

# Taxonomy of User Impairments

Shuaib Karim, A. Min Tjoa

Vienna University of Technology  
{skarim, amin}@ifs.tuwien.ac.at

**Abstract.** User impairments can be modeled in an ontology using semantic web technology which may be beneficial in many ways for the users of computer systems over the internet. To start with, important terms of the domain must first be collected and then their inter-relationships must be determined. In the domain of discourse the relationships can be defined permanently for some terms, and at times it is practical to infer some relationships based upon certain pre-conditions. The relationships or concepts may also change over time. Once the analysis is done so far, one can encode this conceptual schema of interconnected concepts using some ontology language like OWL [1], and its instances can be populated according to the context in which it is being used. The impairments ontology thus created could be used for adapting the user interface according to user impairments. Since the taxonomy of impairments is meaningfully and formally described in the ontology, therefore it is sharable with other users as well as with software agents for the collective benefit of all types of users especially the users with special needs.

## Introduction

The medical terms can be found in abundance in libraries & internet sources like WordNet [2], Galen [3], SNOMED-RT [4], UMLS [5], & MeSH [6]. We also interviewed some physicians<sup>1</sup> for this purpose. Important terms with their brief definitions were written down. The intention was to find the concept hierarchies & their interconnections in the domain of discourse. A sample of impairments hierarchy based on existing medical categorization is given below:

- a. Impairment (damage that results in a reduction of strength or quality)
  - Inherited (genetically transmitted) / Acquired (due to environmental forces)
  - Reliant (relies on another person for support)
    - PartiallyReliant / FullyReliant
  - SelfReliant
- b. Physical (general loss of physical ability)
  - Vision, causedBy Eye
    - ColorBlindness (Inability to perceive some or all colors)
      - Red-Green ColorBlindness
        - Protanopia (unable to distinguish green-yellow-red section, rare)

---

<sup>1</sup> Private communications with Zubair Kareem, M.D. Phy-Neurologist (Holyoke, MA)

- Protanomaly (less sensitive to red light than normal, red confuses with black, rare)
- Deuteranomaly (less sensitive to green light than normal, most common)
  - Blue-Yellow color blindness
  - Monochromacy (complete inability to distinguish any color)
    - Cone Monochromacy (vision is normal)
    - Rod Monochromacy (vision problem in lights of normal intensity)
- Blindness (Lack of visual perception)
  - Monocular (affecting one eye) / Binocular (affecting both eyes)
  - LegalBlindness (visual acuity of 20/200 or less; person is allowed to avail blindness privileges as allowed by law)
  - CompleteBlindness (inability to perceive light)
  - Hemianopsia (absence of vision in half of visual field, each eye misses a half circle of visual field, left or right sided)
    - HomonymousHemianopsia (a half of visual field is missing on same side, right or left)
    - BitemporalHemianopsia (outer 1/2 visual field missing on both sides)
    - BinasalHemianopsia (inner 1/2 of visual field missing on both sides)
    - Quadrantopia (similar to Hemianopsia above with same types, except that the affected visual field is 1/4<sup>th</sup> instead of 1/2)
  - Scotoma (An island of loss of vision surrounded by normal vision, black hole in centre)
  - Diplobia (seeing double, in all field of vision or only in left/right eye)
  - Hemeralopia (day blindness, partial or complete loss of vision in bright light or day light)
  - Nyctalopia (night blindness, partial or complete loss of vision during dim light or darkness)
  - TunnelVision (constricted field of vision in both eyes)
- Vision, causedBy Brain
  - Agnosia (loss of ability to recognize objects, people, sounds, shapes, or smells; the inability to attach appropriate meaning to objective sense-data)
    - VisualAgnosia, synonym-CorticalBlindness (blindness due to processing part of the brain, brain loses the capacity to make sense of the image presented, could be due to stroke or tumor)
    - ProsopAgnosia (inability to recognize familiar faces at times their own)
    - ColorAgnosia (inability to recognize one or more colors, in spite of normal eyes and anterior visual pathways)
    - TunnelVision (constricted field of vision in both eyes, due to migraine or in psychiatry)
- Mobility [7]
  - Permanent / Temporary
  - LowerBody (Canes, Walkers, WheelChairs) / UpperBody (Limited or no use of the upper extremities and hands)
  - Orthopedic / Neuromuscular

- c. Cognitive (general loss of mental or cognitive ability, related with lack of perception/ learning/reasoning)
- Aphasia (inability to use or understand spoken or written language)
    - Broca (Motor aphasia, spontaneous speech and fluency diminished, cannot name object, comprehension normal or mildly affected, repetition may or may not be affected, reading affected, writing poor, condition varies from mutism to hesitant speech)
    - Wernicke (sensory aphasia, main defect is of comprehension of spoken language, reading and writing. Patient's own spoken language is fluent though not making any sense, repetition and naming is also poor)
    - Global (mixture of above two conditions, unable to understand or produce any spoken or written language)
    - Gerstmann syndrome (Agraphia, inability to calculate, right-left confusion, and finger agnosia - inability to recognize fingers)
  - Dyslexia (learning disability that affects language processing and reading skills, average or above-average intelligent people)

## References

1. Web Ontology Language <http://www.w3.org/2004/OWL/> (2<sup>nd</sup> May'06)
2. WordNet <http://wordnet.princeton.edu/> (4<sup>th</sup> Mar'06)
3. OpenGALEN 2002: The GALEN Common Reference Model Version 6. <http://www.opengalen.org/open/crm> (4<sup>th</sup> Mar'06).
4. Spackman K.A., Campbell K.E. and Cote R.A., SNOMED-RT: a reference terminology for health care; Proceedings of the 1997 AMIA Annual Fall Symposium, 1997, pp. 640-644.
5. Unified Medical Language System <http://www.nlm.nih.gov/research/umls/> (4<sup>th</sup> Mar'06)
6. Medical Subject Headings <http://cvs.sourceforge.net/viewcvs.py/obo/obo/ontology/vocabularies/mesh.obo> (4<sup>th</sup> Mar'06)
7. Mobility Impairments <http://www.washington.edu/doiit/Faculty/Strategies/Disability/Mobility/> (2<sup>nd</sup> May'06)