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DEGREE: Doctor of Philosophy

TITLE: Empirical Modelling for Participative Business Process Reengineering

DATE OF DEPOSIT: 14 January 2002

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dedicated to Jung-He and Ming-Mei, my dad and mum
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Acknowledgments

I am deeply indebted to many persons who have provided help, support and encouragement. First of all, I would like to thank my supervisor Dr Steve Russ for his unvaluable help, advice, patience, and unselfish support throughout the preparation of this thesis. I would surely not have been able to finish this thesis without his help. Warm thanks also to Dr Meurig Beynon, my adviser, for his fruitful discussions and comments during this research. I would also like to thank my colleagues and other friends both in Empirical Modelling Group and in this department.

I also owe thanks to all my friends here during the period of my MSc study in LSE and doctoral programme in Warwick, who made my life of study rich and joyful: Dr James Backhouse (my supervisor in LSE), Dr Sedat Agan, Harun Esen, Russell Lewis, James Nyman, all members of WTC, and to all other friends in UK, Taiwan and Turkey for their help and friendships.

Finally, I would like to express my heartfelt gratitude to my dear parents Jung-He and Ming-Mei for sharing their life-wisdom and giving crucial advise in difficult situations. Also warm thanks to my elder brother Yih-Lang. Without their support this thesis would never have been completed.

Further thanks goes to Dr Chrystopher Nehaniv for his constructive comments during the viva and to Steve Russ and Meurig Beynon for their useful help on this final version.
Declarations

This thesis is presented in accordance with the regulations for the degree of Doctor of Philosophy. It has been composed by myself and has not been submitted in any previous application for any degree. The work in this thesis has been undertaken by myself except where otherwise stated.

The perspective of Empirical Modelling for Business Process Reengineering has been published in (Chen et al., 2000a). The various aspects concerning the application of EM to Participative Process Modelling have been presented in (Chen et al., 2000b). The view of Interactive Situation Models relating to software system development and the framework of SPORE have been proposed in (Sun et al., 1999). Some of the technical work for the example of the warehouse management system has been described in (Chen et al., 2000a), (Chen et al., 2000b) and (Sun et al., 1999).
Abstract

The purpose of this thesis is to introduce a new broad approach to computing – Empirical Modelling (EM) – and to propose a way of applying this approach for system development so as to avoid the limitations of conventional approaches and integrate system development with business process reengineering (BPR). Based on the concepts of agency, observable and dependency, EM is an experience-based approach to modelling with computers in which the modeller interacts with an artefact through continuous observations and experiments. It is a natural way of working for business process modelling because the modeller is involved in, and takes account of, the real world context. It is also adaptable to a rapidly changing environment as the computer-based models serve as creative artefacts with which the modeller can interact in a situated and open-ended manner.

This thesis motivates and illustrates the EM approach to new concepts of participative BPR and participative process modelling. That is, different groups of people, with different perceptions, competencies and requirements, can be involved during the process of system development and BPR, rather than just being involved at an early stage. This concept aims to address the well-known high failure rate of BPR. A framework SPORE (situated process of requirements engineering), which has been proposed to guide the process of cultivating requirements in a situated manner, is extended to participative BPR (i.e. to support many users in a distributed environment). Two levels of modelling are proposed for the integration of contextual understanding and system development. A comparison between EM and object-orientation is also provided to give insight into how EM differs from current methodologies and to point out the potential of EM in system development and BPR. The ISMs (interactive situation models), built using the principles and tools of EM, are used to form artefacts during the modelling process. A warehouse and logistics management system is taken as an illustrative case study for applying this framework.
Abbreviations

ADM .................. Abstract Definitive Machine
AI ................... Artificial Intelligence
AMORE ............. A Methodology based on Object-Orientation for Reengineering Enterprises
BPR .................. Business Process Reengineering
BPRC ............... Business Processes Resource Centre
CORBA ............ Common Object Request Broker Architecture
CREWS .......... Cooperative Requirements Engineering With Scenarios
DEM ................ Distributed Empirical Modelling
DoNaLD ........ Definitive Notation for Line Drawing
DSS ................. Decision Support System
EDDI .............. Eden Definition Database Interpreter
EDEN .............. Evaluator for Definitive Notations
EM ................. Empirical Modelling
GST ................. General System[s] Theory
HCI ................ Human-Computer Interaction
IS ................. Information System[s]
ISM ............... Interactive Situation Model
IT .................. Information Technology
LSD ............... Language for Specification and Description
LSE ............... The London School of Economics and Political Science
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>MIS</td>
<td>Management Information Systems</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>OMG</td>
<td>Object Management Group</td>
</tr>
<tr>
<td>OMT</td>
<td>Object Modelling Technique</td>
</tr>
<tr>
<td>OO</td>
<td>Object-Orientation; Object-Oriented</td>
</tr>
<tr>
<td>OOBEB</td>
<td>Object Oriented Business Engineering</td>
</tr>
<tr>
<td>OOSE</td>
<td>Object Oriented Software Engineering</td>
</tr>
<tr>
<td>RE</td>
<td>Requirements Engineering</td>
</tr>
<tr>
<td>SCCS</td>
<td>Source Code Control System</td>
</tr>
<tr>
<td>SCOUT</td>
<td>Notation for Screen Layout</td>
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<tr>
<td>SPORE</td>
<td>Situated Process of Requirements Engineering</td>
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<tr>
<td>SSM</td>
<td>Soft System Methodology</td>
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<tr>
<td>TQM</td>
<td>Total Quality Management</td>
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<tr>
<td>UML</td>
<td>Unified Modelling Language</td>
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