

A Model for Informality in Knowledge Representation and Acquisition (an extended abstract)

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Introduction

This extended abstract summarizes how we are handling informality as a fundamental aspect of our paradigm for knowledge representation (KR) and acquisition (KA). We have developed this paradigm as a result of several years of experience with industrial application of our research KA system CODE [SKUC 89]. One of the most striking observations from this experience is that people need to be able to work at any level of formality (or informality), and to freely mix such levels. Among various things, our paradigm attempts to systemize the formality spectrum in knowledge based systems.

Concepts and the formality spectrum

In our paradigm, all knowledge is represented in computer memory objects called *concepts*, intended to correspond to concepts in the human mind. We have additional constructs called *knowledge maps* and *knowledge masks* which allow us to interpret networks of concepts in terms of such traditional models as frames or semantic nets, and to restrict the focus of the knowledge to useful contexts.

As in most KR paradigms, concepts are classified ontologically, i.e. on the basis of their knowledge content. Of equal importance though, is an orthogonal classification of concepts in terms of how they are to be interpreted: what processing is performed or performable on them.

The hypothetical extremes of the formality spectrum are defined as follows: The representation of a completely informal concept in a knowledgeable agent would contain only strings or bit maps that are not immediately interpretable by the agent. Uninterpretable strings typically contain natural language fragments. The representation of completely formal concepts would contain only links (which must also be completely formal concepts) to other completely formal concepts.

In practice, neither extreme of the formality spectrum is found (our definition of a completely formal concept is infinitely recursive). Concepts have links to other concepts (if nothing else they may be placed in an isa hierarchy under, say, *entity*) which makes them not totally informal in our paradigm. Similarly they are not totally formal because they either have some uninterpreted content or have direct or indirect links to concepts with uninterpreted content.

Concepts can be partially ordered in terms of their formality level. To compare two concepts one compares their uninterpreted content and the formality of linked concepts. At present we use a heuristic algorithm for this. Note that one does not assign a formality 'measure' to a concept, concepts are merely *comparable* in terms of formality.

Knowledge acquisition as the increasing of concept formality

We consider knowledge acquisition to be the process of increasing a concept's level of formality (by supplying it with more links and hence with more structure or form). The process is recursive in that the primary way to increase a concept's formality is to increase the formality of its linked concepts. The secondary way is to add new links; often this is done as a by-product of increasing the interpretability of the concept's uninterpreted content (by virtue of the acquisition of other concepts, the potential for a system to make automatic interpretations increases).

In our KA model, the early phases of a user's efforts are devoted to entering highly informal concepts (perhaps using an outline-processor style of interface) to capture the user's stream of consciousness [LETH 91a]. As KA progresses the user increasingly enters links that give concepts more formality. By comparing the formality of concepts, a system can help the user decide on a productive direction in his or her knowledge acquisition efforts.

A word about our use of the terms 'formal' and 'informal'

We use the term 'formal' in the ordinary English sense of 'has a form or a structure that follows rules'. A concept that has less such structure than another is more informal.

It is important not to confuse this idea with the sense of 'formal' as used in 'formal language'. The latter sense typically is 'has an unambiguous syntax and semantics'. Our use of 'formal' is more general than the latter: We would prefer to call the latter 'representationally formal', where concepts are only compared with consideration given to representation relations, not all relations.

Conclusion

We have developed a knowledge paradigm that integrates the idea of a formality spectrum. We believe that most existing knowledge based systems stress formality, ignoring the continuum that could exist between them and informal natural language. Integrating the notion of the formality spectrum allows a more accurate representation of what is in a person's mind (which typically has low formality). This can greatly facilitate the knowledge acquisition process by reducing difficulties caused by the user prematurely having to formalize ideas.

We are implementing our ideas in a completely new version of our knowledge based system called CODE [LETH 91b].

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References

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