Assistive Technology Design for Intelligence Augmentation

Synthesis Lectures on Assistive, Rehabilitative, and Health-Preserving Technologies

Editor

Ron Baecker, *University of Toronto*

Advances in medicine allow us to live longer, despite the assaults on our bodies from war, environmental damage, and natural disasters. The result is that many of us survive for years or decades with increasing difficulties in tasks such as seeing, hearing, moving, planning, remembering, and communicating.

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Assistive Technology Design for Intelligence Augmentation

Stefan Carmien
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ABSTRACT

Assistive Technology Design for Intelligence Augmentation presents a series of frameworks, perspectives, and design guidelines drawn from disciplines spanning urban design, artificial intelligence, sociology, and new forms of collaborative work, as well as the author's experience in designing systems for people with cognitive disabilities. Many of the topics explored came from the author's graduate studies at the Center for LifeLong Learning and Design, part of the Department of Computer Science and the Institute of Cognitive Science at the University of Colorado, Boulder. The members of the Center for LifeLong Learning and Design came from a wide range of design perspectives including computer science, molecular biology, journalism, architecture, assistive technology (AT), urban design, sociology, and psychology.

The main emphasis of this book is to provide leverage for understanding the problems that the AT designer faces rather than facilitating the design process itself. Looking at the designer's task with these lenses often changes the nature of the problem to be solved.

The main body of this book consists of a series of short chapters describing a particular approach, its applicability and relevance to design for intelligence augmentation in complex computationally supported systems, and examples in research and the marketplace. The final part of the book consists of listing source documents for each of the topics and a reading list for further exploration.

This book provides an introduction to perspectives and frameworks that are not commonly taught in presentations of AT design which may also provide valuable design insights to general human–computer interaction and computer-supported cooperative work researchers and practitioners.

KEYWORDS

intelligence augmentation, assistive technology, design frameworks, cross-discipline design, task support for persons with cognitive disabilities, computer-supported work

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List of Abbreviations

AAC	Augmentative and Alternative Communication
ADA	Americans with Disabilities Act
ADL	Activities of Daily Living: basic activities including eating and dressing
AI	Artificial Intelligence
ANOVA	Analysis of Variance
ASSISTANT	An AAL EC project: Aiding SuStainable Independent Senior TrAvellers to Navigate in Towns
AT	Assistive Technology
AT/IA	Assistive Technology using Intelligence Augmentation
CLever	The CognitiveLEVERs project in L3D, University of Colorado
COACH	The Cognitive Orthosis for Assisting with aCtivites in the Home project from Intelligent Assistive Technology and Systems Lab (IATSL) in the University of Toronto
DC	Distributed Cognition
DFA	Design for All
DM	Device Model
DRD	Digital Resource Description
EU4ALL	European Union for All an EC FP7 accessibility project
GPRS	General Packet Radio Service
GPS	Global Positioning System
GUI	Graphical User Interface
HAPTIMAP	Haptic, Audio, and Visual Interfaces for Maps and Location Based Services, a FP7 EC project
HCI	Human-Computer Interaction
HIPAA	The US Health Insurance Portability and Accountability Act
IA	Intelligence Augmentation
IADL	Independent Activities of Daily Living: more complex daily activities
ICF	International Classification of Functioning, Disability, and Health of the WHO

L3D	The Center for LifeLong Learning and Design of the Department of Computer Science and the Institute of Cognitive Science at the University of Colorado
MAPS	MAPS Memory Aiding Prompting System
MAPS-DE	Script editor for the MAPS Memory Aiding Prompting System
MAPS-PR	The user interface for the MAPS Memory Aiding Prompting System
PC	Personal Computer
PDA	Personal Digital Assistant (a precursor to the Smartphone)
RAID	Redundant Array of Independent Disks
SMS	Short Message Service
STE	Socio-Technical Environment
STS	Socio-Technical System
TYPE-1 ERROR	Classifying an event as occurring when it has not
TYPE-2 ERROR	Classifying an event as not occurring when it has
UI	User Interface
UM	User Model
WAIS-IQ	Wechsler Adult Intelligence Scale

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Preface

Most of the ideas in this book came to me while I was a student of Gerhard Fischer over the years in his Centre for LifeLong Learning and Design. I had the enormous good fortune to have him as a dissertation advisor and spent five years in the lab soaking up our weekly meetings and being exposed to the widely disparate experts that flowed through—sometimes for the weekly gatherings to give a talk, sometimes visiting and working for months. Beyond this, I brought insights from the last ten years of research in Europe at the Fraunhofer Institute at Bonn under Dr. Carlos Velasco and currently at Tecnalia foundation in San Sebastián Spain. Prior to my academic and research career, I spent 12 years as a production and inventory control manager in manufacturing companies, and prior to that I was a cabinetmaker making custom furniture. I hope that the sum of experiences and teachers I brought to this book can be part of a useful foundation for "pushing back the frontiers of science" as my doktorvater, Gerhard Fischer, would exhort me to do.