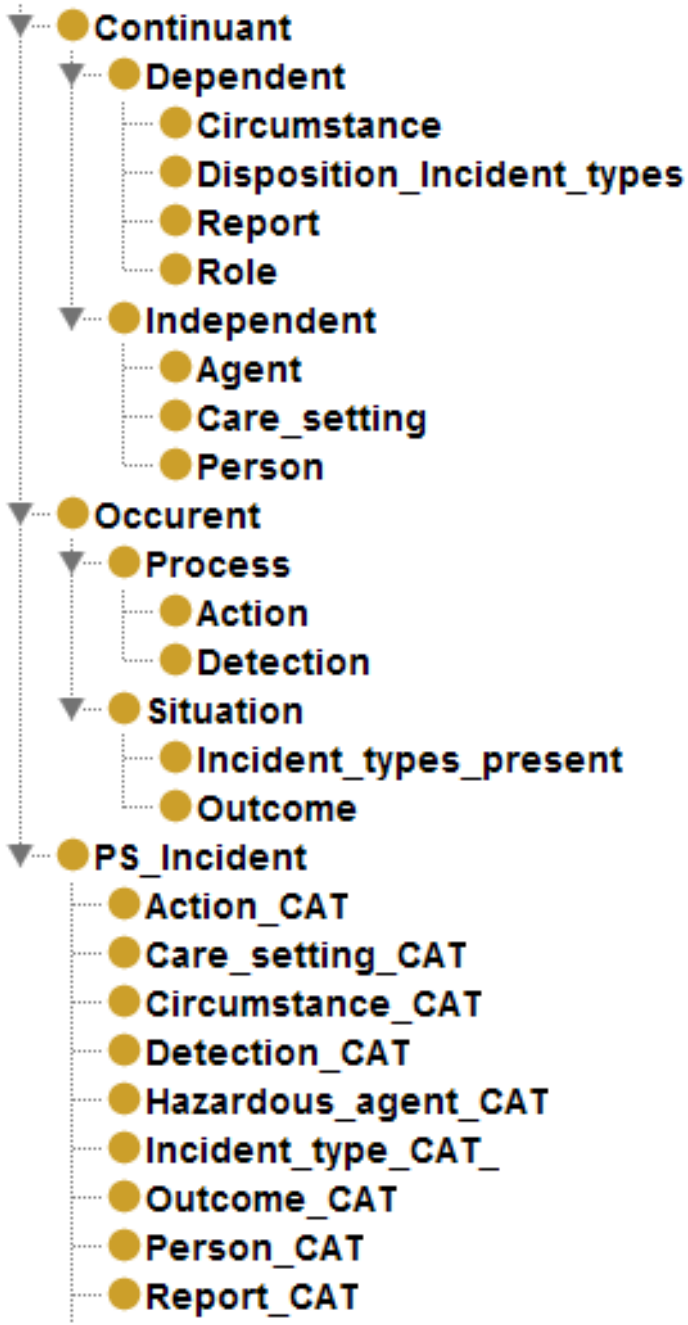
Results: Alignment CAST ULO (3)

- BioTop provides finer alignment of some entities
- BFO was most accurate for domain independent classes
- For relations for BioTop:

  "*PSCAST:***has_means**"

  was mapped only to a high-class level

  "*BioTop:***procesually related to**".



Aligned Upper Level Ontology- Patient Safety CAST

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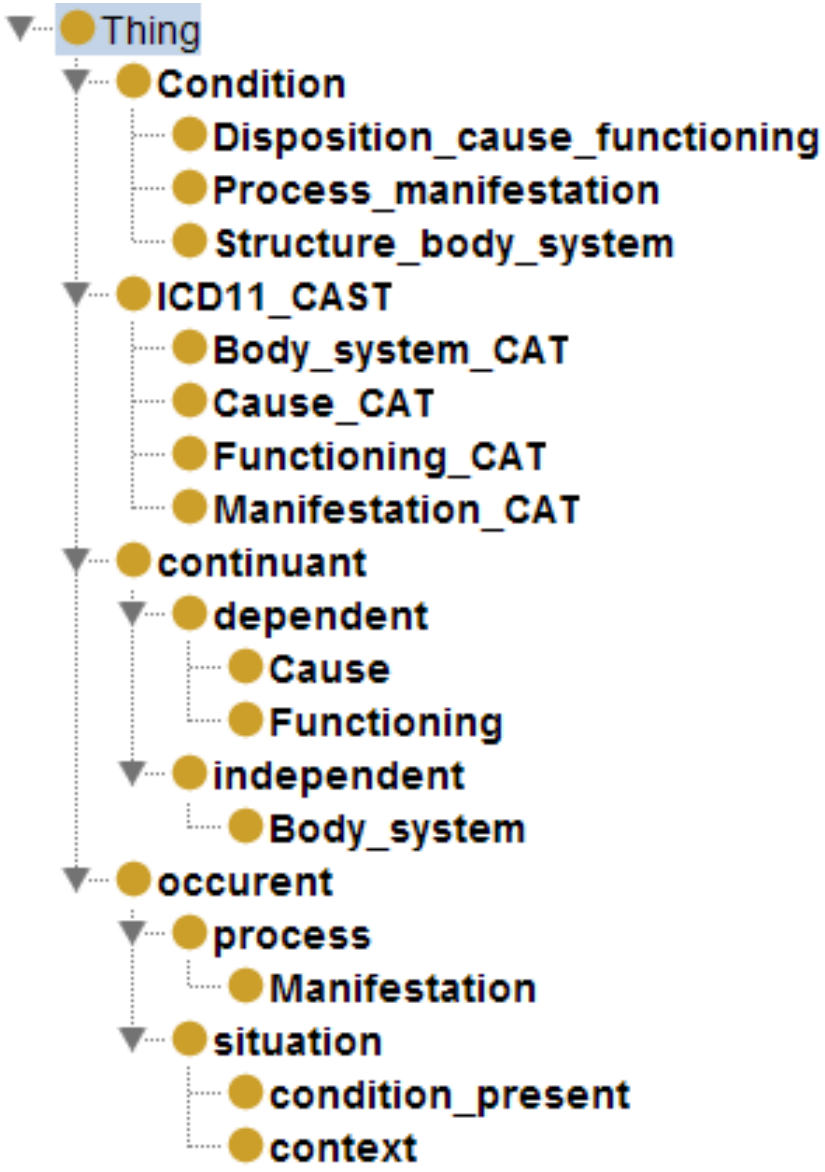
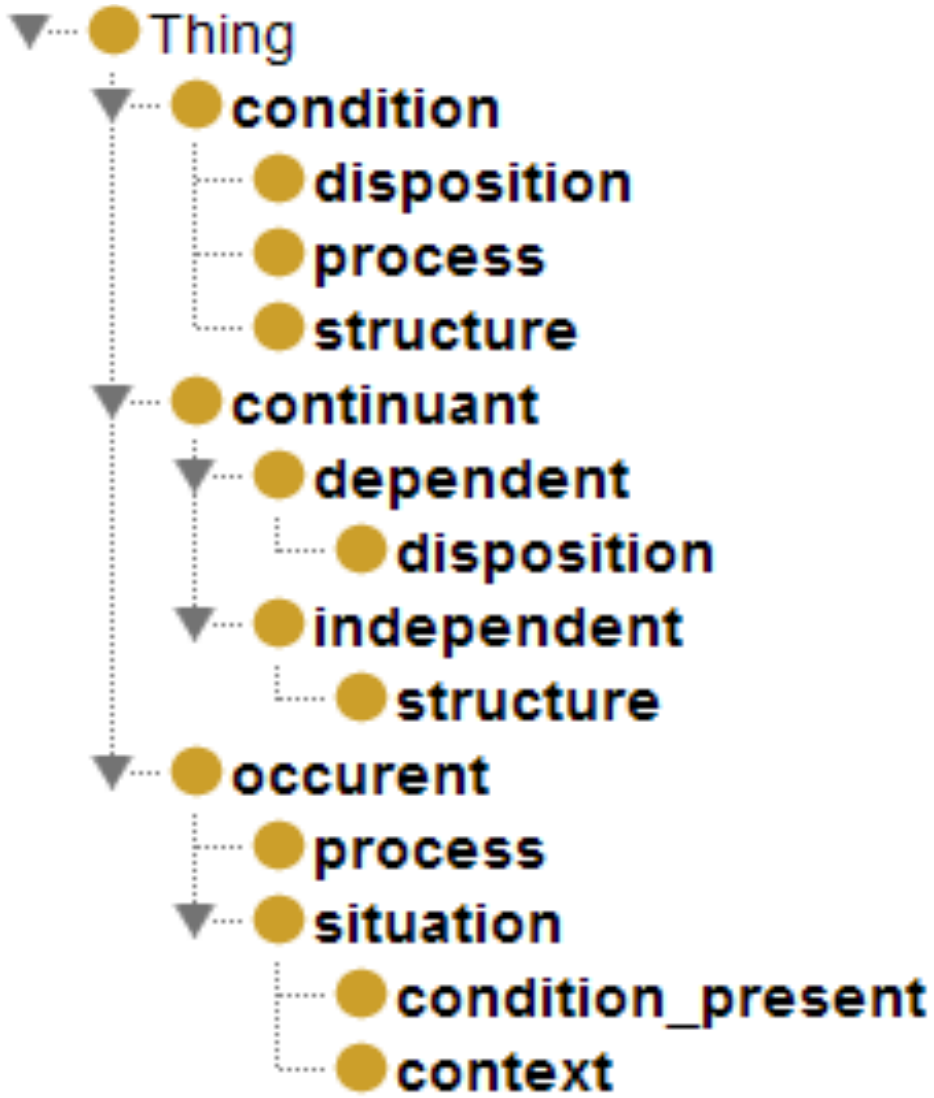
ICD11 revision process and ontology! (2)

- ICD 11 classes are defined by the necessary and sufficient conditions to be part of comparative statistical entities.
- Therefore: ICD11 CAST has to be aligned with ULO in coordination with SNOMED CT work on
  - *Clinical condition* as disjunction classes: *Structure* or *Disposition* or *Process*
  - *Clinical condition* vs. *Clinical situation* interpretation of disease / disorder categories


Thing
Condition
Disposition_cause_functioning
Process_manifestation
Structure_body_system
ICD11_CAST
Body_system_CAT
Cause_CAT
Functioning_CAT
Manifestation_CAT
continuant
dependent
Cause
Functioning
independent
Body_system
occurent
process
Manifestation
situation
condition_present
context

ICD 11 CAST



Tentative SNOMED CT Upper Level

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Discussion (3)

- CAST aligned on ULO allow to clarify PS, ICD 11 and Surgical procedures specific domains healthcare terminologies which are vague in their contents and borders
- They are providing an empirical 'reality check' to quality improvement strategies for unstructured healthcare terminologies that may disallow the inclusion of epistemic notions.
- They can support the process of ontology construction and ease ontology application when complex healthcare knowledge is concerned.

Conclusion

- Categorial Structure (CAST) is not a full Ontology tool but only “DL like”
- It is an intermediate tool between Information Model and Ontology
- CAST minimal domain constraints are an incentive to clarify the relations between Terminology and Ontology
- Aligning CAST categories and semantic links with ULO classes or types and properties allows to increase the quality of CAST
- CAST a Ontology Disjoint Entity?

Acknowledgements

- PS-CAST project has been contracted by WHO (Registration #2009/33635-0, Order 200094768, Reg. File H15 APW 221) as part of ICPS development.
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- ICBO 2012 conference see session 3 paper 15 on USB

Questions?
Vielen Dank für Ihre Aufmerksamkeit

Terima Kashi

Thank you

Merci

Tak **Grazie**

Gracias

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Efcharisto

ARIGATO GOZAIMASU

Multumesc.