

Table of content

Chapter 1. Introduction	1
1.1. Motivation	1
1.2. Conceiving Mobile Collaborative Applications to Support PDCPs	3
1.3. Problem Definition	5
1.4. Work Hypotheses	7
1.5. Research Goals	7
1.6. Research Methodology	8
1.7. Document Structure	9
Chapter 2. Background	11
2.1. Collaborative Processes Structuring	12
2.2. Mobile Collaborative Systems that Support PDCPs	13
2.2.1. Using Mobile Collaborative Applications in PDCPs	14
2.2.2. Types of Participants in a PDCP	16
2.3. Strategies for Developing Mobile Collaborative Systems	17
2.3.1. Development Focused on the System Design	17
2.3.2. Development Focused on the Engineering of the System	20
2.3.3. Hybrid Development Processes	22
2.4. Product Scoping	24
2.4.1. Relevance of the Early Definition of the Product Scoping	24
2.4.2. Product Scoping in Bespoke Projects	26
2.5. Requirements Elicitation for Collaborative Systems	28
2.5.1. Perspectives of Elicitation Techniques for Collaborative Systems and their Contribution to Define the Product Scope	29
2.5.2. Requirements Elicitation for Collaborative Systems Supporting a PDCP	31
2.6. Shared Understanding between Stakeholders and Software Engineers	31
2.6.1. Types of Shared Understanding	32
2.6.2. Practices to Achieve a Shared Understanding	32
2.6.3. Relationship between Explicit Specifications and Explicit Shared Understanding	34
2.7. Designing Effective Visual Modeling Languages	34
2.7.1. The Importance of Visual Representations	35
2.7.2. An Approach for the Development of Modeling Languages	35
2.7.3. Design Principles for Cognitively Effective Visual Notations	37
2.7.4. The notion of complexity in visual modeling	39
2.8. Model Consistency	40
2.8.1. A Classification of Model Consistency	40
2.8.2. Types of Consistency Checking Techniques	40
2.8.3. Main Consistency Checking Techniques Used in Existing Studies	41

2.8.4. Tool Support for Consistency Checking	41
2.9. Summary	42
Chapter 3. Related Work	43
3.1. Modeling Languages Description	43
3.1.1. Case Management Model and Notation	43
3.1.2. BPMN Plus	45
3.1.3. BPMN4SBP	46
3.1.4. Little-JIL and hADL	47
3.1.5. Mobile Collaboration Modeling	49
3.1.6. IoT Modeling Notation	50
3.1.7. Collaboration Graphs	51
3.1.8. Computer-mediated Interaction Modeling Notation	52
3.2. Expert Review of Model Representations	53
3.3. Discussion	55
3.4. Threats to Validity	55
3.5. Summary	56
Chapter 4. The Computer-Mediated Interactions Modeling Language	57
4.1. Language Foundations	57
4.2. Language Metamodel	58
4.3. CIMoL Common Constructions	59
4.4. CIMoL Notation for the Developer View	61
4.5. Interaction Services Specification	63
4.6. Examples of Interaction Graphs	66
4.7. Summary	68
Chapter 5. Evaluation of the CIMoL Capabilities	69
5.1. Study Settings	69
5.2. Definition of the Assessment Instruments	70
5.2.1. Instrument for Assessing the Understandability of the CIMoL Visual Notation	70
5.2.2. Instrument for Assessing the CIMoL Capability to Represent Computer-mediated Interaction Scenarios	72
5.3. Assessment Preparation	74
5.3.1. Documents Preparation	74
5.3.2. Participants in the Assessment	74
5.4. Introduction to the Assessment Activity	75
5.5. Language Assessment Process	75
5.5.1. Dynamic of the Assessment Process	75
5.5.2. Exploring the Language	76
5.5.3. Collecting the Experts' Opinion	77
5.6. Analysis of Results	78

5.6.1. Concerning the Understandability of the Notation	78
5.6.2. Concerning the Suitability of CIMoL to Specify Computer-Mediated Interaction Scenarios	84
5.6.3. Comparing CIMoL with the Related Work	85
5.6.4. Threats to Validity	87
5.7. Summary	87
Chapter 6. CIMoL Modeling Tool	89
6.1. Requirements for the Modeling Tool	89
6.2. Structure of the CIMoL Modeler	90
6.3. Modeling the Process Structure	91
6.4. Modeling Interaction Scenarios	94
6.4.1. Modeling Roles and Interactions	96
6.5. Modeling Prototypes	98
6.5.1. Home Mockup	99
6.5.2. Notifications Mockup	100
6.5.3. Contacts Mockups	100
6.6. Models Consistency Checking	103
6.7. Automatic derivation of interaction services	104
6.8. Where the Tool Should Be Used	105
6.9. Who Should Use the Tool and How to Use It	105
6.10. How to Model an Interaction Graph Using the Modeling Tool	107
6.11. Summary	108
Chapter 7. Case Study: Using CIMoL to Model an Elderly Caregiving Supporting System	109
7.1. Case Study Design	110
7.1.1. Research Questions	110
7.1.2. Introduction to the Informal Elderly Caregiving Process	110
7.1.3. Selection of Participants	111
7.1.4. General Description of the Activity	112
7.1.5. Data Gathering Mechanisms	114
7.1.6. Data Analysis Approach	115
7.2. Case Study Execution	115
7.2.1. Replica I: Elderly with Senile Dementia and Mobility Limitations	115
7.2.2. Replica II: Elderly with Down's Syndrome	119
7.2.3. Replica III: Elderly with Mobility Limitations	122
7.2.4. Replica IV: Elderly with Mobility Limitations	124
7.3. Discussion	126
7.4. Threats to Validity	128
7.5. Summary	128

Chapter 8. Conclusions and Future Work	130
8.1. Goals Achievement	130
8.2. Contributions to Theory and Practice	131
8.3. Limitations	132
8.4. Future Work	133
Glossary	135
Bibliography	136
Annexes	156
Annex A. Instrument for Stakeholder - Replica I	156
Annex B. Instrument for Engineers - Replica I	157
Annex C. Instrument for Stakeholder - Replica II	158
Annex D. Instrument for Engineers - Replica II	159
Annex E. Instrument for Stakeholder - Replica III	160
Annex F. Instrument for Engineers - Replica III	161
Annex G. Instrument for Stakeholder - Replica IV	162
Annex H. Instrument for Engineers - Replica IV	163
Annex I. Analysis of Notations for Modeling User Interaction Scenarios in Ubiquitous Collaborative Systems	164
Annex J. List of Publications	178
Annex K. Technical Reports	180