

Ontology for the Outdoor Mobility of People with Dementia

Documentation

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1 General information

Experiment title	Ontology for the Outdoor Mobility of People with Dementia
Experiment id	D20170804-Ontology_Outdoor_Mobility-KY
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Language	English
Rights	CC BY 4.0
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1.1 Objective

To construct an ontology for the outdoor mobility of people with dementia (PwD). The model serves two purposes: (a) as a knowledge base from which to build an assistive technology device describing the mobility of PwD (we call this a situation model); (b) as a codebook for the annotation of the recorded behaviour.

1.2 Problem Statement

People with dementia have difficulties in performing everyday activities and assistive technology devices (ATDs) have the potential to help them maintain their independent social life by supporting their everyday mobility. On the one hand, such systems should only intervene if needed so that the user still relies on his or her own cognitive resources. Such systems have been termed situation aware deliberative assistive technology devices. To be operational, such a device needs to track the user’s actions, recognise the goal, detect the errors in behaviour, and decide about the best way of assisting the user [3]. To achieve that the ATD needs domain knowledge in machine understandable format, which describes the actions a user is able to execute, the errors in behaviour that may occur, and the reasons for these errors as well as the situation in which the person is. We call this collection of knowledge a situation model. This ontology contains the implementation of the situation model for the outdoor mobility of people with mild dementia.

2 Description

The ontology was developed following the process shown in Figure 1. It consists of domain analysis, conceptualisation, implementation, and maintenance. During each of these phases, evaluation and documentation are performed. To collect the relevant information implemented in the ontology, the following sources were used:

- **system requirements examination** based on discussions with experts and literature review of existing situation-aware assistive systems;

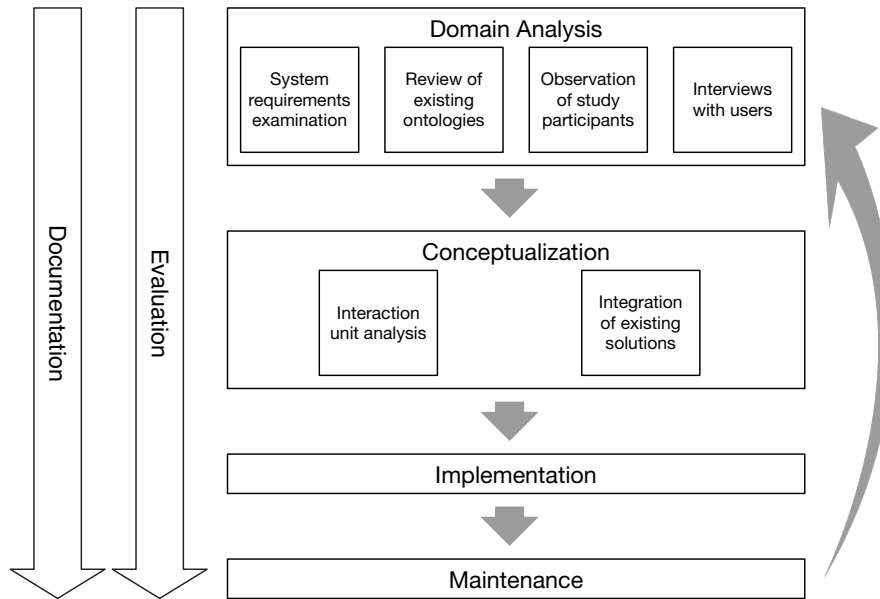


Figure 1: The process for developing the ontology.

- **review of existing ontologies** both in databases and through literature review;
- **observation of study participants** through an outdoor mobility study;
- **interviews with the users**, i.e. the people with dementia.

The resulting ontology consists of 98 concepts categorised in a hierarchical structure where the uppermost categories are those identified from the system requirements examination, while the middle and bottom layers are based on the literature review, the interviews, the mobility study, and the interaction unit analysis. Apart from the concepts, 11 relation types were identified, divided into four categories.

More information about the knowledge elicitation process and the resulting situation model can be found in the article “Situation Model for Situation-aware Assistance of Dementia Patients in Outdoor Mobility” [2]. Furthermore, each of the concepts and relations in the ontology contains a short definition.

2.1 Data format

The ontology is implemented in the Web Ontology Language (OWL) [1] and OBO Edit¹ to encode the ontology.

Folder *Ontology* contains the ontology in OWL format (“Situation-model.owl”) and in OBO format (“Situation-model.obo”). Both of them contain the same information and the first format can be opened with e.g. Protege or OBO Edit, while the second with OBO Edit.

¹<http://oboedit.org/>

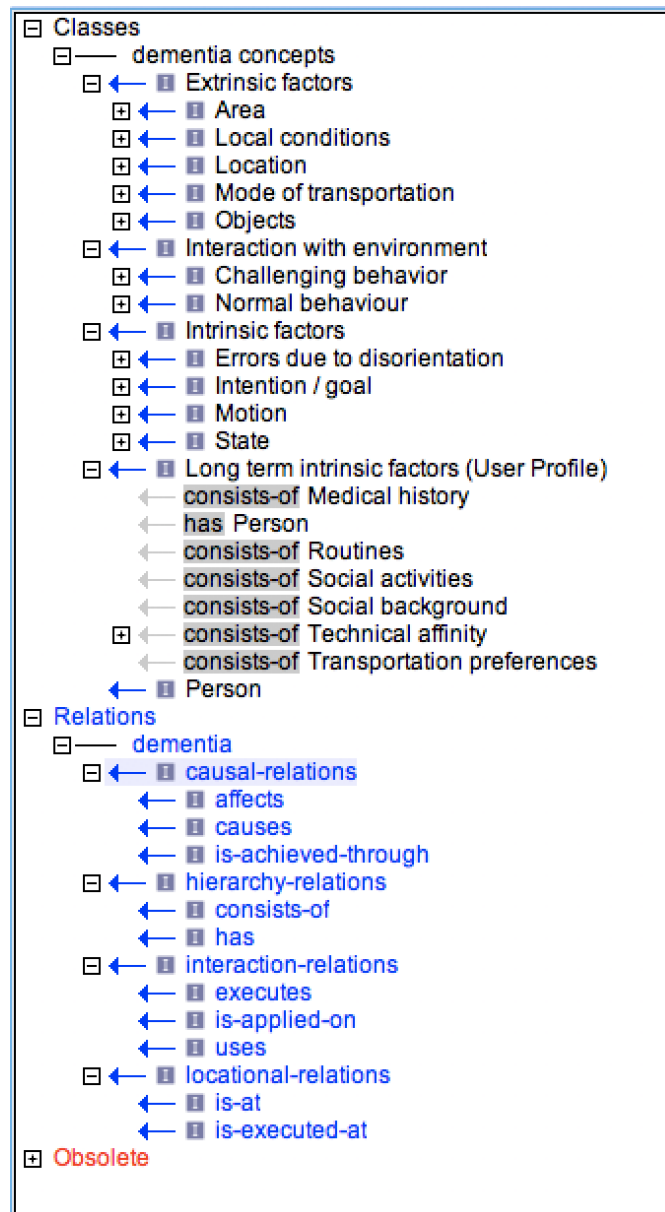


Figure 2: The tree-like structure of the concepts and relations in the ontology.

Figure 2 shows the tree-like structure of the concepts and relations while Figure 3 shows the compact representation of the ontology.

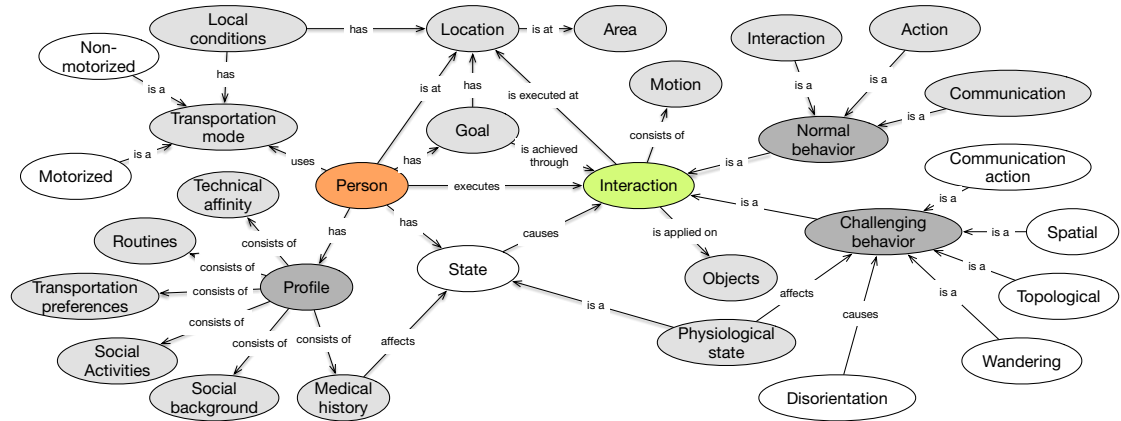


Figure 3: The main concepts in the ontology and the relations between them. Figure taken from [2].

3 Bibliography

References

- [1] Deborah L McGuinness, Frank Van Harmelen, et al. OWL web ontology language overview. *W3C recommendation*, 10(10):2004, 2004.
- [2] Kristina Yordanova, Philipp Koldrack, Christina Heine, Ron Henkel, Mike Martin, Stefan Teipel, and Thomas Kirste. Situation model for situation-aware assistance of dementia patients in outdoor mobility. *Journal of Alzheimer's Disease*, 2017. accepted.