A Perspective and Framework for the Conceptual Modelling of Knowledge

by

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This thesis is presented for the degree of Doctor of Philosophy of Murdoch University

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

.....
(Diarmuid Pigott)

Abstract

Conceptual modelling of knowledge has remained an open research challenge. Existing frameworks do not cope with problems such as multiple user viewpoints, the plurality of epistemologies and representational forms, the mutability of knowledge, and the great body of legacy encoded knowledge. This thesis addresses the lack of a systematic method for the conceptual modelling of knowledge by presenting a novel perspective for dynamic knowledge exchange together with an associated modelling framework and tools.

The thesis establishes a new perspective, the erotetic perspective, based on question-and-answer exchanges that match knowledge needs with knowledge capacities. It presents a unified design framework within this perspective and introduces appropriate modelling constructs, the *Functional Entity* and the *Knowledge Relation*. The framework comprises a methodology (the *Functional Entity Relationship Methodology*), a diagramming system for drawing conceptual models (the *Functional Entity Relationship Diagram*) and a transactioning language for representing the knowledge exchanges (the *Functional Entity Relationship Language*). These respectively extend the classic Entity Relationship Diagram and the class of SQL-like languages adequately to describe all possible transactions involving encoded knowledge. The different types of Functional Entity are shown to cover the complete space of knowledge seeking and retrieval and cope with situations not possible in conventional data modelling.

As the modelling framework is a secondary design artefact (one that is capable of producing routine design artefacts) the design science research approach of Gregor & Jones was used. This approach necessitates an Alexander pattern drawn from prior research to guide development, followed by expository instantiations of the artefacts sought. Evaluation comprising verification, validation, generalization, substantiation and some external accreditation was conducted throughout. The models developed were tested for mutual encompassing through docking, which also confirms the erotetic perspective. Illustrative cases are presented to show the completed framework in action.

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Acknowledgements

I would like to thank my supervisors Dr Val Hobbs and Prof John Gammack for their guidance, insight and unflagging enthusiasm. I ended up with a different sort of thesis on the same research problem, one which has proved educating and enlightening.

I would especially like to thank Val for the extensive series of discussions on data modelling that began the idea of the Functional Entity and the Functional Entity Relationship Diagram, and John for the gift of the Nicholas Rescher books which began that entire approach to the problem (as well as explaining to me how much design science had to offer).

I would like to thank some friends for their guidance on some technical matters: Dr Colin Young for help on linguistics and speech act theory in pragmatics, Dr Callan Ledsham on philosophy of science, speech acts theory in philosophy of language, Bruce Axtens for discussions and feedback on EBNF and Patrick Pigott for the cooperation on the ecological examples.

On a personal note I would like to thank Callan for stepping in with the right kind of advice and help when I most needed it. Thanks too, to Steve Poulson for keeping the ball rolling while I did something that mattered so much to me. And to my parents for driving me towards something that has proven so richly rewarding.

Finally, never-ending gratitude to Sheila who indulged me in another postgraduate qualification in very trying times.

Publications arising from thesis

This thesis has produced two publications:

- Pigott, D. J., & Hobbs, V. J. (2009). *The Functional-Entity Relationship Diagram: Conceptual Modelling For Complex Knowledge Systems*. Paper presented at the 20th Australasian Conference on Information Systems, Melbourne.
- Pigott, D. J., & Hobbs, V. J. (2011). Complex Knowledge Modelling with Functional Entity Relationship Diagrams. *VINE, 31*(2), 192-211.

Variants of portions of the text from these papers appear in chapters 2 and 9 where noted.