
Contents

Introduction	xiii
Robert PICARD	
Part 1. Ambitions of Connected Healthcare	1
Introduction to Part 1	3
Chapter 1. Ethics of Connected Healthcare: the Connected Individual	5
Caroline GUILLOT, Jean-Baptiste FAURE and Robert PICARD, with contributions by Myriam LEWKOWICZ	
1.1. First approach: the connected pathway.	5
1.2. The citizen's and the patient's stance.	8
1.2.1. Aconnected object for who, why?	8
1.2.2. The citizen, the patient and connected objects	8
1.2.3. The case of observance	9
1.2.4. From observance to the domestication of tools	10
1.2.5. Living well with connections: control or new found freedom?	12
1.2.6. Passivity versus activity	12
1.2.7. Engagement	13
1.2.8. The active patient	13
1.2.9. The implications of knowledge.	14
1.2.10. The expert patient	14
1.2.11. Beyond knowledge: the search for influence	15
1.3. Two illustrations: La Fédération Française des Diabétiques; the ENCAPA association	15

1.3.1. The active patient: example of la Fédération Française des Diabétiques	16
1.3.2. The militant patient: ENCAPA	20
1.4. The connected medical professional and the system.	22
Chapter 2. Introduction to Cases	25
Robert PICARD, with contributions by Frédéric DURAND-SALMON and Loïc LE TALLEC	
2.1. Method	25
2.1.1. Connection: systemic challenges	25
2.1.2. Questioning	27
2.1.3. Sharing knowledge	28
2.1.4. Optimizing the organization	29
2.1.5. Resilience, alerts and security	29
2.2. Feedback: case presentations	29
2.2.1. Typology of applications	30
2.2.2. Use case in prevention	30
2.2.3. Use case in chronic care	31
2.2.4. Use case in research	32
2.3. Working group projects.	33
Chapter 3. Two Stories about Connected Healthcare	39
Yves GRILLET and Guy FAGHERAZZI	
3.1. Case 1: towards building an integrated solution on the basis of the example of care for the treatment of obstructive sleep apnea hypopnea syndrome (OSAHS).	39
3.1.1. Genesis: a medical file meeting only medical needs	39
3.1.2. Technical aspects	40
3.1.3. Patients as actors regarding their own health.	41
3.1.4. DataMedCare providers of technical solutions.	43
3.1.5. Economic model	44
3.1.6. What data? For what purpose?	46
3.1.7. A prefiguration of an integrated health service focused on the individual?	47
3.2. Case 2: clinical research and epidemiology 3.0.	49
3.2.1. The web platform.	51
3.2.2. Ongoing scientific projects in e-health	51
3.2.3. What kind of research question can we address using connected objects?	52

Part 2. Observations and Measurements	55
Introduction to Part 2	57
Chapter 4. Measurement and Knowledge in Health	59
Marie-Noëlle BILLEBOT, Marie-Ange COTTERET, Patrick VISIER, Norbert NOURY, Henri NOAT and Robert PICARD, with contributions by Nathalie BLOT and Bastien FRAUDET	
4.1. Measurement and knowledge in well-being and health: fundamentals	59
4.1.1. The right measurement	60
4.1.2. The correct measurement	61
4.2. Modalities of measurement	65
4.2.1. Sensors: typology and objectives	66
4.2.2. Interactive applications	69
4.2.3. The Hadagio case	69
4.3. Collective intelligence	74
4.3.1. The sharing of knowledge	74
4.3.2. Organizational aspects	75
4.3.3. Resilience, alert and security	83
Chapter 5. Challenges and Limitations of Data Capture versus Data Entry	85
Norbert NOURY and Robert PICARD, with contributions by Marie-Noëlle BILLEBOT, Frédéric DURAND-SALMON, Myriam LEWKOWICZ and Henri NOAT	
5.1. Uses confronted by technique	85
5.1.1. BePatient: feedback	86
5.1.2. Santé Landes	87
5.2. Different sensors for different uses	87
5.2.1. Biological measurement: challenges and constraints	87
5.2.2. Sensors and behaviors	90
5.2.3. Environmental sensors	91
5.3. Applications and actuators	91
5.3.1. The question of meaning for the patient-user	91
5.3.2. Integration into the ecosystem	92
5.3.3. Motivation and domestication	93
5.3.4. Self-measurements versus health measurements	94
5.4. Value of the data	95
5.4.1. Data qualification	95
5.4.2. Compared values of captured data versus collected data	96

Chapter 6. Models and Algorithms	99
Pierre BERTRAND, Daniel ISRAËL and Robert PICARD	
6.1. Representations and algorithms	100
6.2. Artificial intelligence in health	102
6.3. Issues and limitations of algorithms in health.	103
6.3.1. Issues	103
6.3.2. Utility	103
6.3.3. Optimization	104
6.3.4. Limitations	104
6.3.5. Input constraints	104
6.3.6. Power	105
6.4. Case studies.	105
6.4.1. Clinically-validated algorithms for early detection: MoovCare	106
6.4.2. “Do Well B.”: towards an objective measure of stress	108
Part 3. Methods and Tools for Facilitating Appropriation	115
Introduction to Part 3	117
Chapter 7. Design and Evaluation	119
Gaël GUILLOUX and Robert PICARD, with contributions by Sylvie ARNAVIEHLE and Perrine COURTOIS	
7.1. Co-design and Living Labs	120
7.1.1. Elements of method	120
7.1.2. Illustrations	121
7.1.3. Patient involvement in co-design: areas of vigilance	124
7.2. Approaches integrating design	125
7.2.1. Design: a structured approach	126
7.2.2. Specific problem of the design of connected objects	129
7.2.3. Two illustrations	133
7.2.4. The designer’s role	139
7.3. Conclusion	140
Chapter 8. Evaluations and Effectiveness	141
Karima BOURQUARD, Daniel ISRAËL and Robert PICARD, with contributions by Hugues BROUARD, Virginie DELAY, Matthieu FAURE and Bastien FRAUDET	
8.1. Evaluation of mobiles applications and connected objects	141
8.1.1. Challenges	141
8.1.2. Issues	142

8.1.3. Market responses	143
8.1.4. The HAS approach	143
8.1.5. Evaluation matrix	144
8.1.6. Evaluation methodology	145
8.1.7. Perspectives	146
8.2. Evaluation of use versus clinical use	146
8.2.1. Clinical trials and their challenges: MoovCare, the connected solution	147
8.2.2. Evaluation of the LLSA's approach	149
8.2.3. Conjugation of LLSA evaluation and evaluation associated with clinical trials	149
8.3. Test beds: presentation of the work of the Forum LLSA's "test bed" group	154
8.3.1. Concepts and definition	155
8.3.2. Perspectives	158
Chapter 9. Economic and Legal Aspects	159
Anne-Marie BENOÎT, Myriam LE GOFF-PRONOST and Robert PICARD	
9.1. Regulation in real life	159
9.1.1. The connected pillbox	159
9.1.2. The E4N cohort (section 3.2)	160
9.2. The cost of regulation	161
9.3. Soft law: an answer?	161
9.3.1. Discussion	166
9.4. Should we consider specific economic models for connected objects?	167
9.4.1. Economic context	167
9.4.2. Business model	168
9.4.3. Business model of connected objects	169
9.4.4. Multiple partnerships	170
9.4.5. Different economic models adapted	171
9.4.6. Value of data (C. Krychowski, ANR-13-SOIN-001 BBM project)	171
9.4.7. Link between the economic model and evaluation	172
9.4.8. Reimbursement of connected objects	173
9.4.9. Discussion	175
9.4.10. Conclusion	176
Chapter 10. The Question of Technique	177
Denis ABRAHAM and Robert PICARD, with contributions by Henri NOAT	
10.1. Feedback	178

10.1.1. Connectivity	178
10.1.2. Network engineering	179
10.1.3. Maintenance and management of change	181
10.1.4. Autonomy, reliability and adoption	182
10.1.5. Conclusion: technological mastery, myth or reality?	182
10.2. System engineering as an answer	184
10.2.1. Sensors	185
10.2.2. Collection network(s).	186
10.2.3. Network(s) for transporting measured information	187
10.2.4. Storage area	188
10.2.5. Algorithms	190
10.2.6. Identification of the user of the value-added service(s)	190
10.2.7. Tools and systems for access to value-added service(s)	191
10.3. Back to systemic issues	191
10.3.1. End-to-end data security	192
10.3.2. Resilience.	192
10.4. Conclusion	192
Part 4. Perspectives	195
Introduction to Part 4.	197
Chapter 11. Public Health Perspectives	199
Olivier AROMATARIO and Robert PICARD	
11.1. Clinical research based on real data.	199
11.1.1. Context	200
11.1.2. Problems	200
11.1.3. The issue of evaluation.	200
11.1.4. Connected objects and their impact on behaviors	201
11.1.5. Illustrations.	201
11.1.6. The future of clinical trials.	202
11.1.7. Exploitation of existing records.	203
11.1.8. Example.	204
11.1.9. Conclusion	204
11.2. The key elements to behavioral change: from simple tools to complex intervention support – the example of prevention.	204
11.2.1. E-health and prevention: which evaluation for which intervention?	204

Chapter 12. Interdisciplinary Perspectives	211
Mathias BÉJEAN, Gaël GUILLOUX, Robert PICARD and Hervé PINGAUD	
12.1. Anticipating connected objects in healthcare: combining patient–user leaders and design	211
12.2. Maturing new connected healthcare solution concepts: towards a controlled integrative approach	215
12.2.1. Strategic concept maturation activities	215
12.2.2. The enrichment of concepts: “clock” time versus “maturation” time	216
12.2.3. An example: the space industry and the genesis of new mission concepts	217
12.2.4. Upstream phases: from sequential logic to concurrent engineering	218
12.2.5. Concept Maturity Levels (CMLs)	219
12.2.6. An organizational response to the problem of “maturation”?	221
12.2.7. The case of healthcare	221
12.3. Observation of the transformations in engineering by a Living Lab: some elements of reflection	223
12.3.1. Evolutions in engineering of a Living Lab anchored in its territory	223
12.3.2. Engineering professions: what are we talking about?	224
12.3.3. The challenges of engineering professions	225
12.3.4. New approaches	227
12.3.5. Innovation sets new ways of acquiring knowledge	229
 Conclusion: the Success of Conditions Linked to the Connected Health Approach	 231
Robert PICARD	
 References	 235
 List of Authors	 243
 Index	 247