Preface

Usability is defined by the International Organization for Standardization (ISO) norm 9241 as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.” Usability is about making systems and digital products (e.g. computer systems, video games, digital toys, Web pages, etc.) easier to use, and matching them closely to user requirements, needs and desires. Digital products and computer systems that have high usability should be used more efficiently and frequently, and they often are sold more (in the case of commercial applications). Thus, people’s productivity is incremented. However, products with bad usability make people waste their time trying to figure out how they work. It is possible to improve the design of digital products by carrying out usability testing of those products. Usability evaluation is an important part of the development life cycle of any software and hardware to be used by people, and all software and hardware developers should take into account usability testing of their products. There are special cases where usability is a very important part of the product design, for example, in the design of critical systems (systems that can threat human or animal life or the environment when they experience functional problems) and mobile products (such as smart phone applications). Both require special usability methodologies and techniques.

Cases on Usability Engineering: Design and Development of Digital Products presents academic and practicing hands-on experience on usability methods, tests and techniques to improve the human-computer interaction during the design and development of digital products. These products include Web pages, information systems, and interfaces found in mobile computing, among others, to be used for work, entertainment, learning, and for other applications. The usability experiences are presented in this book as comprehensive case studies to be used as learning and teaching materials in usability, human-computer interaction, human factors, software engineering, software systems, and related undergraduate and graduate courses. In this book, I included new perspectives from top practitioners, lecturers, and researchers around the world from the areas of computer science, human-computer inte-
tion, cognitive science, psychology, human factors, and other areas that contribute
to usability engineering, human-computer interaction, and software engineering.

Case studies can help computer science and information technology (IT) students
prepare for real-world situations and problems by providing an approximation of vari-
ous professional environments. Through the discussion and examination of specific
cases on the usability of digital products, students are given the opportunity to work
out their own professional issues through the trials, “war stories,” experiences, and
research findings of usability researchers, specialists, lecturers, and practitioners.
One of the advantages of using case studies as a mode of instruction is that it al-
lows computing students the exposure to contexts and settings that they might not
otherwise experience in educational settings, acquiring the necessary competences.

Writing case studies on usability should require the “coming together” of science,
technology, and social knowledge, among others, working in an interdisciplinary
fashion, since the field of usability is supported by a number of knowledge areas.
This “coming together” happened in this book. New perspectives from top researchers
and practitioners around the world are also included. A number of chapters already
answer the questions on how and why usability can support the design and develop-
ment of digital products, such as Web pages and information systems, among others.
Cases on Usability Engineering comprise a comprehensive –yet specialized– state-
of-the-art compendium of case studies of usability in socio-technical approaches.

This book is one of my projects I always wanted to make since I started studying
my PhD in Computer Science and Artificial Intelligence in late nineties. The idea
for this book began when I saw how important usability testing was when it was
applied to the design and development of computer programs to be used by people,
as watching how my dissertation adviser carried out many usability studies.

Something that also motivated me to write this book is that in many Latin American
countries there is a strong need to improve many of the Web pages, computer systems
and digital products developed there. I felt that one way to do this is to edit a book
that should describe the importance and methods of usability evaluation to improve
the usability of such digital products. It is necessary to improve the quality and ease
of use of many software products (and sometimes hardware) that are generated in
many countries. Over the years, I would say decades, I have seen many computer
systems and Web pages created in universities and in private companies that have
many problems in its interface design. There are not only graphic design problems,
but also functional problems. Many people using those pieces of software or Web
pages cannot do their work or other activities properly due to usability errors, and in
many cases they must use them because they have no other choice. Some managers of
companies and institutions (and some professionals from the software industry) still
think that conducting usability testing is prohibitively expensive. Usability definitely
is not a luxury. That is quite the opposite. It is an important activity that companies
and institutions that develop software and hardware applications should invest in.
This book will serve as a supporting material in academic courses and workshops such as usability, human-computer interaction, ergonomics, engineering and related software which addresses the issue of usability and user experience (UX). I hope this book will be useful for new (and not so new) generations of software developers, students, teachers and technologists that wish to improve their knowledge on usability testing with practical cases such as the ones presented in this book.

The main objective *Cases on Usability Engineering: Design and Development of Digital Products* is to provide a technical rationale for computing practice in the area of usability, providing engaging and thought-provoking case discussions, which will serve to support the comprehension of usability methods and techniques applied to the design and development of digital products and software systems.

The book aims to provide software developers, as well as students and professors of higher education, an introduction to the subject of usability and a compendium of methods and techniques used to apply usability in the design and development digital products, such as Web pages, information systems, mobile applications, video games and more.

The volume will serve as a comprehensive reference for students, lecturers and specialists wishing to learn from and contribute to the area of usability, who require information as to how usability methods and techniques can be potentially applied to the design and development of human-computer interfaces.

*Cases on Usability Engineering: Design and Development of Digital Products* will impact its different audiences by providing information about how and why usability can improve digital technology. This book will provide feedback to its readership by offering diverse technological solutions that many academics have somewhat failed to disseminate. This book will provide a space for its readership to be introduced to topics students ignore or are unaware of, in order to discuss and promote usability. *Cases on Usability Engineering: Design and Development of Digital Products* will impact students, lectures, researchers and practitioners that already study, conduct research, and develop computer applications on the book topic. This book will become an important source of new knowledge, and will pave the way for further computing developments and applications for usability.

This volume will represent potential contribution to the development of usability and human-computer interaction and their applications in computing education. Exploring the practical and theoretical issues of both areas of knowledge, the book will contribute to expand the applications on methods, models, approaches, design guidelines, frameworks, and tools developed in the area of usability towards a dynamic understanding and hands-on experience described in the form of case studies written by usability researchers and practitioners.

There are many technical books about the theory, principles, and the general impact of usability and human-computer interaction and books, but this is not particularly the case with this book. Some of those usability books do not include important and
recent topics, such as mobile computing, and brain-computer interfaces. Thus, this book will be distinguished from existing titles on usability. Moreover, this book will serve as an ideal reference for computer science, and other areas where the topic of usability is addressed and researched.

The target audience of this book will be composed of computer science students, lecturers, instructors, and academics from other related areas. In addition, this book will capture the attention of all those engaged in fields such as knowledge management, information technologies, computer networks, and human factors.

The case studies from this book will serve as supporting learning material for computer science and IT courses on the topic of usability, with the support of other related areas. The book will also serve as library reference and bibliographic supplement for IT, Computing, Human-Computer Interaction, Networking, Web page, graphic design and other Computer Science and technology courses for undergraduate and graduate students, as well as researchers and practitioners interested in the topic. In addition, the case studies from the book will also serve to usability practitioners that would like to put usability knowledge into practice.

Practitioners will also benefit from the pragmatic techniques, implementation guidelines, and case discussions. In addition, undergraduate-level and graduate-level students will find the case studies useful in their course work and research. This book will also be a welcome addition to academic libraries’ research collections for further consult in this particular topic. Ultimately, this book will provide the latest research and applications on usability in order to provide students, researchers, lecturers and practitioners the necessary background in theory and practice to pursue this endeavor.

The book is organized into four sections according to the types of digital products that were analyzed in each chapter: Usability of Web Products (chapters 1 to 7), Usability of Mobile Applications (chapters 8 and 9), Usability of Critical Systems (chapters 10 to 12), and Usability of Virtual Environments, Simulations and Video Games (chapters 13 to 16). Students and/or practitioners may want to read and study the chapters according to the type of digital product wishing to analyze, design or improve. The sixteen chapters are described as follows:

Conducting usability sessions with children is always challenging due to their cognitive skills and vocabulary comprehension, among other issues. These characteristics make it difficult to assess the tasks children need to perform when evaluating a digital product. Chapter 1 (Exploring Evaluation Techniques for Children’s Websites) describes usability testing of a science Web site with children and lessons learned from the experience.

As described in Chapter 2 (Social Negotiations in Web Usability Engineering), user participation and involvement are very important when carrying out usability studies. In addition, social and technical “negotiations” between users and design-
ers play a fundamental role in studying Web site usability. This chapter shows that early user engagement in the design of the Web site using prototypes should support socio-technical negotiations.

A user profile is a characterization of a digital product’s target users, which provides condensed and representative information about users. This tool can help usability designers better understand the target population. Chapter 3 (Developing User Profiles for Interactive Online Products in Practice) describes an exercise with graduate students who created user profiles for online products, showing that people who develop effective user profiles should have previous experience and skills to administer and interpret user demographic questionnaires.

Chapter 4 (Usability Testing of an Education Management Information System: the Case of the University of Colima) explains a compelling case study on the usability testing of an online university reporting system developed by the University of Colima, Mexico. This system shows institutional management statistics, such as undergraduate and graduate statistics. Three usability tools were used in a two-phase usability study of the system: a heuristic evaluation, the System Usability Scale questionnaire, and the Technology Acceptance Model.

Chapter 5 (Usability Impact Analysis of Collaborative Environments) provides a case study involving the application of important usability principles to improve the use of an online corporate collaborative environment, taking into account business goals, user engagement, and the collaborative nature of a company.

The author of Chapter 6 (A Practitioner’s Approach to Collaborative Usability Testing) describes how usability testing and usability methods can be integrated into the development life cycle of public sector Web sites, a necessary step that few public institutions have implemented. Chapter 6 goes on to explain that most public sector Web sites are launched without public (final users) consultation, a bad practice that needs to be avoided. Thus, this chapter describes a methodology that includes collaborative usability testing, the inclusion of subject matter experts, IT professionals, stakeholders, and, of course, potential users of the Web sites.

The case study described in Chapter 7 (Integrating Semiotics Perception in Usability Testing to Improve Usability Evaluation) demonstrates the importance of semiotics in the assessment of visual objects employed in Web pages, such as links and icons. According to the chapter authors, semiotics can improve intuitiveness of the computer interface, and semiotic analysis can be useful for identifying usability problems, which represents a cost-effective methodology to support usability testing.

Chapter 8 (Developing the Intel® Pair & Share Experience) shows the development and usability testing of a commercial application intended for sharing digital photographs among smart phones, PCs, and tablets called Intel® Pair & Share. This cross-platform application was developed based on an interdisciplinary approach and takes into account the wide variety, benefits and challenges of current mobile devices.
Chapter 9 (A Usability Study of Mobile Text Based Social Applications: Towards a Reliable Strategy for Design Evaluation) explains a thorough usability study that tests three social network applications running on mobile devices. The usability testing was carried out using an adapted version of the System Usability Scale (SUS) questionnaire. Based on the usability testing results, the authors propose the creation of a set of heuristics to improve the interface design of mobile social networks.

The case study of chapter 10 (Pilot implementation Driven by Effects Specifications and Formative Usability Evaluation) conveys an important formative usability study performed on an electronic health care record, a critical system used at maternity wards in European hospitals. The authors of this case study used a number of usability tools for their studies, including low-fidelity prototypes (mock-ups) and high-fidelity prototypes (the pilot system). The chapter goes on to explain usability engineering issues, the iterative process and lessons learned.

Chapter 11 (Design and Development of a Digital Error Reporting System for a Rural Nursing Home) describes an interesting case study on the development and usability testing of an online error-reporting system for a rural nursing home. Under-reporting of error events in the workplace, a common occurrence in nursing homes, can result in serious complications. The developed online system was compared to a traditional paper-based reporting approach. Results from the evaluations showed no significant difference in performance with regard to the online system. According to the chapter authors, this is mainly due to the users’ overwhelming familiarity with the paper-based reporting system, although the usability study showed that users preferred the digital interface.

Chapter 12 (The Usability Evaluation of a Touch Screen in the Flight Deck) offers a case study on the usability testing of a flight deck touch-screen prototype. Safety and other issues of this prototype were analyzed using multidisciplinary and iterative testing approaches. The chapter also stresses the importance of understanding and knowing the context in which the technology is to be used. Especially important is considering the crucial constraints that may affect the design of the system, which in this case is the airliner flight deck touch screen simulator.

Chapter 13 (BCI-Based User-Centered Design for Emotionally-Driven User Experience) illustrates the importance of using physiological data in usability testing. The authors devised a special methodology called user-centered evaluation (UCE), which as applied to the design of interactive and adaptable virtual environments. This case study describes the use of a brain-computer interface (BCI) that obtains important data about the user’s emotional levels while interacting with the virtual environment. A BCI is a digital human-computer interface that establishes a communication pathway between a brain and a digital device that enables signals from the brain to direct some external activity, such as steering an avatar in a 3D virtual environment.
Chapter 14 (Digital Heritage Systems: The ARCO Evaluation) explores a number of quantitative and qualitative usability methods to evaluate the usability of an augmented reality system that displays an interactive virtual museum. The case study describes how usability methodologies can improve engagement and interaction of a virtual museum, taking into account users’ subjective presence and learning.

The case study described in Chapter 15 (Usability Optimization of a Military Training System) is compelling. It is about how to improve the design of a military training system where highly-important and demanding key requirements and challenges need to be addressed. To analyze this, it was necessary to design and develop a useful training system to help instructors to apply training lessons to members of the armed forces. This case study also comprises a number of formative and summative usability methodologies that were used to identify the key requirements and improve system performance.

Chapter 16 (Pogo Chat) presents a case study that analyzes the usability of a chat window added to a number of online video games that belong to a Web portal called Pogo. The chat feature was eagerly wanted by many Pogo users. In response, the authors analyzed whether this requested option was feasible or not, since the Pogo game developers did not want the chat window to interfere with the game play. The case study describes a number of chat solutions tested and usability testing methods used for the Pogo games.

The chapters were selected following a thorough analysis based on many factors, including the appropriateness for this book, the depth on which the chapter was written, the practical issues presented in the chapters, the educational value of the case study described in the chapters, the type of the usability methodologies employed, the clarity and structure of the chapters, and the importance of the results from the usability testing, among other issues. To improve the standards of scientific rigor of this book, each chapter was double-blind peer-reviewed by at least two usability, human-computer interaction and software engineering experts from around the globe. This book would not have been possible without the valuable support of the Editorial Advisory Board (EAB).

I sincerely hope this book will help current and future generations of computer science and IT students, practitioners and researchers comprehend the importance and practicality of usability evaluations. These generations are and will be the designers and developers of digital products that many people will use, rely on and enjoy, provided that those products will be developed following adequate usability studies and methodologies. It is now more than ever that case studies on usability engineering can be a great support to those generations.

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