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Human-Computer Interaction is a multidisciplinary field focused on human aspects of the development of computer technology. As computer-based technology becomes increasingly pervasive - not just in developed countries, but worldwide - the need to take a human-centered approach in the design and development of this technology becomes ever more important. For roughly 30 years now, researchers and practitioners in computational and behavioral sciences have worked to identify theory and practice that influences the direction of these technologies, and this diverse work makes up the field of human-computer interaction. Broadly speaking it includes the study of what technology might be able to do for people and how people might interact with the technology. In this series we present work which advances the science and technology of developing systems which are both effective and satisfying for people in a wide variety of contexts. The human-computer interaction series will focus on theoretical perspectives (such as formal approaches drawn from a variety of behavioral sciences), practical approaches (such as the techniques for effectively integrating user needs in system development), and social issues (such as the determinants of utility, usability and acceptability).

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# Web Accessibility

A Foundation for Research

 Springer

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*John Slatin, a well-known Web Accessibility expert and friend to many people in the accessibility community, he passed away on Monday, March 24th 2008. John was in the middle of writing one of our chapters when he became too ill to continue. In recognition of his life and work, we would like to dedicate this book to him.*

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# Introduction

Web accessibility conjures the vision of designers, technologists, and researchers valiantly making the World Wide Web (Web) open to disabled users. While this maybe true in part, the reality is a little different. Indeed, Web accessibility is actually about achieving two complementary objectives: (1) reverse engineering and design rediscovery – correcting our past mistakes by making the current Web fulfil the original Web vision of access for all and (2) the discovery and understanding of factors which influence the accessibility of the Web within the context of the human interaction. It just so happens that in the process of trying to achieve these objectives, that have for the most part been ignored, we may understand and even solve, a number of larger scale usability issues faced by every Web user. Indeed, by understanding disabled-user's interaction, we enhance our understanding of all users operating in constrained modalities, where the user is handicapped by both environment and technology. It is for this reason that Web accessibility is a natural preface to wider Web usability and universal accessibility; it is also why main-stream human factors researchers take it so seriously and understand its cross-cutting benefits.

Humans are variously skilled and part of assuring the accessibility of technology consists of seeing that an individual's skills match up well with the requirements for operating the technology. There are two components to this; training the human to accommodate the needs of the technology and designing the technology to meet the needs of the human. The better we do the latter, the less we need of the former. One of the non-trivial tasks given to a designer of human-machine interfaces is to minimize the need for training. Because computer-based technology is relatively new, we have concentrated primarily on the learnability aspects of interface design, but efficiency of use once learning has occurred and automaticity achieved has not received its due attention. In addition, we have focused largely on the ergonomic problems of users, sometimes not asking if the software is causing cognitive problems. In the area of accessibility, efficiency and cognetics can be of primary concern. For example, users who must operate a keyboard with a pointer held in their mouths benefit from specially designed keyboards and well-shaped pointers. However well-made the pointer, however refined the keyboard layout, and however comfortable the physical environment we have made for this user, if the software requires more keystrokes than absolutely necessary, we are not delivering an optimal interface for that user. When we study interface design, we usually think in terms of accommodating higher mental activities, the human capabilities of conscious thought and ratiocination. Working with these

areas of thought bring us to questions of culture and learning, and the problems of localizing and customizing interface designs. These efforts are essential, but it is almost paradoxical that most interface designs fail to first assure that the interfaces are compatible with the universal traits of the human nervous system in particular those traits that are sub-cortical and that we share with other animals. These characteristics are independent of culture and learning, and often are unaffected by disabilities. Most interfaces, whether designed to accommodate accessibility issues or not, fail to satisfy the more general and lower-level needs of the human nervous system. In the future, designers should make sure that an interface satisfies the universal properties of the human brain as a first step to assuring usability at cognitive levels.

*Jef Raskin*

*The Humane Interface*

We may imagine that there are many reasons for the Web to be accessible ranging from moral necessity, through ethical requirement, to legal obligation. However, the two most compelling are solid mainstream considerations: the business case and the über use case.

The business case for Web accessibility is strong on three fronts. First, one in five people over the age of 65 are disabled. Population demographics indicate that our populations are ageing across the board. As the population ages, the financial requirement to work longer is increased, but the ability to work longer is reduced because disability becomes a bar to employment. Secondly, an ageing and disabled, but Web literate, population indicates a large market for online shopping and services especially when mobility is a problem for the shopper. A final benefit for business, keeping in mind that disability does not equal unskilled, is a highly motivated and skill-rich workforce. With the growth of the knowledge economy through many developed countries, and a move from manual work to more thought-and communication-based activities, there is the very real possibility of disabled Web users being able to finding productive, fulfilling, and social empowering employment; if only technology, and specifically the Web, was available to them. *Web accessibility means commercial success.*

Web accessibility is really just a über use case because in the end, we will all be handicapped by the technology or the environment. Work on Web accessibility is helping us address many other domains including those centred around user mobility. For instance, work on physical disability and the Web is helping solve problems of the usability of mobile technology. By applying the same technology, used to counter a physically disabled user's tremors and jerky movements, to the mobile Web, the operational problems of mobile interaction in moving environments are being solved. Similarly, mobile Web access suffers from the interoperability and usability problems that make the Web as difficult to interact with for mainstream users as it is for visually impaired users. Again, solutions proposed 3–4 years ago in the Web accessibility community are now being applied to mainstream mobile devices. Indeed, a fact often forgotten is that we are all unique. The disabled user serves as a reminder that Web accessibility is a truly individual experience and that by understanding the flexible and personalisation required by disabled users, we can understand that at some point this same

flexibility and personalisation will be required by all. *To understand the needs of disabled users is to understand the needs of everyone.*

An important route to achieve Web accessibility is to improve our knowledge and understanding of it through research and innovation. Although many books have been published on Web accessibility, unfortunately they have been mostly written from a technical perspective. They do not really tell the whole story – What about research on Web accessibility? How did it all start? How did it evolve? Which sub-areas have been developed? What is the current state of the art? What are the missing pieces? If we want to take Web accessibility to the next level, we need to answer these questions and this book aims to do that. We have invited experts from different specialised areas of Web accessibility to give us an overview of their area, discuss the limitations and strengths, and present their thoughts on the future directions of that area. As the famous Nobel prize winning research scientist Albert Szent-Gyorgyi said *research is to see what everybody else has seen and to think what nobody else has thought*. This book aims to help research scientists who are new in the area to see what everybody else has seen and help them think what nobody else thought.

## Web Science

So how does Web accessibility and the foundational research of this book fit into the new and evolving field of Web Science? We can see that practical aspects such as guidelines and practice-related topics fit more closely into a Web engineering context. However, Web accessibility research investigates the Web from both an experimental and analytical deployment viewpoint. Indeed, we can see this to be exactly the perspective of the Web Science Research Initiative.

The Web is an engineered space created through formally specified languages and protocols. However, because humans are the creators of Web pages and links between them, their interactions form emergent patterns in the Web at a macroscopic scale. These human interactions are, in turn, governed by social conventions and laws. Web science, therefore, must be inherently interdisciplinary; its goal is to both understand the growth of the Web and to create approaches that allow new powerful and more beneficial patterns to occur.

*Tim Berners-Lee, Wendy Hall, James Hendler et al.  
Creating a Science of the Web (Science 11 August 2006)*

We can see that these two aspects of experimental, *lets say in vitro*,<sup>1</sup> and observational, “*in vivo*,”<sup>2</sup> enquiry are closely related and are present with Web accessibility research. Indeed, by understanding the Web as it evolves *in vivo* in concert with running experimental studies *in vitro*, our work is placed squarely at the centre of Web Science. Web accessibility research is however missing

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<sup>1</sup> (Latin: (with)in the glass).

<sup>2</sup> (Latin: (with)in the living).

components of the Web Science vision at the moment in that we do not investigate the Web as a first-order organism. We do not yet introduce our in vitro work into the deployed Web and continue to investigate the effects it has on the Web organism” over time.

## Keep in Mind

To understand accessibility, the researcher must take account a number of truths: (1) there is never just one solution; (2) solutions are not simple; (3) a single solution will never work, instead, combinations of solutions are required; (4) you do not know the user or their requirements at the granularity required to make assumptions; and finally, (5) remember that work in the Web accessibility field is not only for disabled people, but for organisations and people without disabilities.<sup>3</sup>

**To build applications and content that allows for heterogeneity, flexibility, and device independence is incredibly difficult, incredibly challenging, and incredibly necessary.**

## Orientation

With this in mind, we will split this book into four main parts. First, we will examine the intersection between accessibility and disability in an effort to understand the differing needs of users, and the technology provided to fulfil those needs; you could consider this to be a Disability Primer.

In Parts II and III, we will investigate the past and current state of play in Web accessibility research. We will define the tools, techniques, and technologies in current use to help design, build, check, and transform Web pages into accessible forms.

Finally, we will present an analysis of the future direction of Web accessibility based on an investigation of emergent technologies and techniques. By defining these emergent areas, explaining their effect on the wider Web, and their possible impact on usability, we may be able to predict the future direction of Web accessibility, and buy guiding research and development suggest a different and accessible future for the fast-evolving Web.

## About this Book

Web accessibility has tended to be considered as a Web Design challenge, and therefore, existing relevant books are mostly prescriptive tutorials on how to achieve Web accessibility. However, there are hundreds, if not thousands, of

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<sup>3</sup> See <http://www.w3.org/WAI/EO/>.

research scientists and research and development programmers working in academia and industry advancing the understanding of the current Web, and making developments in the next Web, accessible. As such, this book will cover Web accessibility from a purely broad research perspective. The book is primarily aimed at academics, scientists, engineers, and postgraduate students as the definitive, foundational text on Web Accessibility from a deeply research perspective. Written by leading experts in the field, it not only provides an overview of existing research but looks to future developments and includes expert opinion with the understanding that this kind of insight cannot be derived purely from existing research publication stores such as Google Scholar.