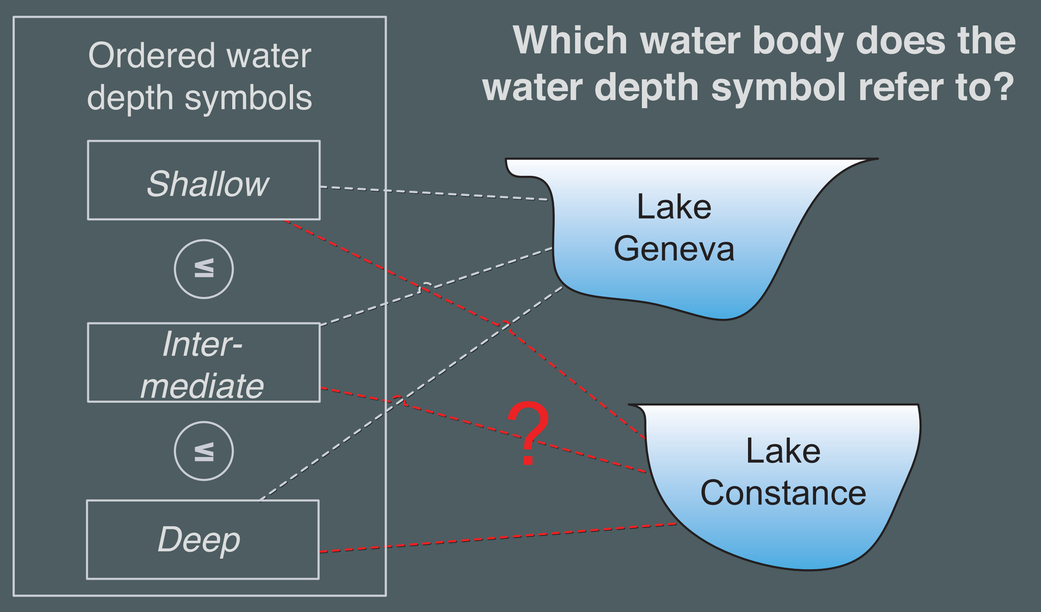
Münster Semantic Interoperability Lab
http://musil.uni-muenster.de

Grounding Geographic Information

Ontologies are used to account for the *intended meaning* of data sets. However, they usually allow for *unintended interpretations* of their symbols, since the meaning of their primitives remains ambiguous. Due to this **symbol grounding problem**, it is impossible to know whether a data set is an intended model of an ontology. We propose a 3 STEP GROUNDING PROCESS as a solution, which fixes the interpretation of primitives by relating them to observation procedures outside the symbol system. We demonstrate our approach by grounding the meaning of water depth values (e.g., *deep*, *shallow)* for a diver and a swimmer, respectively. We address three research questions:

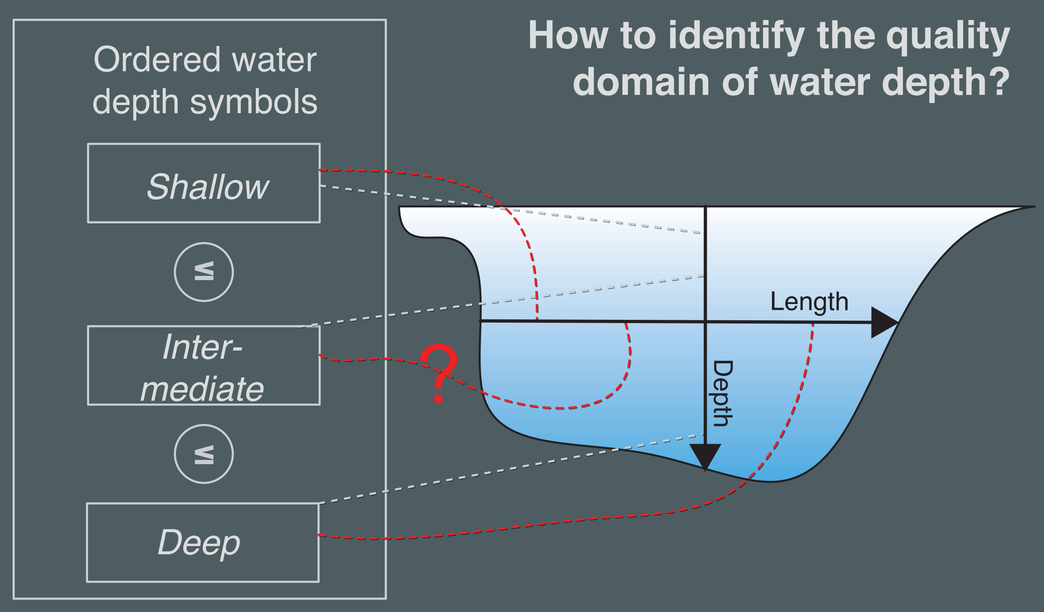
[1] What are the sources of ambiguity?
[2] What are primitive notions reproducible by observation procedures?
[3] How can we ground ambiguous concepts in primitives?



a) Identification of objects of a domain

We search for an **Identification Criterion** for lakes, e.g. *Lake Geneva*, in **Gibson**'s *meaningful environment* in terms of *media*, *substances* and their *surfaces*. Media can be identified by *locomotion affordances*: A lake is a medium for divers. A surface is a place where any such locomotion must stop. The lake body can be given a name by pointing at it. Accordingly, lakes can be grounded by the following schema, where „←“ means *grounded in*:

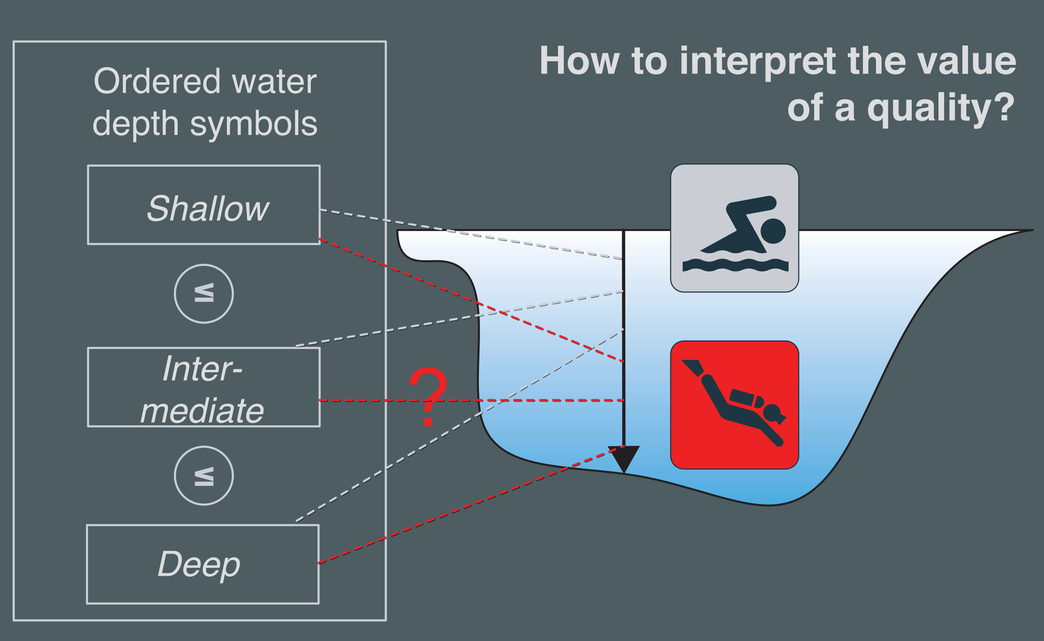
Grounding Schema: [Affordance primitives] ← [Medium, Surface, Substance] ← [Lake]



b) Identification of object qualities in a domain

We define water depth using the meaningful environment. Here, affordance steps can be concatenated to paths. The water depth of a lake is then the set of all *vertically aligned diametrical paths* inside its waterbody touching the ground and the watersurface. There are many such paths for a given waterbody.

Grounding Schema: [Affordance primitives] * [Lake] ← [Vertically aligned diameter path] ← [WaterDepthOf][Lake]



c) Identification of object qualia

How can we fix a unique function from waterdepths to our symbol space (Uniqueness problem of measurement)? Using *measurement standards*, the unit of measurement is given by a particular straight path denoting, for example, one meter (*le mètre des archives*). Subintervals of the meter space are mapped to deep, intermediate and shallow, depending on the agent (swimmer or diver).

Grounding schema: [Mètre des archives] * [WaterDepthOf] [Lake] ← [Meter Symbol Set] ← [Ordinal Symbol Set]

Simon Scheider, Anusuriya Devaraju, Krzysztof Janowicz, Patrick Maué, Sven Schade, Carsten Keßler, Jens Ortmann, Mohamed Bishr, Tonio Fincke, Tobias Weigel & Werner Kuhn

musil muenster semantic interoperability lab

ifgi
Institute for Geoinformatics
University of Münster