

Contents

Introduction	xi
Stéphane SAFIN	
Chapter 1. Exploring Neurocognition in Design	1
Julie MILOVANOVIC	
1.1. Towards a holistic approach to the description of cognitive design processes: cognition and neurocognition	3
1.2. Tools and methods for exploring the neurocognition of design activity	4
1.2.1. Tools: EEG, fMRI and fNIRS	4
1.2.2. Experimental techniques	5
1.2.3. Analysis methods	7
1.2.4. Regions of interest associated with design activity	9
1.3. Neurocognition of design processes: how far have we come?	12
1.3.1. What are the neurocognitive differences between design tasks and constrained problem solving?	13
1.3.2. Impact of using different idea generation techniques on the neurocognition of ideation	16
1.3.3. Creativity, divergent and convergent thinking	17
1.3.4. Hyperscanning as a technique for exploring the neurocognition of collaborative design.	21
1.4. Neurocognition of design processes: what are the limits?	23
1.5. Outlook	24
1.5.1. Benefits and challenges for designers	24
1.5.2. Interests and challenges for researchers in design sciences	25
1.5.3. Benefits and challenges for design teachers	26
1.6. Conclusion	26
1.7. References	26

Chapter 2. Mobilizing Values in the Design Process	37
Françoise DÉTIENNE, Chloé LE BAIL and Michael BAKER	
2.1. Introduction	37
2.2. Value-based approaches to design	38
2.2.1. Values: definitions	38
2.2.2. Moral and/or ethical values	39
2.2.3. Values embedded in design artifacts: a well-documented issue	41
2.2.4. Values in the design process: where do they fit in?	41
2.2.5. Challenges around design values	43
2.3. Participatory housing: a socio-technical system with strong social values	45
2.3.1. History and definition of participatory housing	45
2.3.2. Values in participatory housing projects	46
2.3.3. Values in the artifact codesign process	48
2.4. Discussion	51
2.5. Conclusion	52
2.6. References	53
Chapter 3. Graphic Representations in Design and Participation	59
Stéphane SAFIN	
3.1. Introduction	59
3.2. External cognition	60
3.3. Cognitive functions of external representations	63
3.3.1. Lightening the mental load	63
3.3.2. Structuring behavior	65
3.3.3. Materializing information	66
3.3.4. Extending cognitive abilities	68
3.4. Design representations as mediators of collaborative design activity	69
3.5. Towards a typology of architectural representations	72
3.6. Freehand sketching as a special case in design activities	76
3.7. Synchronic and diachronic articulations of forms of representation: towards the notion of a system of representations	78
3.8. Representations: a central issue in participation	82
3.8.1. The challenges of co-creation	84
3.8.2. Towards the construction of hybrid representation systems for co-creation	85
3.9. Conclusion	89
3.10. References	90

Chapter 4. Information Retrieval in Architectural Design and Parametric Modeling	99
Thomas DISSAUX and Stéphane SAFIN	
4.1. Introduction	99
4.2. Information retrieval.	100
4.2.1. Information retrieval for learning purposes.	103
4.3. Information retrieval in design	105
4.3.1. C-K	106
4.3.2. FBS.	109
4.3.3. Information, inspiration, fixation	111
4.4. The role of tools	116
4.4.1. Parametric design	119
4.4.2. New forms of design induced by PDEs	120
4.4.3. Outlook for education	125
4.5. Conclusion	126
4.6. References	128
Chapter 5. Citizen Participation in Design: Roles Evolving in the Face of Contemporary Challenges	135
Clémentine SCHELINGS	
5.1. Theory and critique of participatory design	136
5.1.1. Towards participatory design	136
5.1.2. Designers: a profession undergoing upheaval	148
5.1.3. On the user side: changing roles	152
5.2. Evolving roles and contemporary issues in participatory design	159
5.2.1. Understanding the complementary roles of designers and users	160
5.2.2. A new role for participation professionals	164
5.2.3. A new role for user ambassadors	167
5.2.4. Other contemporary issues linked to new forms of digital participation	171
5.3. Conclusion	173
5.4. Acknowledgments	174
5.5. References	174
Chapter 6. The Collaborative Challenges of Digitizing Construction Information: The Case of BIM	183
Anabelle RAHHAL, Samia BEN RAJEB and Pierre LECLERCQ	
6.1. Introduction	183
6.2. Digitalization of construction.	185
6.3. BIM for 4.0 construction	186
6.3.1. Towards collaborative management of building information	186
6.3.2. BIM maturity levels	187

6.3.3. Current response trends	190
6.3.4. Limits of the technocentric approach	196
6.3.5. The challenges of collaboration in BIM.	198
6.4. Conclusion	201
6.5. References	203
Chapter 7. People Information Modeling: The Potential of BIM for Human-Centred Design	213
Panos MAVROS	
7.1. Introduction	213
7.2. Four design challenges	214
7.3. Context: the notion of building usability.	216
7.4. A three-part framework	218
7.4.1. Approach 1: simulating human behavior	219
7.4.2. Approach 2: virtual reality, integrating users	222
7.4.3. Approach 3: building lifecycle and operation	225
7.4.4. Approach 4: a macroperspective on the built environment	226
7.5. Perspectives	227
7.6. References	228
Chapter 8. Architectural Ideation Instrumented by GAI	233
Gizem YÜKSEK and Aurélie DE BOISSIEU	
8.1. Introduction: challenges and opportunities of artificial intelligence (AI) for architectural design and ideation.	233
8.2. Modes of interaction with GAIs	235
8.2.1. Introduction to GAIs and the specifics of prompts.	235
8.2.2. Text-to-text: text content generation	236
8.2.3. Text-and-image-to-image: image generation	237
8.2.4. Image generation settings	238
8.3. Uses and potential uses of GAIs	239
8.3.1. Exploring architectural “styles”	239
8.3.2. Exploring materials	240
8.3.3. Exploring combinations of ideas	242
8.3.4. Exploring architectural morphology.	243
8.3.5. Exploring ambiances	246
8.4. Cognitive processes at work in AI-instrumented ideation	248
8.4.1. Divergence strategies	248
8.4.2. Convergence strategies	250
8.4.3. Meaningful indeterminacy and letting go.	251
8.4.4. Fixation	251
8.4.5. Alternating convergence and divergence	253

8.5. Internalization and externalization dynamics supported by GAs	255
8.5.1. The central role of the prompt	255
8.5.2. Iterations between text and image prompts	255
8.5.3. A dynamic process of internalization and externalization	257
8.5.4. A cross-computational design	258
8.6. Conclusion	259
8.7. References	261
List of Authors	265
Index	267