Sustainable Design

Tomayess Issa · Pedro Isaias

Sustainable Design

HCI, Usability and Environmental Concerns

Second Edition

Springer

Tomayess Issa
Curtin University School of Management and Marketing
Perth, WA, Australia

Pedro Isaias
West Wing
UNSW Sydney
Sydney, NSW, Australia

ISBN 978-1-4471-7512-4 ISBN 978-1-4471-7513-1 (eBook)
https://doi.org/10.1007/978-1-4471-7513-1

The author(s) has/have asserted their right(s) to be identified as the author(s) of this work in accordance with the Copyright, Designs and Patents Act 1988.
Springer London Heidelberg New York Dordrecht
1st edition: © Springer-Verlag London 2015
2nd edition: © Springer-Verlag London Ltd., part of Springer Nature 2022
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer-Verlag London Ltd. part of Springer Nature.
The registered company address is: The Campus, 4 Crinan Street, London, N1 9XW, United Kingdom

Foreword

In order to help achieve the world's goals of addressing environmental issues, we are tasked with making our Information Technology (IT) systems and business processes more environmentally friendly and harnessing the potential of IT to solve or mitigate pressing environmental problems. Additionally, the IT sector is being scrutinized more closely owing to the effects that IT products and services have on sustainability throughout their lifecycle. To mitigate risks and maximize the advantages and possibilities offered by green IT, a comprehensive and strategy based on solid principles and best practices is required. Business executives, legislators, IT experts, academics, and students, as well as the general public, need realistic advice on how to utilize green IT. However, there are very few books on green IT that are both practical and helpful.

Many IT professionals, business personnel, and individuals who use IT are keen to explore and implement innovative ideas in this field. The combination of the principles of Human–Computer Interaction (HCI) with sustainability design is one such innovation. Previously, the primary goal of incorporating HCI in the design process was to create a user interface that was both efficient and effective in meeting the needs and requirements of prospective users. However, this book is intended to guide designers and users in the creation of IT systems and devices that meet future needs while incorporating HCI principles and sustainability in the design.Therefore, this work offers guidelines regarding the management and participation of users in the development of successful designs for various platforms such as websites, phones, tablets, and wearable devices. The intention of this book is to provide guidelines for the clean, minimalist design of systems that enable users to interact easily with the platform, while minimizing any negative impacts on the environment.

This book is for anyone interested in learning about sustainable design in human–computer interaction, usability, and environmental concerns in order to ensure a more sustainable ecosystem for coming generations. These designs have been evaluated by users in a number of countries comprising both developed and developing nations: Australia, Brazil, China, Germany, India, Norway, Singapore, South Korea, Sweden, the UK, and the USA. The data obtained from the research participants helped the

researchers to determine the most important elements to include in the new sustainable design. Additionally, the writers will continue to include other subjects into to the textbook, including social and global problems, social networking, big data, and Internet of Things (IoT).

Finally, this book establishes the relationship between HCI, usability, and sustainable design and presents the most up-to-date knowledge on the aforementioned topics, as the majority of HCI authors are eager to develop frameworks, tools, techniques, and models that comply with sustainable design requirements.

Riyadh, Saudi Arabia

Abdulaziz Albahlal, Ph.D.
IT Professional, Consultant at Saudi Authority for Data and Artificial Intelligence (SDAIA)

Acknowledgements

We acknowledge the support of all people that contributed directly or indirectly to this book.

Tomayess Issa owe special gratitude first to God, the Almighty, and her parents: V. Rev. Fr. Boutros Touma Issa; and of course, to the Spirit of Bathqyomo Marine Khoury-Issa (2016+). Her sister Dr. Theodora, her brother Dr. Touma, his wife Siba, and their daughter Talitha; her Sister Tamara, her husband Tony, and their children Tabitha, Antoinette, Jacob, and finally to her bother Theodore, his wife Mary, and their children Cephas and Mary; for their continuous support, and encouragement since without their help, this work would never have been completed. Tomayess would like to acknowledge the support of The School of Management and Marketing at the Faculty of Business and Law of Curtin University, Australia, for their inspiration and encouragement.

Pedro Isaias would like to acknowledge The School of Information Systems and Technology Management (SISTM) from the University of New South Wales, Sydney, for their support. Also, a special acknowledgment to Sara Pifano from ISRLab for her continuous support. Finally, he would like to acknowledge the support of his family. Without their assistance, this work would not have been possible at all.

Perth, WA, Australia — Tomayess Issa
Sydney, NSW, Australia — Pedro Isaias

Contents

1 Introduction 1
1.1 Introduction 1
1.2 Human–Computer Interaction 2
1.3 Usability 4
1.4 Sustainability 5
1.5 Sustainable Design 7
1.6 Methodology 11
1.7 The Initial Sustainable Step in the New Participative Methodology for Sustainable Design 11
1.8 Outline of the Book 13
1.9 Conclusion 17
References 17

2 Usability and Human–Computer Interaction (HCI) 23
2.1 Introduction 23
2.2 User-Centered System Design 24
2.3 Human–Computer Interaction (HCI) 25
2.3.1 What is HCI? 25
2.3.2 HCI as Process 27
2.3.3 Relationship Between the HCI and Human Dialogue 27
2.3.4 Goals of HCI 28
2.3.5 Purpose of HCI 29
2.3.6 Interaction and Interactivity 30
2.3.7 Factors in HCI Design 32
2.4 What is Usability? 33
2.4.1 Concepts of Usability 34
2.4.2 Usability Criteria 36
2.4.3 Usability Specifications 37
2.5 Conclusion 38
References 39

3 User Participation in the System Development Process 41
3.1 Introduction 41
3.2 What is Participation? 41
3.2.1 Change Processes 44
3.2.2 Managing User Participation in Development Processes 46
3.2.3 How to Participate? 47
3.2.4 Some Problems with the Participative Approach 50
3.3 How We Know Our Users 51
3.3.1 User Characteristics 51
3.3.2 Knowledge of User Tasks 53
3.3.3 Recruiting Users 54
3.3.4 Techniques for Observing and Listening to Users 55
3.3.5 Internet Marketing and User Responses 58
3.4 Conclusion 59
References 60

4 Physical, Cognitive, and Affective Engineering 63
4.1 Introduction 63
4.2 Physical Engineering 64
4.3 Cognitive Engineering 66
4.4 Goals, Operators, Methods, and Selection Rules (GOMS) 68
4.5 Norman's Model 69
4.6 Affective Engineering 69
4.7 Conclusion 72
References 72

5 Color, Prototyping and Navigation, Principles and Guidelines Design, Evaluation and Testing, and Task Analysis 75
5.1 Introduction 75
5.2 Color 76
5.3 Navigation 78
5.4 Prototyping 80
5.5 Guidelines and Principles Design 81
5.6 Evaluation and Testing 83
5.6.1 What is Evaluation? 83
5.6.2 Why Evaluate? 84
5.6.3 When to Evaluate? 84
5.6.4 Methods and Means of Evaluation 85
5.7 Task Analysis 86
5.7.1 Goals, Tasks, and Actions 87
5.7.2 Techniques for Identifying Types and Granularity of Tasks 87
5.8 Conclusion 89
References 89

6 Models and Methodologies 93
6.1 Introduction 93
6.2 Lifecycle Models 95
6.2.1 The Waterfall Lifecycle Model 95
6.2.2 The Spiral Lifecycle Model 96
6.2.3 Rapid Application Development (RAD) 97
6.2.4 Systems Development Lifecycle 97
6.2.5 The Star Lifecycle Model 99
6.2.6 The Usability Engineering Lifecycle 100
6.2.7 Summary of Lifecycle Models 100
6.3 Information Systems Development Methodologies 101
6.3.1 Structured Systems Analysis and Design Methodology (SSADM) 102
6.3.2 Soft Systems Methodology (SSM) 104
6.3.3 User-Centered Development Methodology 108
6.3.4 ETHICS Methodology 110
6.3.5 Summary of Information Systems Development Methodologies 112
6.4 Methodologies for Developing Websites 114
6.4.1 Human Factors Methodology for Designing Websites 115
6.4.2 Relationship Management Methodology (RMM) 116
6.4.3 The W3DT Design Methodology 119
6.4.4 Information Development Methodology for the Web 121
6.4.5 The Web Site Design Method (WSDM) 123
6.4.6 Summary of Methodologies for Developing Websites. 126
6.5 Marketing Methodologies 129
6.5.1 E-Marketing Plan 129
6.5.2 The Advertures Company Methodology 133
6.5.3 The Market-Vantage (Internet Performance Marketing) Methodology 135
6.5.4 EnSky's Unique Methodology 138
6.5.5 Review of Marketing Methodologies 139
6.5.6 Summary of Marketing Methodologies 139
6.6 Detailed Website Design and Implementation 142
6.6.1 The Object-Oriented Hypermedia Design Model (OOHDM) 142
6.6.2 Implementation Methodology 144
6.7 Summary of Information Systems Development Methodologies, Methodologies for Developing Websites, and Marketing Methodologies 145
6.8 New Participative Methodology for Marketing Websites (NPMMW) 151
6.9 Conclusion 156
References 156

7 New Participative Methodology for Sustainable Design (NPMSD) 159
7.1 Introduction 159
7.2 New Participative Methodology for Sustainable Design 160
7.3 Conclusion 187
References 189

8 Innovative Technologies: Applications in the Present and Considerations for the Future 193
8.1 Introduction 193
8.2 Social Networks in the Information Age 194
8.2.1 Implications for Business 194
8.2.2 Social Networks in the Education Sector 195
8.2.3 Social Networks Main Challenges 196
8.3 AI and the Barrier Between Human and Machines 197
8.3.1 AI in Educational Settings 198
8.3.2 The Health Sector Under AI Adoption 199
8.3.3 The Issues and Ethics of AI 200
8.4 IoT and Big Data 201
8.4.1 IoT for Smarter Cities 201
8.4.2 E-Government's Adoption of IoT 202
8.4.3 Assessing IoT Challenges 203
8.5 XR and the Boundaries Between Realities 204
8.5.1 XR in Healthcare 204
8.5.2 The Business Affordances of XR 205
8.5.3 The Challenges of Bridging Realities 206
8.6 Reflecting About the Future of ICTs 207
8.6.1 Sustainability 207
8.6.2 Digital Divide 208
8.7 Conclusion 209
References 210

Index 217