Standards and Biomedical Terminologies: the CEN TC 251 and ISO TC 215 Categorial Structures. A step towards increased interoperability

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Terminology to Ontology through standards

1 Introduction

2 Categorial structure

3 Different Categorial structures

4 Discussion
DEFINITIONS

1 Semantic interoperability:
   - the ability for information shared by systems to be understood at the level of formally defined entities, so that the receiving system can process the information effectively and safely

2 Ontology
   - 1. reflects the properties of the entities within its domain in such a way that it obtains a systematic or according to rule correlation between reality and the representation itself and the non ambiguous comparison between different formal representations of the reality
   - 2. is intelligible to a health care domain expert,
   - 3. is formalised in a way that allows it to support automatic information processing.
3 Terminology

- Term + meaning
- Terminology artefacts (nomenclature, flat list of controlled vocabularies, classifications and thesaurus, coding system)
- Used to analyse the reality from instances of universals (entities invariant in time and space) known or to know
- Used by humans with flexibility and ambiguity
4 clinical terminological systems:
- UMLS (Unified Medical Language System)
- SNOMED international
- Read Clinical Classification Version 3
- LOINC for clinical laboratories
- DICOM SDM for imaging
- SNOMED CT
- Convergent Medical Terminology (CMT)
- Et.

5 Classifications and coding systems
- ICD 10 to ICD 11 (ICF+procedures=FIC)
- ACHI (Australian Classification of Health Interventions) or ICD10 AM
- Canadian Classification of Health Interventions (CCI) Canadian Institute for Health Information (CIHI)
- France CCAM (Classification Commune des Actes Médicaux)
DEFINITIONS (Cont)

- **6 biomedical ontology driven tools**
  - terminology server architecture
  - knowledge bases representing multi-hierarchies of concepts associated by semantic subsuming the logical meaning of their relations
  - automated language generation including the linkage of lexicons from different national languages to the knowledge representation.

- **GALEN (Generalised Architecture for Languages, Encyclopaedias and Nomenclatures in Medicine)**
- **FMA (Foundational Model of Anatomy)**
- **OBO (Open Biomedical Ontology)**
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• Definitions

• 21 Categorial structure EN 12264 2005

• 22 Categorial structure ISO 17115 2007

• 23 Categorial structure EN 15521 Cat anat 2008

• 24 Categorial structure in natural language

• 25 Categorial structure for CEN/ISO
Definitions

Categorial structure for healthcare terminologies:
Minimal set of domain constraints to represent a healthcare terminology in a precise domain with a precise goal.

- a) list of semantic categories
- b) goal of the categorial structure
- c) list of semantic links authorised with their associated semantic categories,
- d) minimal constraints allowing the generation and validation of well formed terminological phrases.
WHAT IS A CATEGORIAL STRUCTURE
CEN EN 12 264 (http://www.centc251.org)

1. a list of semantic categories
   ex surgical deed, human anatomy, lesion, device

2. the goal of 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 allowing the generation and the validation of well formed terminological phrases
2 Minimal constraints

1 Each surgical procedure terminological phrase shall, as a minimum, consist of a surgical deed and have the semantic link ‘hasObject’.

2 Each surgical procedure terminological phrase shall contain the category human anatomy in relation with the semantic link ‘hasObject’ or ‘hasSite’. It can also have both.

3 The surgical procedure terminological phrase shall include the category lesion when the surgical deed is applied to a modified human anatomy structure without mention of the disease cause of the lesion.
2 Minimal constraints

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 hasSubsurgicaldeal.

5.5 Each surgical procedure sub-process terminological phrase shall as a minimum, consists of 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)
3 Examples

Endarteriectomy of the carotid bifurcation by everting”.

excising hasObject “endarterium” contained_in “carotid bifurcation” and hasSubsurgicaldeed “everting” which hasObject “carotid bifurcation”
3 example(snomed ct)

Excision of benign neoplasm (procedure)

Snomed formalism (named editorial rules)
- METHOD Excision - action (qualifier value)
- Direct morphology Neoplasm, benign (morphologic abnormality)

Categorial structure non conformant
- for Anatomy is mandatory and shall be related to direct morphology by hasSite
3 example(snomed ct)

- **Excision of benign neoplasm (procedure)**
- **Categorial structure formalism**

*Excising hasObject “benign neoplasm” hasSite?? -*
3 Example (snomed ct)

- Excision of vegetations from implanted mitral valve (procedure)
- Snomed formalism (named editorial rules)
- Method Excision - action (qualifier value)
- Direct morphology Vegetation (morphologic abnormality)
- Indirect device Mitral valve prosthesis, device (physical object)
- Procedure SITE - INDIRECT Mitral valve structure (body structure)
- OK in this case it is conformant with the standard
3 Example snomed ct

Excision of vegetations from implanted mitral valve (procedure)

Categorial structure formalism

Excising hasObject « vegetation » hasSite « prosthesis device » hasSite Mitral valve
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Different categorial structures


Different categorial structures


[18] ENV 12 611: 1996, Medical Informatics – Categorial structure for system of concepts - medical devices


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Standards and biomedical terminologies

A Standard to do what?

1. Traditional or politically correct: THE S. e.g. WHO-FIC

Simple (good idea) BUT

- Size of knowledge increasing so quickly:
- bottomless updating,
- clinical specialists domain experts dependent
- Multilingualism outside the commonwealth
- Divergent standards (HL7, CEN, ISO, IHTSDO,
- UN, national, clinical specialist, de facto,)
- different levels (Architecture to Information Model, Archetypes, Data types, Categorial structures, Terminology Ontology et.)
Standards and biomedical terminologies

- **A Standard to do what?**
  - 2 New emerging one: biomedical coordinated approach based on formal ontology and the biomedical ontology tools coordinated with natural language processing and web based tools e.g. OBO GALEN FMA

- **Complex BUT**
  - separates from terminology artefacts the logic of knowledge and the linguistic characteristics of the different national languages.
  - By associating clinical specialist domain experts, ontology experts and linguists this infrastructure gives the opportunity to assess clinical terminology by logical expertise and as well ontology modeling by clinical domain experts working in their national language.
  - By de-multiplying the workload it can allow to open the cross fertilisation of knowledge and to increase its dissemination

- **Open question**: feasibility on all the health knowledge
Standards and biomedical terminologies

A Standard to do what?

- 3 Categorial structures: a compromise between the 2 on the road from 1 to 2 for several reasons
  - The world is a multilingual space and no legacy is entitled to prescribe a reference terminology standard in one language
  - The work started in the 90s with the goal to move from a syntactic or functional semantic interoperability level 1 to a semantic interoperability of level 2 where the recipient is able to understand the meaning of terms used by the sender but cannot process them as SAFELY as he can do with his own terms and meaning (semantic interoperability level 3).

Limited BUT

- Are based on Ontology principles or models (e.g. FMA for Catanat).
- Are not constraining very much system developers and linguistic expressiveness
- Are evolving each 5 years to a more formal and extended standard (e.g. Surgical procedures, Catanat)
ENDE
Vielen Dank für Ihre Aufmerksamkeit

Thank you
Merci

Gracie
Gracias
Obligado
Efcharisto
ARIGATO GOZAIMASU
Tag

Multumesc.