

Assistive Technology Assessment Handbook

REHABILITATION SCIENCE IN PRACTICE SERIES

Series Editors

Marcia J. Scherer, Ph.D.

President
Institute for Matching Person and Technology

Professor
*Orthopaedics and Rehabilitation
University of Rochester Medical Center*

Dave Muller, Ph.D.

Executive
Suffolk New College
Editor-in-Chief
Disability and Rehabilitation
Founding Editor
Aphasiology

Published Titles

Assistive Technology Assessment Handbook,
edited by Stefano Federici and Marcia J. Scherer

Paediatric Rehabilitation Engineering: From Disability to Possibility,
edited by Tom Chau and Jillian Fairley

Forthcoming Titles

Ambient Assisted Living, *edited by Nuno M. Garcia, Joel Jose P. C. Rodrigues,
Dirk Christian Elias, Miguel Sales Dias*

Assistive Technology for the Visually Impaired/Blind,
Roberto Manduchi and Sri Kurniawan

Computer Systems Experiences of Users with and without Disabilities:
An Evaluation Guide for Professionals,
Simone Borsci, Masaaki Kurosu, Stefano Federici, Maria Laura Mele

Multiple Sclerosis Rehabilitation: From Impairment to Participation,
edited by Marcia Finlayson

Neuroprosthetics: Principles and Applications, *Justin C. Sanchez*

Rehabilitation Goal Setting: Theory, Practice and Evidence,
edited by Richard Siegert and William Levack

Quality of Life Technology, *Richard Schultz*

Assistive Technology Assessment Handbook

Edited by
Stefano Federici and Marcia J. Scherer



CRC Press

Taylor & Francis Group

Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2012 by Taylor & Francis Group, LLC
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works
Version Date: 20120227

International Standard Book Number-13: 978-1-4398-3866-2 (eBook - PDF)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Visit the Taylor & Francis Web site at
<http://www.taylorandfrancis.com>

and the CRC Press Web site at
<http://www.crcpress.com>

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2012 by Taylor & Francis Group, LLC
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Printed in the United States of America on acid-free paper
Version Date: 20120227

International Standard Book Number: 978-1-4398-3865-5 (Hardback)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data

Assistive technology assessment handbook / editor[s], Stefano Federici, Marcia J. Scherer.
p. ; cm. -- (Rehabilitation science in practice series)
Includes bibliographical references and index.
ISBN 978-1-4398-3865-5 (hardback : alk. paper)
I. Federici, Stefano. II. Scherer, Marcia J. (Marcia Joslyn), 1948- III. Series: Rehabilitation science in practice series.
[DNLM: 1. Self-Help Devices. 2. Technology Assessment, Biomedical. 3. Disabled Persons--rehabilitation. WB 320]

617'.033--dc23

2012000644

Visit the Taylor & Francis Web site at
<http://www.taylorandfrancis.com>

and the CRC Press Web site at
<http://www.crcpress.com>

*This book is dedicated to the psychotechnologists of today and the
future, regardless of the country in which they work.*

Contents

Foreword	ix
Preface.....	xv
Contributors.....	xix

Section I The Assistive Technology Assessment Model and Basic Definitions

S. Federici and M. J. Scherer

1. Assessing Individual Functioning and Disability	11
<i>S. Federici, M. J. Scherer, F. Meloni, F. Corradi, M. Adya, D. Samant, M. Morris, and A. Stella</i>	
2. Measuring Individual Functioning	25
<i>S. Federici, F. Meloni, and F. Corradi</i>	
3. Measuring the Assistive Technology Match	49
<i>F. Corradi, M. J. Scherer, and A. Lo Presti</i>	
4. The Assessment of the Environments of AT Use: Accessibility, Sustainability, and Universal Design	67
<i>M. Mirza, A. Gossett Zakrajsek, and S. Borsci</i>	
5. Measuring the Impact of AT on Family Caregivers	83
<i>L. Demers and B.W. Mortenson</i>	

Section II Assessment Professionals: Working on the Multidisciplinary Team

M. J. Scherer and S. Federici

6. The Cognitive Therapist	107
<i>M. Olivetti Belardinelli, B. Turella, and M. J. Scherer</i>	
7. The Special Educator	131
<i>S. Zapf and G. Craddock</i>	
8. The Psychologist	149
<i>F. Meloni, S. Federici, A. Stella, C. Mazzeschi, B. Cordella, F. Greco, and M. Grasso</i>	
9. The Psychotechnologist: A New Profession in the Assistive Technology Assessment	179
<i>K. Miesenberger, F. Corradi, and M. L. Mele</i>	

10. The Optometrist	201
<i>M. Orlandi and R. Amantis</i>	
11. The Occupational Therapist: Enabling Activities and Participation Using Assistive Technology	229
<i>D. de Jonge, P. M. Wielandt, S. Zapf, and A. Eldridge</i>	
12. Pediatric Specialists in Assistive Solutions	245
<i>L. W. Braga, I. L. de Camillis Gil, K. S. Pinto, and P. S. Siebra Beraldo</i>	
13. The Geriatrician	269
<i>M. Pigliautile, L. Tiberio, P. Mecocci, and S. Federici</i>	
14. Role of Speech–Language Pathologists in Assitive Technology Assessments	301
<i>K. Hill and V. Corsi</i>	
 Section III Assistive Technology Devices and Services	
<i>S. Federici and M. J. Scherer</i>	
15. Systemic User Experience	337
<i>S. Borsci, M. Kurosu, M. L. Mele, and S. Federici</i>	
16. Web Solutions for Rehabilitation and Daily Life	361
<i>G. Liotta, E. Di Giacomo, R. Magni, and F. Corradi</i>	
17. Brain–Computer Interfaces: The New Landscape in Assistive Technology	379
<i>E. Pasqualotto, S. Federici, M. Olivetti Belardinelli, and N. Birbaumer</i>	
18. New Rehabilitation Opportunities for Persons with Multiple Disabilities Through the Use of Microswitch Technology	399
<i>G. E. Lancioni, N. N. Singh, M. F. O’Reilly, J. Sigafos, D. Oliva, and G. Basili</i>	
19. Methods and Technologies for Leisure, Recreation, and an Accessible Sport	421
<i>C. M. Capio, G. Mascolo, and C. H. P. Sit</i>	
Index	439

Foreword

Global Perspectives and Emerging Themes in Assistive Technology Assessment

I am delighted and privileged to be asked by the eminent editors of this text, Stefano Federici and Marcia J. Scherer, to write a foreword. These colleagues are at the forefront of work within the field of assistive technology and have pioneered much of the current thinking resulting in both the delivery of services to individuals and transformational research. The emergence and importance of this field can be demonstrated through the emergence of *Disability and Rehabilitation: Assistive Technology* as a standalone journal affiliated with *Disability and Rehabilitation*. This journal, which embraces the broad field of assistive technology, is edited by Marcia J. Scherer, ably assisted by Stefano Federici as an editorial board member.

These two journals, like this book, are characterized by their international coverage, multiprofessional publications, and interprofessional research of the highest quality. This edited volume includes contributions from five continents and reinforces the global approach to responding to the needs of individuals and in some cases communities requiring support and intervention.

This is no easy challenge, and the need remains to recognize both the integrity of those contributing disciplines and individuals along with the emerging integrative approach to rehabilitation.

What this text does is set a framework for future practice and research within the field of assistive technology assessment. It is clearly structured into three sections, the first of which sets the context, the second brings together perspectives from those professions working in the field, and the third focuses on assistive technology devices themselves and the positive outcomes that can emerge. Each section of this book has a separate introduction, and these contributions themselves are not only informative but reflect the vision of the editors for this field of work.

Having been asked to write this introduction, it was with pleasure that I was able to read the chapters prior to their publication, and rather than repeating or simply reiterating what can readily be assimilated, I found myself reflecting on some of the emerging cross-cutting themes. Although not comprehensive, the four themes that stood out for me characterize the need to develop innovative approaches within this field while recognizing the individuality of both the user and those professionals engaged.

In many ways the topic all of the authors are addressing and the field of enquiry is relatively straightforward. The advances in technology and the potential benefits that can accrue highlight the need to undertake purposeful and sophisticated forms of assessment of individuals to understand their need and how they can benefit from the wide range of available devices. These individuals themselves in different ways are looking for better outcomes in response to their disabilities and broadly through the rehabilitative process to improve in some way or other their quality of life. Therefore, assessment is the first stage of

this process and facilitates an evaluation of the effectiveness of the intervention that must be undertaken on a regular basis. What then emerges from my initial reading of these outstanding chapters from individuals working in this field?

Assistive Technology Is Increasingly Complex and Sophisticated, Which Needs to Be Reflected in the Assessment Process

Although this actually states the obvious, it still provides one of the greatest challenges in undertaking the assessment of individuals to determine how best to deploy technology. Chapters 16, 17, and 18 highlight the sophistication emerging within the fields of technology and the potential benefits to individuals.

Nevertheless, the more complex both the assessment process and the technological aids themselves become, there is a danger that they become less accessible, and a number of authors throughout this text remind us through their work of “abandonment,” with one of the greatest problems being that individuals stop using the devices. Furthermore, the more complex the assessment process, the less motivated individuals can become given their need and their understandable desire to have access to available facilities and support. And not only is the complexity difficult for the user and those professionals undertaking the assessments, but there remains the danger that they become more costly and hence have lower impact.

Indeed, the process of assessment itself is costly given the number of professionals who potentially need to be engaged, and there is an “opportunity cost” issue here in terms of direct therapeutic intervention as compared with careful assessment and planning. Therefore, one of our conundrums is that the more complex and greater technological advances we make, there remains a potential threat of the extent to which these can be applied in practice, which in turn affects the vulnerability of those with disabilities.

The Need for Inter- and Multidisciplinary Approaches to Assessment

For me, this is then the second major issue. It is clear from this text that the assessment process is critical to future success, but that it involves a wide range of disciplines and in some cases the emergence of new interdisciplinary approaches. For example, Chapter 9 introduces for the first time to myself the role of the “psychotechnologist.” I am sure there are other integrated professional approaches yet to be brought together. As knowledge within the professional fields involved with assistive technology becomes more sophisticated and our knowledge simply grows exponentially, the capacity to introduce shared professional education and training becomes increasingly difficult.

Furthermore, we do need to recognize and indeed value the different perspectives offered by the vast range of individuals working within this field through their initial education, training, and postgraduate study. There are different paradigms ranging from those working primarily in the field from a medical perspective, through to those in focused but relatively multidisciplinary professions, and on to those making such enormous contributions through their technological rather than social skills.

No one person or profession can any longer cover this breadth, and we therefore need to find new ways of working together.

Fortunately, it is not the case that people cannot do this, but it is a time-consuming, resource-intensive process, and the outputs as prioritized and measured need to demonstrate the effectiveness of such an approach.

I know that myself and Marcia J. Scherer are proud to be editing journals that encourage multidisciplinary approaches and perspectives on different aspects of rehabilitation and work hard to include contributions from diverse cultures and backgrounds. In reflecting upon these issues, we should not forget the range of professionals not included in this text, particularly those working in the field of employment, advocacy, insurance, and related business professions. There is nothing negative about recognizing the changing roles of professionals, but the challenge remains to help all of us take different perspectives and to give away some aspects of our own understanding to work better with others.

The Impact of the Environment and the Context

Individuals and indeed communities both embrace and are constrained by the context in which they live. The assessment of an individual has to take this into account, and both place and context are integral to this process. In relatively structured rehabilitation, there are well-worked processes and procedures within which to undertake assessment and to draw upon the services and opportunities presented by the environment within which this is done. However, there are circumstances in which the assessment process is either limited through the resources that are available or by the requirement to respond at a pragmatic level. Community-based programs are often limited by personnel and resources and rely much more upon those living and working within that particular environment. Disasters such as those recently affecting Japan and Haiti require swift and emergency response mechanisms in which the assessment process might be less important when looking to provide assistive technologies to help support the vast numbers of individuals clearly in need. These issues are not confined to the environment or the context but to the interpersonal connections of the individual being assessed.

Chapter 5 highlights the impact on caregivers and the family, but we should add to this the wide range of individual contacts, including friends, peers, and those in the workplace.

This also affects the social context and influences those outputs by which the effectiveness of any intervention is judged, including economic well-being. Underpinning this in many cases is a commitment to enhance the quality of life, often through participation in the world of others with the view to retaining and playing a respected role within wider society.

What the User Wants and How Can It Be Measured?

The importance of participation and enhancing the quality of life as much as alleviating some aspects of disability was referred to in the previous section. In many cases these measures are more important to the individual and more greatly affect the way in which

the success of having access to assistive technology is measured. Chapter 15 is an excellent overview of the “user experience framework.” Any perceived improvement through the use of assistive technology must be recognized and valued by the individual himself or herself for the impact to be measured effectively.

Many studies are published that do show improvement on a range of variables, and although these are important in demonstrating the efficacy of particular techniques without recourse to simply measuring the impact on the individual from his or her perspective, they do lack an element of validity.

This is not to say that publications of this kind should not be published; it just further reinforces the complexity of working in the field of rehabilitation. The more recent emphasis on goal-setting both jointly with professionals and individually is a positive way forward in terms of measuring impact. There is both a realism to goal-setting and the opportunity to be aspirational and to go beyond that which perhaps others think possible. The goal of employment is not unlikely to remain critical to many for reintegration into the life experienced prior to the disability. This might not always be possible, but without understanding the perspective of the user, the success or otherwise of intervention cannot fully be understood.

At the heart of undertaking an assessment of an individual for the use of assisted technology is where this person is starting from, where they want to go or believe they can get, aspirational thinking to take them further, and the journey itself. I judge that this book in the way it has brought together such a wide range of committed individuals has as its underpinning philosophy a commitment to listening to and responding positively to the voice of the individual participant. Resources are still given to rather than owned by those requiring them, and as in other changing areas such as education and social care there may yet be a further strengthening of the role of the user by providing resources from which they can choose or even purchase.

I found this book stimulating, and I am proud to have had an opportunity to contribute a few thoughts. Thank you to Marcia and Stefano for this opportunity to join you in contributing to this debate.

Dave J. Muller

*Editor-in-Chief, Disability and Rehabilitation
Suffolk New College, United Kingdom*

The collaboration between Marcia J. Scherer and the Centre for Technological Aid and Research Ausilioteca of the Leonarda Vaccari Institute in Rome was born when Marcia, accompanied with Stefano Federici, visited our institute. On that day, a warm empathy between me and Marcia was born. An interesting brainstorm about the various activities took off: activities that we could carry out together because we realized that we share the same visions. The activities of the Leonarda Vaccari Institute—with its multidisciplinary team—reflected the working methods for the Matching Person and Technology model carried out by Professor Scherer.

Almost a year later, I went to Rochester University to see Marcia again, and it was there that we managed to bring the drafting of the handbook to reality. The Ausilioteca di Roma (Centre for Technological Aid of Rome) put itself at the authors’ disposal to verify the

assistive technology assessment process model and the new competencies that had to be given to the new specific figure of the psychotechnologist.

The following are just a few words to understand what the Leonarda Vaccari Institute does and, in particular, what the Ausilioteca di Roma stands for. The Leonarda Vaccari Institute, the oldest nonprofit educational institution in Italy, addresses the special needs of children, adolescents, and adults with disabilities. Founded in 1936 by Professor Marchesa Leonarda Vaccari to help children affected with polio, today the institute provides comprehensive service to hundreds of individuals each year. The Leonarda Vaccari Institute is acknowledged as the Moral Entity with Royal Charter No. 2032 and public noncommercial initiative certified by the Region of Lazio; the institute functions under the National Health Service. Established 75 years ago, today the institution is one of the most experienced centers for the rehabilitation of people affected by severe mental and/or physical disabilities between the developmental stages of childhood and adulthood. On December 8, 2007, the President of Italy, Giorgio Napolitano, awarded the Leonarda Vaccari Institute with the Gold Medal of Merit for Public Health Service. In the same year, the center was included in the 2° "Eurispes survey" among the 100 Italian Centres of Excellence. The Vaccari Institute is certified with the ISO 9001-200 IMQ/CSQ 9211.LVA quality.

The intent to provide a comprehensive diagnosis and to help people with disabilities with their special needs have been one of the initiative's main concerns since its foundation. In accordance with the institute's 1936 Constitution, treatment extending to the various aspects of disability can be synthesised in three procedures: medical care, education, and integration into the labor market. Since then, the Leonarda Vaccari Institute has been expanding its activities throughout comprehensive and individualized interventions, bringing a multidisciplinary analysis to every single case. Each day, the Vaccari Institute provides support to more than 300 people who require re-education and rehabilitation care within the framework of full-time hospital care, day care, or outpatient services. The institute provides a large number of therapies such as kinesitherapy and logotherapy, alternative communication, psychosensory stimulation, respiratory exercises, drama, etc., all charged to the National Health Service. The diagnostic team is composed of experienced clinical and school psychologists, psychotechnologists, psychiatrists, neuropsychiatrists, neuropsychologists, pediatricians, orthopedists, rehabilitation therapists, and other professionals working in specific relative fields.

In 1996, the Vaccari Institute founded the Ausilioteca di Roma, a center for technological aid and research. The sector of technological devices is characterized by a fast evolution, by the complexities of solutions that need to be found, and by the necessity to personalize these solutions. This innovative vision leads to different procedures for the various rehabilitation, welfare, and educational processes. To find an international model of assistive technology assessment, the institute has therefore initiated a fruitful collaboration with Stefano Federici of the University of Perugia, Olivetti Belardinelli of the Sapienza University of Rome, and Marcia J. Scherer of the Institute for Matching Person and Technology of Webster, NY. The success of this assistive technology assessment process lies primarily in the selection and implementation of technical aids determined by

- The quality of the assignment's processes,
- The quality of assistive proposals, and
- The taking into account of the specific context of use.

The development of this sector finds its cultural motivations and improvement in the recent declaration of intents issued at the European level (e.g., Madrid 2002; *European Year for People with Disabilities* 2003), at the national level (e.g., *Guidelines for the Rehabilitation* released by the Ministry of Health in 1998), and at the international level [e.g., the International Classification of Functioning, Disability, and Health (ICF), promoted by the World Health Organization].

Digital devices are instruments of an extraordinary importance apt to satisfy the needs of autonomy and quality of life of people with disabilities and their families. They also guarantee a suitable proposal by adding value to the right solutions and giving a permanent help to health service professionals and users. Moreover, a good assistive technology match can also guarantee the efficiency of the public expenses in this sector.

The Ausilioteca is a highly specialized service center that operates together with the National Health Service, various public entities, and schools, sustaining different projects and the use of advanced technologies aimed to the best inclusion of people with disabilities in schools and other life environments.

The handbook, realized in collaboration with academic professionals from different countries (United States, Europe, Australia, Brazil, and Japan), contains a scientific pattern for the assignment of assistive technologies to people with disabilities founded under the ICF model. The fulfillment and achievement of the model described in the handbook—together with the highlighted procedures—are one of the best practices carried out by the highly specialized personnel of the Leonarda Vaccari Institute.

It is with satisfaction and gratitude that I thank the authors of the handbook and in particular the editors, Marcia J. Scherer of the Institute for Matching Person and Technology and Stefano Federici of the University of Perugia, for their useful and splendid work.

Saveria Dandini De Sylva

Executive President

Istituto Leonarda Vaccari

Preface

This book is the result of scientific collaboration and sincere friendship that was born in 2001 and has gradually strengthened over time.

The collaboration begins with the creation, at the Faculty of Psychology, Sapienza University of Rome, of the first course in psychotechnology that was held in Italy. This course aimed to combine multiple topics, bringing together technological and ergonomic arguments and issues concerning the psychology of rehabilitation to train competent psychologists within assistive technology provision.

The course was designed by Stefano Federici and held at the Sapienza University of Rome from 2001 to 2008. The term “psychotechnology,” with the meaning adopted and introduced in the psychology of rehabilitation by Federici, initially sounded like a neologism. In fact, the objective of the course was to integrate technology and ergonomic aspects with those more specific of cognitive ergonomics, reread under the lens of the biopsychosocial model of disability, to train psychologists with both psychological and technological expertise and who were able to lead a user to meet their needs. Only in this way would it have been possible for the user to search and find a technological product that not only was satisfactory to his or her own person, but was also able to support him or her in the integration process within its milieu, by preventing, compensating, monitoring, relieving, or neutralizing disability and social barriers. Therefore, the psychotechnologist should possess those skills to be spent in centers for technical aid that, at the end of the last millennium, have begun to be characterized as autonomous centers of technology device assessment and assignment for an individual’s disability and independent living.

The main theoretical difficulty in designing the psychotechnology course was to integrate technological-engineering models—not dissimilar in some way by certain models of cognitive functioning that tend to generalize and idealize the individual—with the biopsychosocial model of disability. The ergonomic approach to technology, both of cognitive and engineering types, indeed often tends to neglect the emotional, motivational, and social user experience so that it does not take into account those factors that very often affect it with a higher rate of incidence in the successful outcome in device use.

The discovery by Federici of the Matching Person and Technology model by Marcia J. Scherer was like the key to squaring the circle. It is a model that has combined people with disabilities’ needs with assistive technologies in a user-centered context, without neglecting the functional and ergonomic features of the device. The answer to that fateful question was found, namely, that the psychotechnologist usually turned to him- or herself to find an effective integration of knowledge. As Federici was used to repeating in the psychotechnology course at the Sapienza University of Rome: “This course could also be called ‘Matching Person and Technology from the psychologist’s standpoint.’”

The collaboration between the Sapienza University of Rome and the Institute for Matching Person and Technology has produced dozens of theses and several doctoral dissertations concerning the adaptation and validation of the Matching Person and Technology model and tools or related to the professional profile and role of the psychologist in the assistive technology assessment and assignment processes. Some of those researchers and students are now successful professionals in psychotechnology. Furthermore, many authors who

took part in writing of the chapters of this book come from that experience of study and research.

However, the collaboration and friendship between Marcia and Stefano has not only led to the sharing of ideas and research projects, but they have also created a scientific network among Italian, American, and other nations' scholars who have formed the scientific community that has allowed such a large participation of authors in the writing of this work.

As the editors, let us now respond to the reasons for this book, which certainly was not intended to be a history of this social network or a biography of its editors. This book is a challenge for us: to develop an international ideal model of the assistive technology assessment process that gathers the most recent scientific developments in the assessment and provision of technical aids for an outcome that, if reached, would be a real success—the well-being of the disabled person. Therefore, this model intends to express in an idealized and essential form an assessment process performed in a center for technical aid because it provides such tools for the assessment and the professional profiles that we might also define as “psychotechnological.”

Of course, just because we speak of “challenge,” we reveal our awareness about the problems and limitations of an “international” ideal model. For example, one of the unsolved problems is the difficulty, already met several times, in defining the features of a center for technical aid. The modeling process of a center for technical aid is difficult if one takes into account the extraordinary variety of systems of regional and national health and social care, both public and private. This variety influences in different ways the specific characteristics that are required at a center. Furthermore, the different nature of the center for technical aid makes problematic the definition itself of the individual who addresses to it: user, patient, client, or consumer? The user (for convenience we use this definition, a little more generic than the others) of a center for technical aid could be a patient of a physician (physiatrist) who operates in a national system of health care and sends him or her to a specialized facility, the center for technical aid indeed, for a more thorough assessment of a particular device. This assessment can be provided free of charge if the center is part of a national health system or by paying out money if the center is part of a private health system. Furthermore, the product chosen by the user could be sold or assigned directly from the center for technical aid or, alternatively, the device provision may be made later by other providers, external and independent from the center for technical aid.

These are just some of the issues to be discussed by the authors of this book. In fact, other issues will be also addressed that are even more problematic from a scientific viewpoint. We refer to those that are intrinsically linked to the design of an international model. Because of the difficulty in finding an adequate and effective synthesis of the various models proposed by specific national systems of public health and welfare, the scientific community faces a modeling of assistive technology system delivery that will be increasingly individualized with respect to either the social and cultural diversity of users or to the necessary adjustment of the center for technical aid's functioning to the local health system. However, it should be noted that this particularization of the models clashes with some trends that are aimed at instead promoting their globalization (for example, this occurs both in social and health policies of the European Community and in those of the World Health Organization). The internationalization of a model is indeed advantageous because it often emerges as a synthesis of experiences and know-hows of regional models. Moreover, it offers the opportunity, by sharing the theoretical

model and evaluation criteria, to share data essential to scientific research, planning, and evaluation of national and international policies and verify the quality of public services.

A goal that we set in the writing of this project was to narrow the topics, trying to legitimate the choice made. In fact, our intention was not only to provide a theoretical text that aims to develop an ideal model of assistive technology assessment processes, but also to provide an operational tool that is able to outline both the specific space of applicability of the model itself and the main characteristics of a center for technical aid's functioning, a tool-kit for a proper assessment, and profiles of professionals acting within the center. Moreover, it even seemed essential for us to compare our model with some of the most advanced researches in technologies for rehabilitation and supports for independent living. However, we were well aware that a detailed description of all matters regarding the functioning of a center for technical aid (i.e. assessment tools, professional profiles, the latest technology devices for rehabilitation and independent living) would have required an encyclopedia and not a manual such as this book. Therefore, and this could be read both as a limit and as well an advantage of this book, we have chosen, for each of the three areas mentioned—the tools of evaluation, the experts of the evaluation in a center for technical aid and new technologies—the aspects of the current state of the art that we judged as the most representative or innovative. So, we not only identified for each topic the leading experts and invited them to write about their topic, but also, where possible, we tried to ensure that each chapter was written by more hands, concerted and promoting cross-cultural viewpoints. For this reason, the reader should certainly not be surprised if he or she will not find mention some professions among those that could be treated in such a manual. We tried to give more prominence to the definition, training, and professional role of the new profession of psychotechnologist, as well as to highlighting the professional profile of the speech language pathologist because of the relevance of dysfunctions in language in today's international health and social policies.

Finally, we would like to stress that this book does not intend to model the assistive technology assessment process as a result of a mere academic mental exercise, but it has even faced an applied research of the model. This is for two main reasons: The theoretical view of the authors' chapters and editors emerge from experimental research applied to rehabilitation and assistive technologies. In addition, the international ideal model of the assistive technology assessment process is already applied in centers for technical aid. Thanks to scientific and clinical collaboration, economic and operational support of the Centre for Technical Aid of Rome, Leonarda Vaccari Institute—which, in turn, is part of the Italian Network of Centres Advice on Computer and Electronic Aids and cooperates with the Institute for Matching Person and Technology and Columbia University, with whom it shares the principles that underlie the assistive technology assessment process—it was possible to define the assessment model proposed in this book because the model is already operative in the Centre for Technical Aid of Rome. This center offers a noncommercial advisory and support on assistive technology and computers for communication, learning, and autonomy. The service is free of charge for users who access it through the Italian National Health Service. Several scientific projects granted by the institute are in progress at the center to verify not only the advantages of a systematic application of the Matching Person and Technology tools in the assessment process, but also the application of the assistive technology assessment process model. Some results will be presented and discussed in the chapters of this book.

Sincere thanks go to the authors of the chapters who have welcomed with enthusiasm our model, enriching in many parts the initial draft of this work and giving it a wide-ranging speech that is updated and credible. Special thanks also go to the publisher, Taylor & Francis, who accepted the project with competence, supporting the long process of drafting and revising the work. Again, special thanks go to many peer-reviewers of the chapters, who have played a generous and valuable role, such as guarantors for the scientific nature and validity of each contribution as well as representatives of the international scientific community in this area.

Contributors

M. Adya

Burton Blatt Institute
Syracuse University
Syracuse, New York

R. Amantis

Leonarda Vaccari Institute for
Rehabilitation
Integration, and Inclusion of Persons with
Disabilities
Rome, Italy

G. Basili

Department of Pediatrics
Senigallia General Hospital
Senigallia, Italy

N. Birbaumer

Institute of Medical Psychology and
Behavioral Neurobiology
Eberhard-Karls University
Tübingen, Germany
and
IRCCS, San Camillo Scientific Hospital
Institute
Venezia Lido, Italy

S. Borsci

Department of Human Science and
Education
University of Perugia
Perugia, Italy
and
School of Information Systems, Computing
and Mathematics
Brunel University
Uxbridge, United Kingdom
and
Mathematics for Match Plus Project Brunel
University Uxbridge,
United Kingdom

L. W. Braga

Director, Neurosciences and
Neurorehabilitation Division
SARAH Network of Neurorehabilitation
Hospitals
Brasilia, Brazil

C. M. Capio

Institute of Human Performance
University of Hong Kong
Hong Kong, China

B. Cordella

Department of Dynamic and Clinical
Psychology
Sapienza University of Rome
Rome, Italy

F. Corradi

Leonarda Vaccari Institute for
Rehabilitation Integration,
and Inclusion of Persons
with Disabilities
Rome, Italy

V. Corsi

F.A.R.E—Specialist Centre for Dyslexia
and Learning Difficulties
Perugia, Italy

G. Craddock

Centre for Excellence in Universal Design
Dublin, Ireland

I. L. de Camillis Gil

Neurological Rehabilitation Division
SARAH Network of Neurorehabilitation
Hospitals
Brasilia, Brazil

D. de Jonge

Division of Occupational Therapy
 School of Health and Rehabilitation
 Sciences
 University of Queensland
 Brisbane St. Lucia, Queensland, Australia

L. Demers

School of Rehabilitation
 Université de Montréal
 Montréal, Quebec, Canada

E. Di Giacomo

Department of Computer Engineering
 University of Perugia
 Perugia, Italy

A. Eldridge

Division of Occupational Therapy
 School of Health and Rehabilitation
 Sciences
 University of Queensland
 Brisbane St. Lucia, Queensland, Australia

S. Federici

Department of Human Science and
 Education
 University of Perugia
 Perugia, Italy
 and

CIRID - Interdisciplinary Centre for
 Integrated
 Research on Disability
 Sapienza University of Rome
 Rome, Italy

A. Gossett Zakrajsek

Occupational Therapy Program
 School of Health Sciences
 Eastern Michigan University
 Ypsilanti, Michigan

M. Grasso

Department of Dynamic and Clinical
 Psychology
 Sapienza University of Rome
 Rome, Italy

F. Greco

Department of Dynamic and Clinical
 Psychology
 Sapienza University of Rome
 Rome, Italy

K. Hill

Performance and Testing Teaching
 Laboratory
 School of Health and Rehabilitation
 Sciences
 University of Pittsburgh
 Pittsburgh, Pennsylvania

M. Kurosu

Center of ICT and Distance Education
 Open University of Japan
 Chiba City, Japan

G. E. Lancioni

Department of Psychology
 University of Bari
 Bari, Italy

G. Liotta

Department of Computer Engineering
 University of Perugia
 Perugia, Italy

A. Lo Presti

CIRID
 Interdisciplinary Centre for Integrated
 Research on Disability
 Sapienza University of Rome
 Rome, Italy

R. Magni

Pragma Engineering Sr1
 Perugia, Italy

G. Mascolo

External collaborator at the Department of
 Dynamic and Clinical Psychology
 Sapienza University of Rome
 Rome, Italy

C. Mazzeschi

Department of Human Science and
Education
University of Perugia
Perugia, Italy

P. Mecocci

Institute of Gerontology and Geriatrics
University of Perugia
Perugia, Italy

M. L. Mele

ECoNA—Interuniversity Centre for
Research on Cognitive Processing in
Natural and Artificial Systems
Sapienza University of Rome
Rome, Italy

F. Meloni

CIRID
Interdisciplinary Centre for Integrated
Research on Disability, and Department
of Psychology
Sapienza University of Rome
Rome, Italy

K. Miesenberger

Institute Integriert Studieren
University of Linz
Linz, Austria

M. Mirza

Institute for Healthcare Studies
Northwestern University
Chicago, Illinois

M. Morris

Burton Blatt Institute
Syracuse University
Syracuse, New York

B. W. Mortenson

School of Rehabilitation
Université de Montréal
Montréal, Quebec, Canada

M. Olivetti Belardinelli

Department of Psychology and CIRID
Interdisciplinary Centre for Integrated
Research on Disability
Sapienza University of Rome
Rome, Italy

and

ECoNA Interuniversity Center for
Research in Cognitive Processing in
Natural and Artificial Systems, and
Department of Psychology
Sapienza University of Rome
Rome, Italy

D. Oliva

Lega F. D'Oro Research Center
Osimo, Italy

M. F. O'Reilly

Meadows Center for Preventing
Educational Risk
University of Texas at Austin
Austin, Texas

M. Orlandi

Vision Research Center of Rome
Rome, Italy

E. Pasqualotto

Institute of Medical Psychology and
Behavioral Neurobiology
Eberhard-Karls University
Tübingen, Germany

M. Pigliautile

Institute of Gerontology and Geriatrics
University of Perugia
Perugia, Italy

and

Department of Psychology
Sapienza University of Rome
Rome, Italy

K. S. Pinto

Pediatric Rehabilitation Division
SARAH Network of Neurorehabilitation
Hospitals
Brasilia, Brazil

D. Samant

Burton Blatt Institute
Syracuse University
Syracuse, New York

M. J. Scherer

Institute for Matching Person &
Technology, Inc.
Webster, New York

and

Burton Blatt Institute
Syracuse University
Syracuse, New York

P. S. Siebra Beraldo

Clinical Research Division
SARAH Network of Neurorehabilitation
Hospitals
Brasilia, Brazil

J. Sigafos

School of Psychology and Pedagogy
Victoria University of Wellington
Wellington, New Zealand

N. N. Singh

American Health and Wellness Institute
Verona, Virginia

C. H. P. Sit

Institute of Human Performance
University of Hong Kong
Hong Kong, China

and

Department of Sports Science and Physical
Education
Chinese University of Hong Kong, China

A. Stella

Department of Comparative Cultures
University for Foreigners
Perugia, Italy

L. Tiberio

Institute for Cognitive Science and
Technologies
National Research Council of Italy
Rome, Italy

B. Turella

Department of Psychology
Sapienza University of Rome
Rome, Italy

P. M. Wielandt

Department of Occupational Therapy
School of Health & Human Services
Central Queensland University
Rockhampton, Australia

S. Zapf

Children's Journey to Shine, Inc.
Houston, Texas

Section I

The Assistive Technology Assessment Model and Basic Definitions

S. Federici and M. J. Scherer

Introduction

As a part of the human condition, “Disability is complex, dynamic, multidimensional, and contested” (WHO and World Bank 2011, p. 3). The concept of disability conveys a very wide set of different and correlated issues: from disability models to individual functioning and its measurement, from social barriers to the digital divide, from the objective quality of life to subjective experience, to concepts of functioning, activity and participation, human rights and poverty, health and well-being, morbidity, and quality of life (WHO and World Bank 2011). Because of the multidimensionality of disability, the International Classification of Functioning, Disability, and Health (ICF) would like to make clear that disability (and its correlated term “functioning”) must be understood as an umbrella term, “encompassing all body functions, activities and participation” (WHO 2001, p. 3).

Disability’s multidimensionality and complexity entails a kind of “definitional paradox” (Madans and Altman 2006): On the one hand, any theoretical definition of disability implies aporia, and on the other hand, operational meaning is determined by the purpose of research. In fact, Mont explains:

[If] each domain represents a different area of measurement and each category or element of classification within each domain represents a different area of operationalization of the broader domain concept, [then] to generate a meaningful general prevalence measure one must determine which component best reflects the information needed to address the purpose of the data collection. (2007, p. 4)

user/client and assistive solution. Because the assistive solution represents the outcome of a user-driven process aimed toward the improvement of individual functioning, it can be considered as a mediator of quality of life and well-being in a specific context of use. For these reasons, it is important to underscore that the assistive solution does not coincide with AT because the first one is a complex system in which psycho-socio-environmental factors and AT interact in a nonlinear way by reducing activity limitations and participation restrictions by means of one or more technologies.

The definition of ATA represents the core definition of this handbook, summarizing the properties of the ATA process. All of the chapters in the section first refer to this definition and follow a guiding reference model (see Figure I.1).

References

- Dijcks, B. P. J., De Witte, L. P., Gelderblom, G. J., Wessels, R. D., and Soede, M. (2006). Non-Use of Assistive Technology in the Netherlands: A Non-Issue? *Disability and Rehabilitation: Assistive Technology*, 1(1–2), 97–102. doi:10.1080/09638280500167548
- Estreen, M. (2010). *Europe with Free Choice of Assistive Technology. the Provision of Assistive Devices in Specific European Countries*. Retrieved from www.hi.se/bestall
- Federici, S., and Borsci, S. (2011). The use and non-use of assistive technology in Italy: A pilot study. In G. J. Gelderblom, M. Soede, L. Adriaens, and K. Miesenberger (Eds.), *Everyday Technology for Independence and Care: AAATE 2011* (Vol. 29, pp. 979–986). Amsterdam, NL: IOS Press. doi:10.3233/978-1-60750-814-4-979
- Kittel, A., Di Marco, A., and Stewart, H. (2002). Factors Influencing the Decision to Abandon Manual Wheelchairs for Three Individuals with a Spinal Cord Injury. *Disability and Rehabilitation*, 24(1–3), 106–114. doi:10.1080/0963828011006678 5
- Madans, J. H., and Altman, B. M. (2006). *Purposes of Disability Statistics*. Paper presented at the Training Workshop on Disability Statistics for SPECA Countries: UN Special Programme for the Economies of Central Asia, Bishkek, Kyrgyzstan. Retrieved from <http://www.unece.org/stats/documents/2006.12.health.htm>
- Madans, J. H., Altman, B. M., Rasch, E. K., Synneborn, M., Banda, J., Mbogoni, M., et al. (2002). *Washington Group Position Paper: Proposed Purpose of an Internationally Comparable General Disability Measure*. Retrieved from www.cdc.gov/nchs/ppt/citygroup/meeting3/WG3.6a%20Madans_Altman.ppt
- Mathiassen, N.-E. (2010). *Assistive Technology: Service Delivery Systems, Presence and Future*. [Aids and Solutions for Quality of Life in a Changing Society: Challenges and Opportunities]. Paper presented at the Ausili e soluzioni per la qualità della vita in una società che cambia: Sfide e opportunità, Bologna, Italy. Oral presentation retrieved from <http://www.ausilioteca.org/>
- Mont, D. (2007). *Measuring Disability Prevalence. Special Protection Discussion Paper No. 0706*. Retrieved from <http://siteresources.worldbank.org/DISABILITY/Resources/Data/MontPrevalence.pdf>
- Philips, B., and Zhao, H. (1993). Predictors of Assistive Technology Abandonment. *Assistive Technology*, 5(1), 36–45. doi:10.1080/10400435.1993.10132205
- Ripat, J., and Booth, A. (2005). Characteristics of Assistive Technology Service Delivery Models: Stakeholder Perspectives and Preferences. *Disability and Rehabilitation*, 27(24), 1461–1470. doi:10.1080/09638280500264535
- Scherer, M. J. (1996). Outcomes of Assistive Technology Use on Quality of Life. *Disability and Rehabilitation*, 18(9), 439–448. doi:10.3109/09638289609165907
- Scherer, M. J. (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.

- Scherer, M. J. (2005). Cross-walking the ICF to a measure of Assistive Technology Predisposition and Use. Paper presented at the 11th Annual North American Collaborating Center (NACC) Conference on the International Classification of Functioning, Disability and Health (ICF), Rochester, NY, US.
- Scherer, M. J., and Craddock, G. (2002). Matching Person & Technology (MPT) Assessment Process. *Technology and Disability*, 3(14), 125–131. Retrieved from <http://iospress.metapress.com/content/g0eft4mnlwly8y8g>
- Scherer, M. J., Cushman, L. A., and Federici, S. (2004, June 1–10). *Measuring Participation and the Disability Experience with the "Assistive Technology Device Predisposition Assessment"*. Paper presented at the North American Collaborating Center 10th Annual Conference on ICF: NACC 2004, Halifax, Canada. Retrieved from http://secure.cihi.ca/cihiweb/en/downloads/10NACC_Conf_Report_FINAL_e.pdf
- Scherer, M. J., Sax, C. L., Vanbiervliet, A., Cushman, L. A., and Scherer, J. V. (2005). Predictors of Assistive Technology Use: The Importance of Personal and Psychosocial Factors. *Disability and Rehabilitation*, 27(21), 1321–1331. doi:10.1080/09638280500164800
- Stack, J., Zarate, L., Pastor, C., Mathiassen, N.-E., Barberà, R., Knops, H., et al. (2009). *Analysing and Federating the European Assistive Technology ICT industry. Final Report*. Retrieved from European Commission website: <http://ec.europa.eu/einclusion>
- United States Congress. (2004). *Assistive Technology Act (Public Law 108–364)*. Retrieved from http://www.ataporg.org/atap/atact_law.pdf.
- Verza, R., Carvalho, M. L. L., Battaglia, M. A., and Uccelli, M. M. (2006). An Interdisciplinary Approach to Evaluating the Need for Assistive Technology Reduces Equipment Abandonment. *Multiple Sclerosis*, 12(1), 88–93. doi:10.1191/1352458506ms1233oa
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2004). *A Glossary of Terms for Community Health Care and Services for Older Persons*. (WHO/WKC/Tech.Ser./04.2). Retrieved from http://whqlibdoc.who.int/wkc/2004/WHO_WKC_Tech.Ser._04.2.pdf
- World Health Organization (WHO). (2007). *ICF-CY: International Classification of Functioning, Disability, and Health—Children and Youth Version*. Geneva, Switzerland: WHO.
- World Health Organization (WHO), and World Bank. (2011). *World Report on Disability*. Geneva, Switzerland: WHO.
- Wressle, E., and Samuelsson, K. (2004). User Satisfaction with Mobility Assistive Devices. *Scandinavian Journal of Occupational Therapy*, 11(3), 143–150. doi:10.1080/11038120410020728

1

Assessing Individual Functioning and Disability

S. Federici, M. J. Scherer, F. Meloni, F. Corradi,
M. Adya, D. Samant, M. Morris, and A. Stella

CONTENTS

1.1	The Universal Model of Disability	11
1.2	Classification, Declaration, and International Definitions of Functioning and Disability	13
1.3	Where Individual Functioning and Disability Are Assessed: Assistive and Rehabilitation Technology Service Delivery Models	16
1.3.1	Charity-Based Models	17
1.3.2	Community-Based Rehabilitation Models	17
1.3.3	Individual Empowerment Models	17
1.3.4	Entrepreneurial Models	17
1.3.5	Globalization Model	18
1.3.6	Universal Design Models	18
1.4	Assessing Individual Functioning Within a Rehabilitation Process	18
1.5	Assessing Individual Functioning and Disability in the ATA Process	20
1.6	Conclusions	23
	Summary of the Chapter	23
	References	23

1.1 The Universal Model of Disability

The origins of the biopsychosocial model date back to the proposal put forward by psychiatrist George Engel in 1977 to integrate within the medical model the dominant social and psychological variables:

The dominant model of disease today is biomedical, and it leaves no room within its framework for the social, psychological, and behavioural dimensions of illness. A biopsychosocial model is proposed that provides a blueprint for research, a framework for teaching, and a design for action in the real world of health care. (1977, p. 130)

Engel made the leading theoretical contribution to building the biopsychosocial model, identified in von Bertalanffy's general systems theory (von Bertalanffy 1950). According to this approach, the unifying principles in the scientific context are not a reduction of but the organization that explains a scientific phenomenon. It is not sufficient to divide a scientific phenomenon into a simpler unit of analysis and study such units one by one, but it is necessary to study the interrelations among these units. We contrast the old scientific method, which refuses all forms of teleology and is based on linear causality and relations

technical aid column, Figure 1.2) and subjective (the user's actions column, Figure 1.2), or rather between the objective and subjective functioning measurements. The features of this dynamic, within the assessment process, tie professionals of rehabilitation to finding solutions that take into consideration the social and cultural context of an individual.

1.6 Conclusions

An ATA model is needed and proposed in this chapter that is consistent with the ICF in that it emphasizes the individual's well-being and the best match between the user/client and the assistive solution. This requires a user-driven process through which the selection of one or more technological aids for an assistive solution is facilitated by the comprehensive use of clinical measures, functional analysis, and psycho-socio-environmental evaluations.

Summary of the Chapter

This chapter discusses the biopsychosocial model as operationalized by the WHO's International Classification of Functioning, Disability, and Health, the Convention on the Rights of Persons with Disabilities, the 2002 AAMR *Definition, Classification, and System of Supports*, and most recently the *World Report on Disability*. A move from the medical to social view of disability requires that assistive technology professionals view disability as existing within a cultural, political, and economic milieu. International models of assistive technology service delivery are reviewed and the need for enhanced assessment of the person with a disability's functioning is highlighted in order to achieve a good match of person and technology.

References

- Adya, M., Samant, D., Mofris, M., and Scherer, M. (in review). Assistive/Rehabilitation Technology, Disability, and Service Delivery Models. *Disability and Rehabilitation*.
- Bickenbach, J. E. (2009). Disability, culture and the UN convention. *Disability and Rehabilitation*, 31(14), 1111–1124. doi:10.1080/09638280902773729
- Bickenbach, J. E., Chatterji, S., Badley, E. M., and Üstün, T. B. (1999). Models of disablement, universalism and the international classification of impairments, disabilities and handicaps. *Social Science and Medicine*, 48(9), 1173–1187. doi:10.1016/S0277-9536(98)00441-9
- Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge, MS: Harvard University Press.
- Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, 196(4286), 129–136. doi:10.1126/science.847460

- Gracey, F., Evans, J. J., and Malley, D. (2009). Capturing process and outcome in complex rehabilitation interventions: A “Y-shaped” model. *Neuropsychological Rehabilitation*, 19(6), 867–890. doi:10.1080/09602010903027763
- Gray, W., Duhl, F. J., and Rizzo, N. D. (1969). *General Systems Theory and Psychiatry*. Boston: Little Brown.
- Luckasson, R., Borthwick-Duffy, S., Buntinx, W. H. E., Coulter, D. L., Craig, E. M., Reeve, A., et al. (2002). *Mental Retardation: Definition, Classification, and System of Supports* (10th ed.). Washington, DC: AAMR.
- Schalock, R. L., and Luckasson, R. (2004). American Association on Mental Retardation’s *Definition, Classification, and System of Supports* and its relation to international trends and issues in the field of intellectual disabilities. *Journal of Policy and Practice in Intellectual Disabilities*, 1(3–4), 136–146. doi:10.1111/j.1741-1130.2004.04028.x
- Steiner, W. A., Ryser, L., Huber, E., Uebelhart, D., Aeschlimann, A., and Stucki, G. (2002). Use of the ICF model as a clinical problem-solving tool in physical therapy and rehabilitation medicine. *Physical Therapy*, 82(11), 1098–1107.
- Stucki, G., and Sangha, O. (1998). Principles of rehabilitation. In J. H. Klippel and P. A. Dieppe (Eds.), *Rheumatology* (pp. 11.11–11.14). London: Mosby.
- United Nations (UN). (2006). *Convention on the Rights of Persons with Disabilities*. (A/RES/61/106). New York: UN Retrieved from <http://www.un-documents.net/a61r106.htm>.
- von Bertalanffy, L. (1950). An outline of general system theory. *The British Journal for the Philosophy of Science*, 1(2), 134–165. doi:10.1093/bjps/I.2.134
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2011). *European Report on Preventing Elder Maltreatment*. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0010/144676/e95110.pdf
- World Health Organization (WHO), and World Bank. (2011). *World Report on Disability*. Geneva, Switzerland: WHO.
- Zola, I. K. (1989). Toward the necessary universalizing of a disability policy. *Milbank Quarterly*, 67(Suppl 2 Pt. 2), 401–428. doi:10.2307/3350151
- Zola, I. K. (1993). Disability statistics, what we count and what it tells us: A personal and political analysis. *Journal of Disability Policy Studies*, 4(2), 9–39. doi:10.1177/104420739300400202

2

Measuring Individual Functioning

S. Federici, F. Meloni, and F. Corradi

CONTENTS

2.1	What Individual Functioning Measures	25
2.1.1	The Best Measure: Is There an Elixir of Measurements for Turning an Assessment into Gold?	25
2.1.1.1	Fitting Measure for the Purpose of the Assistive Technology Assessment.....	28
2.1.1.2	From the Measures to the Purposes (Well-Being), from the Purposes to the Measurers (Multidisciplinary Team).....	29
2.1.1.3	What Is Measured Versus Who Measures: Balancing the Power of the Assessment	30
2.2	How to Measure Individual Functioning	31
2.2.1	Guidelines for Measurement and Assessment.....	31
2.2.2	Measurement and Assessment in the ATA Process	32
2.2.3	Monitoring Individual Functioning in the Context of an AT Use: The Outcome of the ATA Process.....	34
2.3	Suggested Measurement Tools for an ATA Process	35
2.3.1	Outcome Analysis Tools	39
2.4	Conclusions.....	42
	Summary of the Chapter.....	43
	References.....	44

2.1 What Individual Functioning Measures

2.1.1 The Best Measure: Is There an Elixir of Measurements for Turning an Assessment into Gold?

In June 2001, the U.N. International Seminar on the Measurement of Disability brought together a large number of experts in disability measurement from developed and developing countries to review the current status of methods used in population-based data collection activities to measure disability in national statistical systems (UN 2001). The seminar developed recommendations and priorities to advance work on the measurement of disability. In particular, the seminar improved principles and standard forms for global indicators of disability for use in censuses and helped to build a network of institutions and experts given the broad consensus on the need for population-based measures of disability for countrywide use and international comparisons. The U.N. international seminar experts selected the International Classification of Functioning, Disability, and

valid for every assessment. Additionally, the only guiding principle for a proper measurement is the clarity of the purpose of the measurement. The second section focuses on how to measure individual functioning by both pointing out some guiding principles for choosing and applying a set of measures and by suggesting some tools that fit these principles. The third section suggests some measurement tools for an ATA process used in a center for technical aid.

References

- Altman, B. M., and Gulley, S. P. (2009). Convergence and divergence: Differences in disability prevalence estimates in the United States and Canada based on four health survey instruments. *Social Science and Medicine*, 69(4), 543–552. doi:10.1016/j.socscimed.2009.06.017
- Andrich, R., and Besio, S. (2002). Being informed, demanding and responsible consumers of assistive technology: An educational issue. *Disability and Rehabilitation*, 24(1–3), 152–159. doi:10.1080/09638280110064778
- Brown, M., and Gordon, W. A. (2004). Empowerment in measurement: “muscle,” “voice,” and subjective quality of life as a gold standard. *Archives of Physical Medicine and Rehabilitation*, 85(2 Suppl.), S13–S20. doi:10.1016/j.apmr.2003.08.110
- Carswell, A., McColl, M. A., Baptiste, S., Law, M., Polatajko, H., and Pollock, N. (2004). The Canadian Occupational Performance Measure: A research and clinical literature review. *Canadian Journal of Occupational Therapy*, 71(4), 210–222.
- Day, H., and Jutai, J. (1996). Measuring the Psychosocial Impact of Assistive Devices: the PIADS. *Canadian Journal of Rehabilitation*, 9(2), 159–168.
- Demers, L., Monette, M., Lapierre, Y., Arnold, D. L., and Wolfson, C. (2002). Reliability, validity, and applicability of the Quebec User Evaluation of Satisfaction with assistive Technology (QUEST 2.0) for adults with multiple sclerosis. *Disability and Rehabilitation*, 24(1–3), 21–30. doi:10.1080/09638280110066352
- Demers, L., Weiss-Labrou, R., and Ska, B. (2000). Item analysis of the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST). *Assistive Technology*, 12(2), 96–105. doi:10.1080/10400435.2000.10132015
- DeRuyter, F. (1995). Evaluating outcomes in assistive technology: Do we understand the commitment? *Assistive Technology*, 7(1), 3–8. doi:10.1080/10400435.1995.10132246
- Elliott, T. R., Kurylo, M., and Carroll, M. N. (2002). Personality assessment in medical rehabilitation. In M. J. Scherer (Ed.), *Assistive Technology: Matching Device and Consumer for Successful Rehabilitation* (pp. 47–48). Washington, DC: American Psychological Association.
- EUSTAT. (1999). *Empowering Users through Assistive Technology: Final Report*. (Project DE3402 EUSTAT). Retrieved from <http://www.siva.it/research/eustat/index.html>
- Federici, S., and Meloni, F. (2010a). A note on the theoretical framework of World Health Organization Disability Assessment Schedule II. *Disability and Rehabilitation*, 32(8), 687–691. doi:10.3109/09638280903290012
- Federici, S., and Meloni, F. (2010b). WHODAS II: Disability self-evaluation in the ICF conceptual frame. In J. Stone and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation* (pp. 1–22). Buffalo, NY: Center for International Rehabilitation Research Information and Exchange (CIRRIE). Retrieved from <http://cirrie.buffalo.edu/encyclopedia/en/article/299/>
- Federici, S., Meloni, F., Mancini, A., Lauriola, M., and Belardinelli, M. O. (2009). World Health Organisation Disability Assessment Schedule II: Contribution to the Italian validation. *Disability and Rehabilitation*, 31(7), 553–564. doi:10.1080/09638280802240498

- Fulford, K. W. M., and Stanghellini, G. (2008). The third revolution: Philosophy into practice in twenty-first century psychiatry. *Dialogues in Philosophy, Mental and Neuro Sciences*, 1(1), 5–14. Retrieved from <http://www.crossingdialogues.com/Ms-A08-03-6.pdf>
- Garber, S. L., and Gregorio, T. L. (1990). Upper extremity assistive devices: Assessment of use by spinal cord-injured patients with quadriplegia. *American Journal of Occupational Therapy*, 44(2), 126–131.
- Gelderblom, G. J., and de Witte, L. P. (2002). The assessment of assistive technology outcomes, effects and costs. *Technology and Disability*, 14(3), 91–94. Retrieved from <http://iospress.metapress.com/content/qf91ufxw9nwe003h/>
- Gelderblom, G. J., Driessen, M., Evers, H., and Claus, E. (2009). Design of a MPT based instrument supporting the quality of procurement of assistive technology. In P. L. Emiliani, L. Burzagli, A. Como, F. Gabbanini, and A.-L. Salminen (Eds.), *Assistive Technology from Adapted Equipment to Inclusive Environments: AAATE 2009* (Vol. 25, pp. 567–561). Amsterdam, The Netherlands: IOS Press. doi:10.3233/978-1-60750-042-1-557
- Gitlin, L. N. (1995). Why older people accept or reject assistive technology. *Generations*, 19(1), 41–46.
- Goffman, E. (Ed.). (1963). *Stigma: Notes on the Management of Spoiled Identity*. Englewood Cliffs, NJ: Spectrum Book.
- Gzil, F., Lefevre, C., Cammelli, M., Pachoud, B., Ravaud, J. F., and Leplege, A. (2007). Why is rehabilitation not yet fully person-centred and should it be more person-centred? *Disability and Rehabilitation*, 29(20–21), 1616–1624. doi:10.1080/09638280701618620
- Hahn, H. (1985). Introduction: Disability policy and the problem of discrimination. *American Behavioral Scientist*, 28(3), 293–318. doi:10.1177/000276485028003002
- Holburn, S., and Vietze, P. (Eds.). (2002). *Person-Centered Planning: Research, Practice and Future Directions*. Baltimore, MD: PH Brookes.
- Jutai, J., and Day, H. (2002). Psychosocial Impact of Assistive Devices Scale (PIADS). *Technology and Disability*, 14(3), 107–111. Retrieved from <http://iospress.metapress.com/content/2rc2plwxwbhtcyta/>
- Kayes, N. M., and McPherson, K. M. (2010). Measuring what matters: Does ‘objectivity’ mean good science? *Disability and Rehabilitation*, 32(12), 1011–1019. doi:10.3109/09638281003775501
- Kolcaba, K. Y. (1992). Holistic comfort: Operationalizing the construct as a nurse-sensitive outcome. *Advances in Nursing Science*, 15(1), 1–10.
- Kolcaba, K. Y., and Kolcaba, R. J. (1991). An analysis of the concept of comfort. *Journal of Advanced Nursing*, 16(11), 1301–1310. doi:10.1111/j.1365-2648.1991.tb01558.x
- Kupfer, D. J., First, M. B., and Regier, D. E. (2002). Introduction. In D. J. Kupfer, M. B. First, and D. A. Regier (Eds.), *A Research Agenda for DSM-V™* (pp. xv–xxiii). Washington, DC: American Psychiatric Association.
- Lain Entralgo, P. (1982). *El Diagnostico Medico*. Barcelona, Spain: Salvat.
- Lauer, A., Longenecker Rust, K., and Smith, R. O. (2006, August 18). *ATOMS Project Technical Report—Factors in Assistive Technology Device Abandonment: Replacing “Abandonment” with “Discontinuance.”* Retrieved from <http://www.r2d2.uwm.edu/atoms/archive/technicalreports/tr-discontinuance.html>
- Law, M., Baptiste, S., McColl, M. A., Opzooomer, A., Polatajko, H., and Pollock, N. (1990). The Canadian occupational performance measure: An outcome measure for occupational therapy. *Canadian Journal of Occupational Therapy*, 57(2), 82–87.
- Law, M., Baptiste, S., McColl, M. A., Polatajko, H., and Pollock, N. (2005). *Canadian Occupational Performance Measure* (4th ed.). Ottawa, Canada: COAT.
- Leplege, A., Gzil, F., Cammelli, M., Lefevre, C., Pachoud, B., and Ville, I. (2007). Person-centredness: Conceptual and historical perspectives. *Disability and Rehabilitation*, 29(20–21), 1555–1565. doi:10.1080/09638280701618661
- Linder-Pelz, S. (1982). Toward a theory of patient satisfaction. *Social Science and Medicine*, 16(5), 577–582. doi:10.1016/0277-9536(82)90311-2

- Long, T., Huang, L., Woodbridge, M., Woolverton, M., and Minkel, J. (2003). Integrating assistive technology into an outcome-driven model of service delivery. *Infants and Young Children*, 16(4), 272–283. doi:10.1097/00001163-200310000-00002
- Madans, J. H., and Altman, B. M. (2006). *Purposes of Disability Statistics*. Paper presented at the Training Workshop on Disability statistics for SPECA countries: UN Special Programme for the Economies of Central Asia, Bishkek, Kyrgyzstan. Retrieved from <http://www.unece.org/stats/documents/2006.12.health.htm>
- Madans, J. H., Altman, B. M., Rasch, E. K., Synneborn, M., Banda, J., Mbogoni, M., et al. (2002). Washington Group Position Paper: Proposed Purpose of an Internationally Comparable General Disability Measure, Retrieved from http://www.cdc.gov/nchs/ppt/citygroup/meeting3/WG3.6a%20Madans_Altman.ppt
- Menchetti, B. M., and Sweeney, M. A. (1995). *Person-Centered Planning (Technical Assistance Packet 5)*. Gainesville, FL: University of Florida, Department of Special Education, Florida Network.
- Mezzich, J. E. (2002). Comprehensive diagnosis: A conceptual basis for future diagnostic systems. *Psychopathology*, 35(2–3), 162–165. doi:10.1159/000065138
- Mont, D. (2007). *Measuring Disability Prevalence. Special Protection Discussion Paper No. 0706* Retrieved from The World Bank website: <http://siteresources.worldbank.org/DISABILITY/Resources/Data/MontPrevalence.pdf>
- Oliver, M., and Barnes, C. (1998). *Disabled People and Social Policy: from Exclusion to Inclusion*. London: Longman.
- Pearson, E. J. M. (2009). Comfort and its measurement—A literature review. *Disability and Rehabilitation: Assistive Technology*, 4(5), 301–310. doi:10.1080/17483100902980950
- Philips, B., and Zhao, H. (1993). Predictors of assistive technology abandonment. *Assistive Technology*, 5(1), 36–45. doi:10.1080/10400435.1993.10132205
- Rust, K. L., and Smith, R. O. (2006). Perspectives of outcome data from assistive technology developers. *Assistive Technology Outcomes and Benefits*, 3(1), 34–52.
- Ryan, S., Campbell, K. A., Rigby, P., Germon, B., Chan, B., and Hubley, D. (2006). Development of the new Family Impact of Assistive Technology Scale. *International Journal of Rehabilitation Research*, 29(3), 195–200. doi:10.1097/01.mrr.0000210051.94420.1b
- Schalock, R. L., and Alonso, M. A. V. (2002). *Handbook on Quality of Life for Human Service Practitioners*. Washington, DC: American Association on Mental Retardation.
- Schalock, R. L., Borthwick-Duffy, S., Bradley, V., Buntinx, W. H. E., Coulter, D. L., Craig, E. P. M., et al. (2010). *Intellectual Disability: Definition, Classification, and Systems of Support* (11th ed.). Washington, DC: AAIDD.
- Schalock, R. L., Buntinx, W., Borthwick-Duffy, S., Luckasson, R., Snell, M., Tasse, M., et al. (2007). *User's Guide: Mental Retardation: Definition, Classification and Systems of Supports: Applications for Clinicians, Educators, Disability Program Managers, and Policy Makers* (10th ed.). Washington, DC: AAMR.
- Scherer, M. J. (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J., and Craddock, G. (2002). Matching Person & Technology (MPT) assessment process. *Technology and Disability*, 3(14), 125–131. Retrieved from <http://iospress.metapress.com/content/g0eft4mnlwly8y8g>
- Sen, A. (2002). Health: Perception versus observation. *British Medical Journal (Clinical Research Edition)*, 324(7342), 860–861. doi:10.1136/bmj.324.7342.860
- Sparrow, S. S., Balla, D. A., and Cicchetti, D. V. (Eds.). (1984). *Vineland Adaptive Behavior Scales*. Circle Pines, MN: American Guidance Service.
- Sparrow, S. S., Cicchetti, D. V., and Balla, D. A. (2005). *Vineland Adaptive Behavior Scales* (2nd ed.). Circle Pines, MN: American Guidance Service.
- Steiner, W. A., Ryser, L., Huber, E., Uebelhart, D., Aeschlimann, A., and Stucki, G. (2002). Use of the ICF model as a clinical problem-solving tool in physical therapy and rehabilitation medicine. *Physical Therapy*, 82(11), 1098–1107.

- Stucki, G., Cieza, A., Ewert, T., Kostanjsek, N., Chatterji, S., and Üstün, T. B. (2002). Application of the International Classification of Functioning, Disability and Health (ICF) in clinical practice. *Disability and Rehabilitation*, 24(5), 281–282. doi:10.1080/10.1080/0963828011010522 2
- Tewey, B. P., Barnicle, K., and Perr, A. (1994). The wrong stuff. *Mainstream*, 19(2), 19–23.
- Thompson, J. R., Bryant, B., Campbell, E. M., Craig, E. P. M., Hughes, C., Rotholz, D. A., et al. (2004). *Supports Intensity Scale Users Manual*. Washington, DC: American Association on Mental Retardation.
- Ueda, S., and Okawa, Y. (2003). The subjective dimension of functioning and disability: What is it and what is it for? *Disability and Rehabilitation*, 25(11–12), 596–601. doi:10.1080/0963828031000137108
- United Nations (UN). (2001, June 4–6). *Document Index of the International Seminar on the Measurement of Disability*. Paper presented at the 1st International Seminar on the Measurement of Disability, New York. Retrieved from <http://unstats.un.org/unsd/disability/Seminar%202001.html>
- Uppal, S. (2006). Impact of the timing, type and severity of disability on the subjective well-being of individuals with disabilities. *Social Science and Medicine*, 63(2), 525–539. doi:10.1016/j.socscimed.2006.01.016
- Üstün, T. B., Chatterji, S., Bickenbach, J. E., Kostanjsek, N., and Schneider, M. (2003a). The International Classification of Functioning, Disability and Health: A new tool for understanding disability and health. *Disability and Rehabilitation*, 25(11–12), 565–571. doi:10.1080/0963828031000137063
- Üstün, T. B., Chatterji, S., Bickenbach, J. E., Trotter II, R. T., and Saxena, S. (2001a). *Disability and Culture: Universalism and Diversity*. Seattle, WA: Hogrefe and Huber.
- Üstün, T. B., Chatterji, S., Mechbal, A., Murray, C. J. L., and WHS Collaborating Groups. (2003b). The World Health Surveys. In C. J. L. Murray and D. B. Evans (Eds.), *Health Systems Performance Assessment: Debates, Methods and Empiricism* (pp. 797–808). Geneva, Switzerland: WHO.
- Üstün, T. B., Chatterji, S., Villanueva, M., Bendib, L., Celik, C., Sadana, R., et al. (2001b). *WHO Multi-Country Survey Study on Health and Responsiveness*. (Paper Series: No. 37). Retrieved from <http://www.who.int/healthinfo/survey/whspaper37.pdf>
- Üstün, T. B., Chatterji, S., Villanueva, M., Bendib, L., Celik, C., Sadana, R., et al. (2003c). WHO multi-country survey study on health and responsiveness 2000–2001. In C. J. L. Murray and D. B. Evans (Eds.), *Health Systems Performance Assessment: Debates, Methods and Empiricism* (pp. 761–796). Geneva, Switzerland: WHO.
- Üstün, T. B., Kostanjsek, N., Chatterji, S., and Rehm, J. (Eds.) (2010). *Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0)*. Geneva, Switzerland: WHO.
- Verza, R., Carvalho, M. L. L., Battaglia, M. A., and Uccelli, M. M. (2006). An interdisciplinary approach to evaluating the need for assistive technology reduces equipment abandonment. *Multiple Sclerosis*, 12(1), 88–93. doi:10.1191/1352458506ms1233oa
- Weiss-Lambrou, R. (2002). Satisfaction and comfort. In M. J. Scherer (Ed.), *Assistive Technology: Matching Device and Consumer for Successful Rehabilitation* (pp. 77–94). Washington, DC: American Psychological Association.
- Weiss-Lambrou, R., Tremblay, C., LeBlanc, R., Lacoste, M., and Dansereau, J. (1999). Wheelchair seating aids: How satisfied are consumers? *Assistive Technology*, 11(1), 43–53. doi:10.1080/10400435.1999.10131984
- Wessels, R., Persson, J., Lorentsen, Ø., Andrich, R., Ferrario, M., Oortwijn, W., et al. (2002). IPPA: Individually Prioritised Problem Assessment. *Technology and Disability*, 14(3), 141–145. Retrieved from: <http://iospress.metapress.com/content/2bm793b7pbdah9bw/>
- World Health Organization (WHO). (1992). *ICD-10: International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (Vol. 1–3). Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2002–2004). *World Health Survey*. Retrieved from: <http://www.who.int/healthinfo/survey/en/>
- World Health Organization (WHO). (2003). *ICF Checklist Version 2.1a, Clinician Form*. Geneva, Switzerland: WHO.

- World Health Organization (WHO). (2004). *WHODAS-II—Disability Assessment Schedule Training Manual: A Guide to Administration*. Retrieved from http://www.who.int/icidad/whodas/training_man.pdf
- World Health Organization (WHO). (2008). *The Global Burden of Disease: 2004 Update*. Geneva, Switzerland: WHO.
- World Health Organization (WHO), and World Bank. (2011). *World Report on Disability*. Geneva, Switzerland: WHO.
- Zola, I. K. (1993). Disability statistics, what we count and what it tells us: A personal and political analysis. *Journal of Disability Policy Studies*, 4(2), 9–39. doi:10.1177/104420739300400202

3

Measuring the Assistive Technology Match

F. Corradi, M. J. Scherer, and A. Lo Presti

CONTENTS

3.1	Introduction.....	49
3.2	Measuring the Assistive Technology Match.....	51
3.2.1	The ICF and Other Outcome Measures.....	51
3.2.2	The Matching Person and Technology Model.....	52
3.2.3	The MPT Process and Measures.....	55
3.2.4	The MPT Model and the ICF.....	58
3.2.5	Different Versions of Matching Person and Technology	58
3.3	The Assistive Technology Assessment Process.....	58
3.3.1	The ATA Process in the Center for Technical Aid and in the Rehabilitation Project	60
3.4	The MPT and the Assistive Technology Assessment Process	61
3.5	Conclusions.....	62
	Summary of the Chapter.....	62
	References.....	63

3.1 Introduction

The World Health Organization (WHO) Disability and Rehabilitation Action Plan 2006–2011 (2006) reports that approximately 10% of the world’s population experiences some form of temporary or permanent disability. This document highlights that assistive technology (AT) may be a helpful aid for people with disabilities “to increase their level of independence in their daily living and to exercise their rights” (WHO 2006, p. 5). To achieve this goal, it is necessary to further the development, production, distribution, and support to use AT. In particular, the aims of the WHO are to

- Support member states to develop national policies on AT;
- Support member states to train personnel at various levels in the field of AT, especially in prosthetics and orthotics; and
- Promote research on assistive technology and facilitate transfer of technology.

WHO’s *World Report on Disability* (2011) affirms this commitment.

Different studies show an average rate of approximately 30% of abandonment of AT within the first year of use, realizing that rates vary depending on the type of AT (Philips and Zhao 1993; Scherer 1998; Kittel et al. 2002; Scherer et al. 2004, 2005; Dijcks et al. 2006). A recent study (Federici and Borsci 2011) found approximately 25% AT abandonment in a

and private centers for technical aid provision, allowing them to compare, evaluate, and improve their own matching model. The actions required by the ATA model to centers for technical aid can be divided into four fundamental steps: access to the structure and activation of the process, evaluation and activation of the aid/AT selection, delivery, and follow-up. The ATA is a user-driven process through which the selection of one or more aids/AT is facilitated by the utilization of comprehensive clinical measures, functional analysis, and psycho-socio-environmental evaluations that address, in a specific context of use, the personal well-being of the user through the best matching of user/client and assistive solution (Scherer et al., Early Online). Because the ATA process and the MPT model and accompanying measures share a user-driven working methodology and embrace the ICF biopsychosocial model, they can be integrated within a path aiming for the best combination of AT to promote user/customer's personal well-being.

References

- Bausch, M., and Ault, M. (2008). Assistive technology implementation plan: A tool for improving outcomes. *Teaching Exceptional Children*, 41(1), 6–14. Retrieved from <http://cec.metapress.com/content/K57165H1X52W5731>
- Bernd, T., Van Der Pijl, D., and De Witte, L. P. (2009). Existing models and instruments for the selection of assistive technology in rehabilitation practice. *Scandinavian Journal of Occupational Therapy*, 16(3), 146–158. doi:10.1080/11038120802449362
- Brown, D. L. (1997). Personal implications of functional electrical stimulation standing for older adolescents with spinal cord injuries. *Technology and Disability*, 6(3), 199–216. doi:10.1016/s1055-4181(96)00038-6
- Brown, D. L., and Merbitz, C. (1995). *Comparison of Technology Match between Two Types of Functional Electrical Stimulation Hand Grasp Systems*. Paper presented at the RESNA '95 Annual Conference: RECREAbility. Recreation and Ability: Explore the Possibilities!, Arlington, VA. Retrieved from <http://books.google.com/books?id=d1BRAAAAMAAJ>
- Caudrey, D. J., and Seeger, B. R. (1983). Rehabilitation engineering service evaluation: A follow-up study of device effectiveness and patient acceptance. *Rehabilitation Literature*, 44(3–4), 80–85.
- Demers, L., Weiss-Lambrou, R., and Ska, B. (1996). Development of the Quebec User Evaluation of Satisfaction with assistive Technology (QUEST). *Assistive Technology*, 8(1), 3–13. doi:10.1080/10400435.1996.10132268
- Dijcks, B. P. J., De Witte, L. P., Gelderblom, G. J., Wessels, R. D., and Soede, M. (2006). Non-use of assistive technology in The Netherlands: A non-issue? *Disability and Rehabilitation: Assistive Technology*, 1(1–2), 97–102. doi:10.1080/09638280500167548
- Endler, N. S., and Parker, J. D. A. (1999). *Coping Inventory for Stressful Situations (CISS): Manual* (2nd ed.). North Tonawanda, NY: Multi-Health Systems.
- Federici, S., and Borsci, S. (2011). *The use and non-use of assistive technology in Italy: A pilot study*. In G. J. Gelderblom, M. Soede, L. Adriaens, and K. Miesenberger (Eds.), *Everyday Technology for Independence and Care: AAATE 2011* (Vol. 29, pp. 979–986). Amsterdam, NL: IOS Press. doi:10.3233/978-1-60750-814-4-979
- Federici, S., Corradi, F., Mele, M. L., and Miesenberger, K. (2011). *From cognitive ergonomist to psychotechnologist: A new professional profile in a multidisciplinary team in a centre for technical aids*. In G. J. Gelderblom, M. Soede, L. Adriaens, and K. Miesenberger (Eds.), *Everyday Technology for Independence and Care: AAATE 2011* (Vol. 29, pp. 1178–1184). Amsterdam, NL: IOS Press. doi:10.3233/978-1-60750-814-4-1178

- Federici, S., Corradi, F., Lo Presti, A., & Scherer, M. J. (2009). The Adaptation and Use of the Italian Version of the *Matching Assistive Technology and CHild* (MATCH) Measure. In P. L. Emiliani, L. Burzagli, A. Como, F. Gabbanini, and A.-L. Salminen (Eds.), *Assistive Technology from Adapted Equipment to Inclusive Environments: AAATE 2009* (Vol. 25, pp. 562–566). Amsterdam, NL: IOS Press. doi:10.3233/978-1-60750-042-1-562
- Federici, S., Scherer, M. J., Micangeli, A., Lombardo, C., and Olivetti Belardinelli, M. (2003). A cross-cultural analysis of relationships between disability self-evaluation and individual predisposition to use assistive technology. In G. M. Craddock, L. P. McCormack, R. B. Reilly, and H. T. P. Knops (Eds.), *Assistive Technology—Shaping the Future* (pp. 941–946). Amsterdam, The Netherlands: IOS Press.
- Gatti, N., Matteucci, M., and Sbattella, L. (2004). An adaptive and predictive environment to support augmentative and alternative communication. In K. Miesenberger, J. Klaus, W. Zagler, and D. Burger (Eds.), *Computers Helping People with Special Needs* (Vol. 3118, pp. 624–631). Heidelberg, Germany: Springer. doi:10.1007/978-3-540-27817-7_144
- Goodman, G., Tiene, D., and Luft, P. (2002). Adoption of assistive technology for computer access among college students with disabilities. *Disability and Rehabilitation*, 24(1–3), 80–92. doi:10.1080/09638280110066307
- Judge, S. (2002). Family-centered assistive technology assessment and intervention practices for early intervention. *Infants and Young Children*, 15(1), 60–68. doi:10.1097/00001163-200207000-00009
- Jutai, J., and Day, H. (2002). Psychosocial Impact of Assistive Devices Scale (PIADS). *Technology and Disability*, 14(3), 107–111. Retrieved from <http://iospress.metapress.com/content/2rc2plwxwbhtcyta/>
- Karlsson, P. (2010). *ICF: A Guide to Assistive Technology Decision-Making*. Paper presented at the ARATA 2010 National Conference, Hobart, Tasmania. Retrieved from <http://www.arata.org.au/arataconf10/index.html>
- Kittel, A., Di Marco, A., and Stewart, H. (2002). Factors influencing the decision to abandon manual wheelchairs for three individuals with a spinal cord injury. *Disability and Rehabilitation*, 24(1–3), 106–114. doi:10.1080/0963828011006678 5
- Lauer, A., Longenecker Rust, K., and Smith, R. O. (2006, August 18). ATOMS Project technical report—Factors in assistive technology device abandonment: Replacing “abandonment” with “discontinuance.” Retrieved from <http://www.r2d2.uwm.edu/atoms/archive/technicalreports/tr-discontinuance.html>
- Law, M., Baptiste, S., McColl, M. A., Polatajko, H., and Pollock, N. (2005). *Canadian Occupational Performance Measure* (4th ed.). Ottawa, Canada: COAT.
- Lenker, J. A., and Paquet, V. L. (2004). A new conceptual model for assistive technology outcomes research and practice. *Assistive Technology*, 16(1), 1–10. doi:10.1080/10400435.2004.10132069
- Pasqualotto, E., Federici, S., Simonetta, A., and Olivetti Belardinelli, M. (2011, August 31–September 2). *Usability of Brain Computer Interfaces*. Paper presented at the 11th European Conference for the Advancement of Assistive Technology: AAATE 2011, Maastricht, The Netherlands. Retrieved from <http://www.aaate2011.eu/>
- Philips, B., and Zhao, H. (1993). Predictors of assistive technology abandonment. *Assistive Technology*, 5(1), 36–45. doi:10.1080/10400435.1993.10132205
- Ryan, S., Campbell, K. A., Rigby, P., Germon, B., Chan, B., and Hubley, D. (2006). Development of the new Family Impact of Assistive Technology Scale. *International Journal of Rehabilitation Research*, 29(3), 195–200. doi:10.1097/01.mrr.0000210051.94420.1b
- Scherer, M. J. (1997). *Matching Assistive Technology and Child: A Process and Series of Assessments for Selecting and Evaluating Technologies Used by Infants & Young Children*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J. (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J. (2005). *Living in the State of Stuck: How Technologies Affect the Lives of People with Disabilities* (4th ed.). Cambridge, MA: Brookline Books.

- Scherer, M. J. (Ed.). (2002). *Assistive Technology: Matching Device and Consumer for Successful Rehabilitation*. Washington, DC: American Psychological Association.
- Scherer, M. J., and Craddock, G. (2002). Matching Person & Technology (MPT) assessment process. *Technology & Disability*, 3(14), 125–131. Retrieved from <http://iospress.metapress.com/content/g0eft4mnlwly8y8g>
- Scherer, M. J., and Cushman, L. A. (1995). Differing therapist-patient views of assistive technology use and implications for patient education and training. *Archives of Physical Medicine and Rehabilitation*, 76(6), 595. Retrieved from <http://download.journals.elsevierhealth.com/pdfs/journals/0003-9993/PIIS0003999395805214.pdf>
- Scherer, M. J., Cushman, L. A., and Federici, S. (2004, June 1–10). *Measuring Participation and the Disability Experience with the "Assistive Technology Device Predisposition Assessment."* Paper presented at the North American Collaborating Center 10th Annual Conference on ICF: NACC 2004, Halifax, Canada. Retrieved from http://secure.cihi.ca/cihiweb/en/downloads/10NACC_Conf_Report_FINAL_e.pdf
- Scherer, M. J., Federici, S., Tiberio, L., Pigliatulle, M., Corradi, F., and Meloni, F. (Early Online). ICF core set for Matching Older Adults with Dementia and Technology. *Ageing International*. doi:10.1007/s12126-010-9093-9
- Scherer, M. J., and Glueckauf, R. (2005). Assessing the benefits of assistive technologies for activities and participation. *Rehabilitation Psychology*, 50(2), 132–141. doi:10.1037/0090-5550.50.2.132
- Scherer, M. J., and Sax, C. L. (2010). Measures of assistive technology predisposition and use. In E. Mpofu and T. Oakland (Eds.), *Rehabilitation and Health Assessment. Applying ICF Guidelines* (pp. 229–254). New York: Springer.
- Scherer, M. J., Sax, C. L., Vanbiervliet, A., Cushman, L. A., and Scherer, J. V. (2005). Predictors of assistive technology use: The importance of personal and psychosocial factors. *Disability and Rehabilitation*, 27(21), 1321–1331. doi:10.1080/09638280500164800
- Verza, R., Carvalho, M. L., Battaglia, M. A., and Uccelli, M. M. (2006). An interdisciplinary approach to evaluating the need for assistive technology reduces equipment abandonment. *Multiple Sclerosis*, 12(1), 88–93. doi:10.1191/1352458506ms1233oa
- Vincent, C., and Morin, G. (1999). L'utilisation ou non des aides techniques: Comparaison d'un modèle américain aux besoins de la réalité Québécoise. *Canadian Journal of Occupational Therapy*, 66(2), 92–101.
- Wessels, R. D., Persson, J., Lorentsen, Ø., Andrich, R., Ferrario, M., Oortwijn, W., et al. (2002). IPPA: Individually Prioritized Problem Assessment. *Technology and Disability*, 14(3), 141–145. Retrieved from <http://iospress.metapress.com/content/2bm793b7pbdah9bw/>
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2002). *Towards a Common Language for Functioning, Disability and Health: ICF The International Classification of Functioning, Disability and Health*. Retrieved from <http://www.who.int/classifications/icf/training/icfbeginnersguide.pdf>
- World Health Organization (WHO). (2004). *A Glossary of Terms for Community Health Care and Services for Older Persons*. (WHO/WKC/Tech.Ser./04.2). Retrieved from http://whqlibdoc.who.int/wkc/2004/WHO_WKC_Tech.Ser._04.2.pdf
- World Health Organization (WHO). (2006). *Disability and Rehabilitation WHO Action Plan 2006-2011*. Retrieved from http://www.who.int/disabilities/publications/dar_action_plan_2006to2011.pdf
- World Health Organization (WHO), and World Bank. (2011). *World Report on Disability*. Geneva, Switzerland: WHO.
- Zimmer, Z., and Chappell, N. L. (1999). Receptivity to new technology among older adults. *Disability and Rehabilitation*, 21(5–6), 222–230. doi:10.1080/096382899297648
- Zola, I. K. (1982). *Disincentives to Independent Living*. Kansas City, KS: University of Kansas.

4

The Assessment of the Environments of AT Use: Accessibility, Sustainability, and Universal Design

M. Mirza, A. Gossett Zakrajsek, and S. Borsci

CONTENTS

4.1	Introduction	67
4.2	Accessibility, Sustainability, and Universal Design: An Overview	68
4.2.1	What Do We Mean by Accessibility, Sustainability, and Universal Design?	68
4.2.2	Interaction between Accessibility, Universal Design, and Sustainability	69
4.3	Environment Assessment in the ATA Process Based on the concepts of Accessibility, Sustainability, and Universal Design.....	71
4.4	The Environmental Assessment Process: An Overview	72
4.4.1	The EA Process: Step-by-Step Decision Making	75
4.4.2	Case Evaluation: Considering Accessibility, Universal Design, and Sustainability Within the EA Process	76
4.5	Conclusions.....	79
	Summary of the Chapter.....	79
	Acknowledgments	80
	References	80

4.1 Introduction

The role of the environment in inhibiting or supporting full societal participation of people with disabilities is increasingly being acknowledged. Theoretical frameworks of disability such as the social model (Oliver 1990) and the International Classification of Functioning, Disability, and Health (ICF; WHO 2001) recognize the role of the environment in “producing” disability, albeit to varying extents. Even the preamble of the United Nations (UN) Convention on the Rights of Persons with Disabilities affirms that disability results from the interaction between individuals with impairments and environmental barriers (UN 2006).

Furthermore, research studies have repeatedly underscored the dynamic relationship between environmental factors and the community participation of people with disabilities (Egilson and Traustadottir 2009; Verdonschot et al. 2009). In addition, there is a robust body of literature demonstrating that conflict between assistive technology (AT) and its context of use is an important contributor to AT nonuse and abandonment (Philips and Zhao 1993; Day et al. 2001; Kittel et al. 2002; Scherer 2002; Scherer et al. 2004, 2005; Dijcks

achieve the “ideal” design solution which will enhance the match between the AT, the user, and his/her environment. The second part of this chapter offers a step-by-step decision-making process to guide the multidisciplinary team to effectively evaluate the environment as an on-going component of the ATA process. The overall aim of this environmental assessment process is to help practitioners arrive at an assistive solution that will optimize user participation and satisfaction in the context of use. The chapter concludes with a case study exemplifying the environmental assessment process in practice.

Acknowledgments

We acknowledge the role of Ann Kathleen Barnds and Daisy Feidt in developing some of the key concepts presented in this chapter. We also thank Joy Hammel and Barbara Knecht for their valuable input and guidance in relation to the UD project that this chapter draws upon. Finally, special thanks to Hsiang-Yi Tseng for her work during the UD project.

References

- AARP Public Policy Institute. (2005). *Livable Communities: An Evaluation Guide*. Retrieved from http://assets.aarp.org/rgcenter/il/d18311_communities.pdf
- Birkeland, J. (2002). *Design for Sustainability: A Sourcebook of Integrated, Eco-Logical Solutions*. London: Earthscan Publications.
- Build-for All Project. (2006). *The Build-for-All Reference Manual*. Retrieved from <http://www.build-for-all.net>
- Center for Universal Design. (1997). *The Principles of Universal Design. Version 2.0*. Retrieved from http://www.ncsu.edu/www/ncsu/design/sod5/cud/about_ud/udprinciplestext.htm
- Center for Universal Design. (2008). *The Principles of Universal Design*. Retrieved from http://www.design.ncsu.edu/cud/about_ud/udprinciples.htm
- Church, G., and Glennen, S. (1992). *The Handbook of Assistive Technology*. San Diego: Singular Publishing Group Inc.
- Day, H., Jutai, J., Woolrich, W., and Strong, G. (2001). The stability of impact of assistive devices. *Disability and Rehabilitation*, 23(9), 400–404. doi:10.1080/09638280010008906
- Dijcks, B. P. J., De Witte, L. P., Gelderblom, G. J., Wessels, R. D., and Soede, M. (2006). Non-use of assistive technology in The Netherlands: A non-issue? *Disability and Rehabilitation: Assistive Technology*, 1(1–2), 97–102. doi:10.1080/09638280500167548
- Dion, B., Balcazar de laCruz, A., Rapson, D., Svensson, E., Peters, M., and Dion, P. (2006). *International Best Practices in Universal Design: A Global Review*. Ottawa, Ontario, Canada: Canadian Human Rights Commission.
- Egillon, S. T., and Traustadottir, R. (2009). Participation of students with physical disabilities in the school environment. *American Journal of Occupational Therapy*, 63(3), 264–272. doi:10.5014/ajot.63.3.264
- EIDD Design for All Europe. (2004). Stockholm Declaration. Adopted on 9 May 2004, at the Annual General Meeting of the European Institute for Design and Disability in Stockholm. Retrieved from <http://www.designforalleurope.org/Design-for-All/EIDD-Documents/Stockholm-Declaration/>
- Gossett, A., Mirza, M., Barnds, A. K., and Feidt, D. (2009). Beyond access: A case study on the intersection between accessibility, sustainability, and universal design. *Disability and Rehabilitation: Assistive Technology*, 4(6), 439–450. doi:10.3109/17483100903100301

- Kibert, C. J. (2008). *Sustainable Construction: Green Building Design and Delivery* (2nd ed.). Hoboken, NJ: John Wiley & Sons.
- Kittel, A., Di Marco, A., and Stewart, H. (2002). Factors influencing the decision to abandon manual wheelchairs for three individuals with a spinal cord injury. *Disability and Rehabilitation*, 24(1–3), 106–114. doi:10.1080/0963828011006678 5
- Knecht, B. (2004). Accessibility regulations and a universal design philosophy inspire the design process. *Architectural Record*, 192, 145–150. Retrieved from <http://archrecord.construction.com/resources/conteduc/archives/0401edit-1.asp>
- Lauer, A., Longenecker Rust, K., and Smith, R. O. (2006, August 18). ATOMS Project technical report—Factors in assistive technology device abandonment: Replacing “abandonment” with “discontinuance.” Retrieved from <http://www.r2d2.uwm.edu/atoms/archive/technicalreports/tr-discontinuance.html>
- Lovelock, B. (2010). Disability and going green: A comparison of the environmental values and behaviors of persons with and without disability. *Disability and Society*, 25(4), 467–484. doi:10.1080/09687591003755856
- Mace, R. L., Hardie, G. J., and Place, J. P. (1991). Accessible environments: Toward universal design. In W. F. E. Preiser, J. Vischer, and E. T. White (Eds.), *Design Intervention: Toward a More Humane Architecture* (pp. 1–44). New York: Van Nostrand Reinhold.
- Mann, W. C., and Lane, J. P. (1991). *Assistive Technology for Persons with Disabilities: The Role of Occupational Therapy*. Bethesda, MD: American Occupational Therapy Association.
- Oliver, M. (1990). *The Politics of Disablement*. London: Palgrave Macmillan.
- Parker, J. (2009). BREEAM or LEED—Strengths and weaknesses of the two main environmental assessment methods. Retrieved from <http://www.bsria.co.uk/news/breeam-or-leed/>
- Philips, B., and Zhao, H. (1993). Predictors of assistive technology abandonment. *Assistive Technology*, 5(1), 36–45. doi:10.1080/10400435.1993.10132205
- Salmen, J. (2008). Is universal design really universal? Retrieved from <http://www.uigarden.net/english/is-universal-design-really-universal>
- Scherer, M. J. (2002). The study of assistive technology outcomes in the United States. In K. Miesenberger, J. Klaus, and W. Zagler (Eds.), *Computers Helping People with Special Needs* (Vol. 2398, pp. 131–142). Berlin: Springer. doi:10.1007/3-540-45491-8_152
- Scherer, M. J., Cushman, L. A., and Federici, S. (2004, June 1–10). *Measuring Participation and the Disability Experience with the “Assistive Technology Device Predisposition Assessment.”* Paper presented at the North American Collaborating Center 10th Annual Conference on ICF: NACC 2004, Halifax, Canada. http://secure.cihi.ca/cihiweb/en/downloads/10NACC_Conf_Report_FINAL_e.pdf
- Scherer, M. J., Sax, C. L., Vanbiervliet, A., Cushman, L. A., and Scherer, J. V. (2005). Predictors of assistive technology use: The importance of personal and psychosocial factors. *Disability and Rehabilitation*, 27(21), 1321–1331. doi:10.1080/09638280500164800
- Söderström, S., and Ytterhus, B. (2010). The use and non-use of assistive technologies from the world of information and communication technology by visually impaired young people: a walk on the tightrope of peer inclusion. *Disability and Society*, 25(3), 303–315. doi:10.1080/09687591003701215
- U.S. Access Board. (2004). *Revised ADA and ABA Accessibility Guidelines*. Retrieved from <http://www.access-board.gov/ada-aba/final.pdf>
- U.S. Green Building Council. (2011). Introduction—What LEED is. Retrieved from <http://www.usgbc.org/DisplayPage.aspx?CMSPageID = 1988>
- United Nations (UN). (2006). *Convention on the Rights of Persons with Disabilities*. (A/RES/61/106). New York: UN Retrieved from <http://www.un-documents.net/a61r106.htm>
- Üstün, T. B., Compton, W., Mager, D., Babor, T., Baiyewu, O., Chatterji, S., et al. (1997). WHO study on the reliability and validity of the alcohol and drug use disorder instruments: Overview of methods and results. *Drug and Alcohol Dependence*, 47(3), 161–169.
- Verdonschot, M. M. L., de Witte, L. P., Reichrath, E., Buntinx, W. H. E., and Curfs, L. M. G. (2009). Community participation of people with an intellectual disability: A review of empirical findings. *Journal of Intellectual Disability Research*, 53(4), 303–318. doi:10.1111/j.1365-2788.2008.01144.x
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.

5

Measuring the Impact of AT on Family Caregivers

L. Demers and B.W. Mortenson

CONTENTS

5.1	Introduction.....	83
5.2	Overview of Current Literature.....	84
5.2.1	AT and Human Assistance.....	84
5.2.2	Caregivers of Assistance Users.....	85
5.3	Conceptual Frameworks on the Impact of AT on Caregivers and Users	87
5.3.1	Conceptual Framework 1.....	87
5.3.2	Conceptual Framework 2.....	89
5.3.3	Conceptual Framework 3.....	90
5.4	Measurement Tools Addressing AT Impacts on Family Caregivers.....	91
5.4.1	Caregiver Assistive Technology Outcome Measure.....	91
5.4.2	Family Impact of Assistive Technology Scale.....	92
5.4.3	Examples of Outcome Measurement With Vignettes Based on the Assistance Users/Caregiver Dyad Assistive Technology Process Model	93
5.4.3.1	<i>Vignette 1</i>	93
5.4.3.2	<i>Vignette 2</i>	95
5.5	Future Directions.....	97
5.6	Conclusions.....	97
	Summary of the Chapter.....	98
	Acknowledgments.....	98
	References.....	98

5.1 Introduction

It is generally understood that assistive technology (AT) has the potential to enhance users' functioning, and, in the process, allow them to be less dependent on the assistance of others. However, for the vast preponderance of ATs, this secondary assumption is not buttressed by systematic evidence (McWilliam et al. 2000; Henderson et al. 2008). To create an enhanced understanding of the impact of AT on caregivers, we need (1) better empirical evidence, (2) an improved conceptual understanding of the inter-relationship of outcomes between assistance users and caregivers, and (3) more developed and refined measurement tools. To address these needs this chapter has the following goals:

- To provide an overview of current literature that explores the impact of AT on informal caregivers of children and adults,
- To offer theoretical contributions that explicate the relationship between AT interventions and outcomes for assistance users and their informal caregivers and

test their psychometric properties. Given the stage of development of research in this area, mixed methods research studies may provide invaluable data about the impact of AT on informal caregivers from a variety of perspectives. By developing a thorough understanding of the impact of AT on assistance users and their informal caregivers, interventions that are more suitable can be offered and funding that is more appropriate can be sought.

Summary of the Chapter

In this chapter, we have provided an overview of research that has explored the impact of AT on informal caregivers. We have offered informal caregiver-specific models that help explicate how AT may impact informal caregivers, and we described two measures that are intended to capture this effect. We have proposed that the process of AT provision needs to explicitly acknowledge the role of the informal caregiver. With two vignettes, this chapter provides examples of how these measures could be used to capture the impact of AT on informal caregivers. We have provided suggestions for future work in this area.

Acknowledgments

Dr. Demers is supported by the Fonds de la Recherche en Sante du Quebec as a senior research scholar. Dr. Mortenson is supported via a postdoctoral fellowship for the Canadian Institutes of Health–Institute of Aging. Funding for the development of the CATOM was provided by the National Institute on Disability and Rehabilitation Research through the Consortium on Assistive Technology Outcomes Research (CATOR, <http://www.outcomes.org/>). (Grant # H133A060062).

References

- Agree, E. M., and Freedman V.A. (2000). Incorporating assistive devices into community-based long-term care: An analysis of the potential for substitution and supplementation. *Journal of Aging and Health, 12*(3), 426–450.
- Agree, E. M., Freedman, V. A., Cornman, J. C., Wolf, D. A., and Marcotte J. E. (2005). Reconsidering substitution in long-term care: When does assistive technology take the place of personal care? *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 60*(5), S272.
- Agree, E. M., Freedman, V. A., and Sengupta, M. (2004). Factors influencing the use of mobility technology in community-based long-term care. *Journal of Aging and Health, 16*(2), 267–307.
- Allen, S., Resnik, L., and Roy, J. (2006). Promoting independence for wheelchair users: The role of home accommodations. *The Gerontologist, 46*(1), 115–123.
- Allen, S. M., Foster, A., and Berg, K. (2001). Receiving help at home: The interplay of human and technological assistance. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 56*(6), S374–S382.
- Blake, H., and Lincoln, N.B. (2000). Factors associated with strain in co-resident spouses of patients following stroke. *Clinical Rehabilitation, 14*(3), 307–314.

- Chappell, N. L., and Reid, R.C. (2002). Burden and well-being among caregivers: Examining the distinction. *The Gerontologist*, 42(6), 772–780.
- Chen, T., Mann, W. C., Tomita, M., and Nochajski, S. (1999). Caregiver involvement in the use of assistive devices by frail older persons. *Occupational Therapy Journal of Research*, 20(3), 179–199.
- Demers, L., Fuhrer, M.J., Jutai, J., Lenker, J., Depa, M., and De Ruyter, F. (2009). A conceptual framework of outcomes for caregivers of assistive technology users. *American Journal of Physical Medicine & Rehabilitation*, 88(8), 645–655.
- Demers, L., Fuhrer, M., Jutai, J., Lenker, J.A., and Deruyter, F. (2007). *A Framework for Evaluating Assistive Technology Outcomes on the User-Care Giver Dyad*. Abstract number T0076, Paper presented at the Festival International Conferences on Caregiving, Disability, Aging and Technology (FICCDAT).
- Demers, L., Ska, B., Desrosiers, J., Alix, C., and Wolfson, C. (2004). Development of a conceptual framework for the assessment of geriatric rehabilitation outcomes. *Archives of Gerontology and Geriatrics*, 38(3), 221–237.
- Department of Health and Human Services. (1998). *Informal Caregiving: Compassion in Action*, Washington, DC: U.S. Department of Health and Human Services.
- Dunst, C. J., Trivette, C. M., Davis, M., and Cornwell, J. (1988). Enabling and empowering families of children with health impairments. *Children's Health Care* 17(2), 71–81.
- Egbert, N., Dellmann-Jenkins, M., Smith, G. C., Coeling, H., and Johnson, R.J. (2008). The emotional needs of care recipients and the psychological well-being of informal caregivers: Implications for home care clinicians. *Home Healthcare Nurse*, 26(1), 50.
- Fuhrer, M., Jutai, J., Demers, L., Scherer, M., Bloch, E., and DeRuyter, F. (2006). Effects of type of locomotive device and disabling condition on device use and disuse among elderly individuals following hospitalization. Abstract. In *Proceedings of the International Conference of Aging, Disability and Independence*.
- Gallego, C. F., Roger, M. R., Bonet, I. B., Vinets, L. G., Ribas, A. P., Pisa, R. L., and Oriol, R. P. (2001). Validation of a questionnaire to evaluate the quality of life of nonprofessional caregivers of dependent persons. *Journal of Advanced Nursing*, 33(4), 548–554.
- Glumac, L. K., Pennington, S. L., Sweeney, J. K., and Leavitt, R. L. (2009). Guatemalan caregivers' perceptions of receiving and using wheelchairs donated for their children. *Pediatric Physical Therapy*, 21(2), 158–166.
- Goberman-Hill, R., and Ebrahim, S. (2006). Informal care at times of change in health and mobility: A qualitative study. *Age and Ageing*, 35(3), 261.
- Henderson, S., Skelton, H., and Rosenbaum, P. (2008). Assistive devices for children with functional impairments: Impact on child and caregiver function. *Developmental Medicine & Child Neurology*, 50(2), 89–98.
- Hoening, H., Taylor Jr., D. H., and Sloan, F. A. (2003). Does assistive technology substitute for personal assistance among the disabled elderly? *American Journal of Public Health: American Journal of Public Health*, 93(2), 330–337.
- Hollander, M. J., Liu, G., and Chappell, N. L. (2009). Who cares and how much? *Healthcare Quarterly*, 12(2), 42–49.
- Houser, A., and Gibson, M. J. (2008). *Valuing the Invaluable: The Economic Value of Family Caregiving, 2008 Update*. Washington, DC: American Association of Retired Persons, Insight on the Issues 13.
- Kane, C. M., Mann, W. C., Tomita, M., and Nochajski, S. (2001). Reasons for device use among caregivers of the frail elderly. *Physical & Occupational Therapy in Geriatrics*, 20(1), 29–47.
- Kaye, H. S., Yeager, P., and Reed, M. (2008). Disparities in usage of assistive technology among people with disabilities. *Assistive Technology*, 20, 194–203.
- McWilliam, C. L., Diehl-Jones, W. L., Jutai, J., and Tadrissi, S. (2000). Care delivery approaches and seniors' independence. *Canadian Journal on Aging*, 19, 101–124.
- Messeccar, D. C., Archbold, P. G., Stewart, B. J., and Kirschling, J. (2002). Home environmental modification strategies used by caregivers of elders. *Research in Nursing and Health*, 25(5), 357–370.
- Metlife Mature Market Institute, National Alliance for Caregiving. (2006). *The Metlife Caregiving Cost Study: Productivity Losses to U.S. Business*. Westport, CT: Metlife Mature Market Institute.

- Mortenson, B., Gélinas-Bronsard, D., Roy, L., Plante, M.*, McCabe, D., & Demers, L. (2009). Impacts des aides techniques auprès des usagers et de leurs proches aidants. Résumés des communications de la 7e Journée scientifique annuelle du Réseau québécois de recherche en vieillissement – La recherche sur le vieillissement : Des défis à relever, Québec, p. 33.
- op Reimer, S., de Haan, R. J., Rijnders, P. T., Limburg, M., and van den Bos, G. A. M. (1998). The burden of caregiving in partners of long-term stroke survivors. *Stroke*, 29(8), 1605–1611.
- Østensjø, S., Carlberg, E. B., and Vøllestad, N. K. (2005). The use and impact of assistive devices and other environmental modifications on everyday activities and care in young children with cerebral palsy. *Disability & Rehabilitation*, 27(14), 849–861.
- Pettersson, I., Berndtsson, I., Appelros, P., and Ahlström, G. (2005). Lifeworld perspectives on assistive devices: Lived experiences of spouses of persons with stroke. *Scandinavian Journal of Occupational Therapy*, 12(4), 159–169.
- Pinquart, M., and Sörensen, S. (2003). Differences between caregivers and noncaregivers in psychological health and physical health: A meta-analysis. *Psychology and Aging*, 18(2), 250–267.
- Rigby, P., Denise, R., Schoger, S., and Ryan, S. (2001). Effects of a wheelchair-mounted rigid pelvic stabilizer on caregiver assistance for children with cerebral palsy. *Assistive Technology*, 13, 2–11.
- Rudman, D. L., Hebert, D., and Reid, D. (2006). Living in a restricted occupational world: The occupational experiences of stroke survivors who are wheelchair users and their caregivers. *Canadian Journal of Occupational Therapy*, 73(3), 141–152.
- Ryan, S. (2010). Development of an indicator of the impact of assistive devices in children and their families in Canadian Child and Youth Coalition [database online]. Retrieved from http://www.ccyhc.org/hsr_indicators_workshop/presentations/ryan.pdf
- Ryan, S., Campbell, K. A., Rigby, P., Germon, B., Chan, B., and Hubley, D. (2006). Development of the new family impact of assistive technology scale. *International Journal of Rehabilitation Research*, 29(3), 195–200.
- Ryan, S. E., Campbell, K. A., and Rigby, P. J. (2007). Reliability of the Family Impact of Assistive Technology Scale for families of young children with cerebral palsy. *Archives of Physical Medicine and Rehabilitation*, 88, 1436–1440.
- Ryan, S. E., Campbell, K. A., Rigby, P. J., Fishbein-Germon, B., Hubley, D., and Chan, B. (2009). The impact of adaptive seating devices on the lives of young children with cerebral palsy and their families. *Archives of Physical Medicine and Rehabilitation*, 90(1), 27–33.
- Statistics Canada. (2005). *Population Projections for Canada, Provinces and Territories, 2005 to 2031*. Ottawa, Ontario, Canada: Statistics Canada, Catalogue no. 91-520-XIE.
- Statistics Canada. (2008). *Participation and Activity Limitation Survey 2006: A Profile of Assistive Technology for People with Disabilities*. Ottawa, Ontario, Canada: Statistic Canada, 89-628-X-no.005.
- Stuckey, J. C., Neundorfer, M. M., and Smyth, K. A. (1996). Burden and well-being: The same coin or related currency? *The Gerontologist*, 36(5), 686–693.
- Taylor, D. H., and Hoening, H. (2004). The effect of equipment usage and residual task difficulty on use of personal assistance, days in bed, and nursing home placement. *Journal of the American Geriatrics Society*, 52(1), 72–79.
- Thompson, L. (1999). Functional changes in persons aging with spinal cord injury. *Assistive Technology* 11(2), 123–129.
- Townsend, E., Stanton, S., Law, M., Polatajko, H., Baptiste, S., Thompson-Franson, T. et al. (1997). *Enabling Occupation: An Occupational Therapy Perspective*. Ottawa, Ontario, Canada: Canadian Association of Occupational Therapists.
- Verbrugge, L. M., and Sevak, P. (2002). Use, type, and efficacy of assistance for disability. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 57(6), S366–S379.
- Visser-Meily, A., van Heugten, C., Post, M., Schepers, V., and Lindeman, E. (2005). Intervention studies for caregivers of stroke survivors: A critical review. *Patient Education and Counselling*, 56(3), 257–267.
- Visser-Meily, J. M., Post, M. W. M., Riphagen, I. I., and Lindeman, E. (2004). Measures used to assess burden among caregivers of stroke patients: A review. *Clinical Rehabilitation*, 18(6), 601–623.
- Wart, L., Darrach, J., Hollis, V., Cook, A., and May, L. (2004). Mothers' perceptions of their children's use of powered mobility. *Physical & Occupational Therapy in Pediatrics* 24(4), 3–21.

Section II

Assessment Professionals: Working on the Multidisciplinary Team

M. J. Scherer and S. Federici

Introduction

How disability is diagnosed and treated differs according to age at onset and the type of disability. Developmental disabilities, which occur in infancy and childhood, are typically diagnosed after behavioral and maturational anomalies are observed and are then confirmed medically. Acquired disability can occur at any time in the life span and treatment is often initiated in a hospital emergency room. Disability associated with a degenerative condition, typically associated with advanced age, is generally managed by primary care physicians, neurologists, gerontologists, and family members.

Treating Developmental Disabilities

Developmental disabilities such as Down syndrome or cerebral palsy cannot be “cured.” However, interventions applied as early as possible can make a great deal of difference in current and future functioning. Orthopedic and neurological impairments can be surgically corrected or medically managed. Often children with developmental disabilities undergo many treatments during their initial development with the goal of strengthening or extending the use of existing capabilities (Scherer 2005). Sensory disabilities can be greatly helped with advances in technology and the means to communicate can be made possible through alternative and augmented communication devices.

TABLE II.1

Chapters of Section II

Chapter	Topic
6	The Cognitive Therapist (Olivetti Belardinelli, Turella, and Scherer)
7	The Special Educator (Zapf and Craddock)
8	The Psychologist (Meloni, Federici, Stella, Mazzeschi, Cordella, Greco, and Grasso)
9	The Psychotechnologist (Miesenberger, Corradi, and Mele)
10	The Optometrist (Orlandi and Amantis)
11	The Occupational Therapist (de Jonge, Wielandt, Zapf, and Eldridge)
12	The Pediatric Specialist (Braga, de Camillis Gil, Pinto, and Siebra Beraldo)
13	The Geriatrician (Pigliautile, Tiberio, Mecocci, and Federici)
14	The Speech–Language Pathologist (Hill and Corsi)

The Joint Committee states that

When cognitive, communication, emotional, and psychosocial domains are affected, the team should include at least a clinical neuropsychologist or rehabilitation psychologist, and speech–language pathologist. Team membership will vary with the age of the persons served, the type of impairment, the stage of recovery, and the special training of team members (2007, p. 4).

Thus, there is considerable consistency in these two views of the rehabilitation team, the first from Singapore and the second from the United States.

The nine chapters presented in this section (Table II.1) focus on and describe the role of many professions in the rehabilitation of persons with disabilities and their match with appropriate assistive technologies.

Each chapters was written by an international expert in his or her area of specialty. What unites these authors is not only their commitment to optimal rehabilitation outcomes, but their perspective of the biopsychosocial approach to the assistive technology evaluation, selection, and provision.

Conclusion

The best rehabilitation outcomes are achieved when individuals with shared perspectives, but representing different areas of knowledge and skill, pool their expertise to derive interventions that meet the personal, psychosocial as well as physical needs and preferences of the individual with a disability. This teamwork also needs to be brought to bear on the selection and provision of assistive solutions. Each of the contributors to this section describes how this can be achieved from the viewpoint of their training and practice.

References

Chua, K. S. G., Ng, Y.-S., Yap, S. G. M., and Bok, C.-W. (2007). A Brief Review of Traumatic Brain Injury Rehabilitation. *Annals of the Academy of Medicine, Singapore*, 36(1), 31–42. Retrieved from Annals.edu.sg website: <http://www.ncbi.nlm.nih.gov/pubmed/17285184>

- Hall, T., Krahn, G. L., Horner-Johnson, W., and Lamb, G. (2011). Examining functional content in widely used Health-Related Quality of Life scales. *Rehabilitation Psychology, 56*(2), 94–99. doi:10.1037/a0023054
- Joint Committee on Interprofessional Relations Between the American Speech–Language–Hearing Association and Division 40 (Clinical Neuropsychology) of the American Psychological Association. (2007). *Structure and Function of an Interdisciplinary Team for Persons with Acquired Brain Injury [Guidelines]*. Retrieved from <http://www.asha.org/policy> doi:10.1044/policy.GL2007-00288
- Maas, A. I., Harrison-Felix, C. L., Menon, D., Adelson, P. D., Balkin, T., Bullock, R., et al. (2010). Common data elements for traumatic brain injury: recommendations from the interagency working group on demographics and clinical assessment. *Archives of Physical Medicine and Rehabilitation, 91*(11), 1641–1649. doi:10.1016/j.apmr.2010.07.232
- Scherer, M. J. (2005). *Living in the State of Stuck: How Technologies Affect the Lives of People with Disabilities* (4th ed.). Cambridge, MA: Brookline Books.
- Scherer, M. J. (2012). *Assistive Technologies and Other Supports for People with Brain Impairment*. New York, NY: Springer Publishing.
- Wilson, B. A. (2006). Recent Developments in Neuropsychological Rehabilitation. *Higher Brain Function Research, 26*(2), 121–127. doi:10.2496/hbfr.26.121

6

The Cognitive Therapist

M. Olivetti Belardinelli, B. Turella, and M. J. Scherer

CONTENTS

6.1 Cognitive Therapy	107
6.2 The Cognitive Therapist	110
6.3 Cognitive Therapy With Individuals Having Cognitive Disability	114
6.4 Cognitive Rehabilitation	115
6.5 Assistive and Cognitive Support Technologies	116
6.6 Case Study	121
6.6.1 A Real-Life Example of a Vocational Rehabilitation Counselor's Solution-Seeking for James, Who Has Early Onset Alzheimer's Disease	121
6.6.2 MPT Survey Results and Assessment Analysis	122
6.6.3 Research, Implementation, and Recommendations	123
6.7 Conclusions	125
Summary of the Chapter	125
References	126

6.1 Cognitive Therapy

The origins of cognitive therapy are generally grounded in behavioral therapies. This is true when we consider the original modalities of the behavioral therapies. However, in the frame of the cognitive therapy panorama, we find that it is important now for therapists to consider behavior within a psychodynamic frame.

Behavioral therapy started in the 1940s and 1950s using the conditioning techniques envisaged by Pavlov for human behavior. On this basis, some authors explained human behavior by means of mediators, defined as intervening variables of a biological basis or cognitive type able to interact with antecedents through conditioning to particular consequences. The paradigm of instrumental conditioning afforded the possibility of modifying human behavior. In the first years behavioral modifications were obtained in situations in which it was easy to manipulate the environmental variables, or with subjects characterized with “cognitive simplicity,” such as children, psychotics, and “generically disabled people.” Afterward, neuroses, emotional problems, and behaviors connected with anxiety and depression were faced.

The name behavioral therapy was given by Lazarus to contrast it with the contemporary psychodynamic therapies. Lazarus based his approach on learning experience and conditioning principles.

References

- Altman, I. M., Swick, S., Parrot, D., and Malec, J. F. (2010). Effectiveness of community-based rehabilitation after traumatic brain injury for 489 program completers compared with those precipitously discharged. *Archives of Physical Medicine and Rehabilitation*, 91(11), 1697–1704. doi:10.1016/j.apmr.2010.08.001
- Arthur, A. R. (2003). The emotional lives of people with learning disability. *British Journal of Learning Disabilities*, 31(1), 25–30. doi:10.1046/j.1468-3156.2003.00193.x
- Beck, A. T. (1976). *Cognitive Therapy and the Emotional Disorders*. New York: International Universities Press.
- Beck, A. T., Emery, G., and Greenberg, R. L. (1985). *Anxiety Disorders and Phobias: A Cognitive Perspective*. New York: Basic Books.
- Beck, A. T., Rush, A. J., Brian, F. S., and Emery, G. (1979). *Cognitive Therapy of Depression*. New York: Guilford Press.
- Bharucha, A., Anand, V., Forlizzi, J., Dew, M. A., Reynolds III, C. F., Stevens, S., et al. (2009). Intelligent assistive technology applications to dementia care: Current capabilities, limitations, and future challenges. *American Journal of Geriatric Psychiatry*, 17(2), 88–104. doi:10.1097/JGP.0b013e318187dde5
- Bickenbach, J. E. (2009). Disability, culture and the UN Convention. *Disability and Rehabilitation*, 31(14), 1111–1124. doi:10.1080/09638280902773729
- Bocchi, G., and Ceruti, M. (Eds.). (1985). *La Sfida della Complessità*. Milano, Italy: Feltrinelli.
- Bowlby, J. (1979). *The Making and Breaking of Affectional Bonds*. London: Routledge.
- Bowlby, J. (1988). *A Secure Base: Clinical Applications of Attachment Theory*. London: Routledge.
- Braddock, D., Rizzolo, M. C., Thompson, M., and Bell, R. (2004). Emerging technologies and cognitive disability. *Journal of Special Education Technology*, 19(4), 49–56.
- Bruner, J. S. (1990). *Acts of Meaning*. Cambridge, MA: Harvard University Press.
- Cicerone, K. D., Dahlberg, C., Kalmar, K., Langenbahn, D. M., Malec, J. F., Bergquist, T. F., et al. (2000). Evidence-based cognitive rehabilitation: Recommendations for clinical practice. *Archives of Physical Medicine and Rehabilitation*, 81(12), 1596–1615. doi:10.1053/apmr.2000.19240
- Cicerone, K. D., Dahlberg, C., Malec, J. F., Langenbahn, D. M., Felicetti, T., Kneipp, S., et al. (2005). Evidence-based cognitive rehabilitation: Updated review of the literature from 1998 through 2002. *Archives of Physical Medicine and Rehabilitation*, 86(8), 1681–1692. doi:10.1016/j.apmr.2005.03.024
- Cicerone, K. D., Langenbahn, D. M., Braden, C., Malec, J. F., Kalmar, K., Fraas, M., et al. (2011). Evidence-based cognitive rehabilitation: Updated review of the literature from 2003 through 2008. *Archives of Physical Medicine and Rehabilitation*, 92(4), 519–530. doi:10.1016/j.apmr.2010.11.015
- Cicerone, K. D., Mott, T., Azulay, J., and Friel, J. C. (2004). Community integration and satisfaction with functioning after intensive cognitive rehabilitation for traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, 85(6), 943–950. doi:10.1016/j.apmr.2003.07.019
- Cionini, L. (1991). *Psicoterapia Cognitiva* [Cognitive Psychotherapy]. Rome: Carocci.
- Cionini, L. (Ed.). (1998). *Psicoterapie. Modelli a Confronto*. Rome: Carocci.
- De Pompei, R., Gillette, Y., Goetz, E., Xenopoulos-Oddsson, A., Bryen, D., and Dowds, M. (2008). Practical applications for use of PDAs and smartphones with children and adolescents who have traumatic brain injury. *NeuroRehabilitation*, 23(6), 487–499. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/19127002>
- Durlak, J. A., Fuhrman, T., and Lampman, C. (1991). Effectiveness of cognitive-behavior therapy for maladapting children: A meta-analysis. *Psychological Bulletin*, 110(2), 204–214. doi:10.1037//0033-2909.110.2.204
- Ellis, A. (1962). *Reason and Emotion in Psychotherapy*. New York: Lyle Stuart.

- Ellis, A. (2003). Reasons why rational emotive behavior therapy is relatively neglected in the professional and scientific literature. *Journal of Rational-Emotive and Cognitive-Behavior Therapy*, 21(3/4), 245–252. doi:10.1023/A:1025842229157
- Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, 196(4286), 129–136. doi:10.1126/science.847460
- Gillette, Y., and De Pompei, R. (2004). The potential of electronic organizers as a tool in the cognitive rehabilitation of young people. *NeuroRehabilitation*, 19(3), 233–243. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/15502256>
- Gonzalez, J. E., Nelson, J. R., Gutkin, T. B., Saunders, A., Galloway, A., and Shwery, C. S. (2004). Rational emotive therapy with children and adolescents: A meta-analysis. *Journal of Emotional and Behavioral Disorders*, 12(4), 222–235. doi:10.1177/10634266040120040301
- Guidano, V. F. (1987). *Complexity of the Self: A Developmental Approach to Psychopathology and Therapy*. New York: Guilford Press.
- Guidano, V. F. (1991). *The Self in Process: Toward a Post-Rationalist Cognitive Therapy*. New York: Guilford Press.
- Guidano, V. F., and Liotti, G. (1983). *Cognitive Processes and Emotional Disorders: A Structural Approach to Psychotherapy*. New York: Guilford Press.
- Hart, T. (2010). Cognitive rehabilitation. In R. G. Frank, M. Rosenthal, and B. Caplan (Eds.), *Handbook of Rehabilitation Psychology* (2nd ed., pp. 285–300). Washington, DC: American Psychological Association.
- Heerkens, Y. F., Bougie, T., and de Kleijn-de Vrankrijker, M. W. (2010). Classification and terminology of assistive products. In J. Stone, and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation* (pp. 1–12). Buffalo, NY: Center for International Rehabilitation Research Information and Exchange (CIRRIE). Retrieved from <http://cirrie.buffalo.edu/encyclopedia/en/article/265/>
- Heyvaert, M., Maes, B., and Onghena, P. (2010). A meta-analysis of intervention effects on challenging behaviour among persons with intellectual disabilities. *Journal of Intellectual Disability Research*, 54(7), 634–649. doi:10.1111/j.1365-2788.2010.01291.x
- High, W. M., Sander, A. M., Struchen, M. A., and Hart, K. A. (2005). *Rehabilitation for Traumatic Brain Injury*. New York: Oxford University Press.
- Hurley, A. D., Tomasulo, D. J., and Pfadt, A. G. (1998). Individual and group psychotherapy approaches for persons with mental retardation and developmental disabilities. *Journal of Developmental and Physical Disabilities*, 10(4), 365–386. doi:10.1023/A:1021806605662
- International Standards Organization (ISO). (2007). *ISO 9999:2007: Assistive Products for Persons with Disability—Classification and Terminology*. Geneva, Switzerland: ISO.
- Liotti, G. (1991). Il significato delle emozioni e la psicoterapia cognitiva [The meaning of emotions and the cognitive psychotherapy]. In T. Magri, and F. Mancini (Eds.), *Emozione e Conoscenza [Emotion and Knowledge]* (pp. 227–244). Roma: Editori Riuniti.
- Liotti, G. (1999). Disorganized attachment as a model for understanding dissociative psychopathology. In J. Solomon, and C. George (Eds.), *Attachment Disorganization* (pp. 291–317). New York: Guilford Press.
- Liotti, G. (2001). *Le Opere della Coscienza. Psicopatologia e Psicoterapia Nella Prospettiva Cognitivo-Evoluzionista [The Labours of Consciousness]*. Milan, Italy: Cortina Raffaello.
- Liotti, G. (2005). *La Dimensione Interpersonale Della Coscienza [The Interpersonal Dimension of Consciousness]* (2nd ed.). Rome: Carocci.
- Mahoney, M. J. (1980). Psychotherapy and the structure of personal revolutions. In M. J. Mahoney (Ed.), *Psychotherapy Process: Current Issues and Future Directions* (pp. 157–180). New York: Plenum Press.
- Mahoney, M. J. (1991). *Human Change Processes: The Scientific Foundations of Psychotherapy*. New York: Basic Books.
- Maturana, H. R., and Varela, F. J. (1980). *Autopoiesis and Cognition: The Realization of the Living*. Boston: Reidel.

- Maturana, H. R., and Varela, F. J. (1987). *The Tree of Knowledge: The Biological Roots of Human Understanding*. Boston: Shambhala.
- McGinn, L. K., and Sanderson, W. C. (2006). What allows cognitive behavioral therapy to be brief: Overview, efficacy, and crucial factors facilitating brief treatment. *Clinical Psychology: Science and Practice*, 8(1), 23–37. doi:10.1093/clipsy.8.1.23
- Olivetti Belardinelli, M. (1973). *La Costruzione della Realtà* [The Construction of Reality]. Torino, Italy: Boringhieri.
- Olivetti Belardinelli, M. (1976). Prospettive dell'odierna psicologia scientifica. [Perspectives of Today's Scientific Psychology]. *Comunicazioni Scientifiche della Cattedra di Psicologia Generale IV*(1), 7–18.
- Rait, S., Monsen, J. J., and Squires, G. (2010). Cognitive behaviour therapies and their implications for applied educational psychology practice. *Educational Psychology in Practice*, 26(2), 105–122. doi:10.1080/02667361003768443
- Reda, M. A. (1986). *Sistemi Cognitivi Complessi e Psicoterapia* [Complex Cognitive Systems and Psychotherapy]. Roma: Carocci.
- Sablier, J., Stip, E., and Franck, N. (2009). Remédiation cognitive et assistants cognitifs numériques dans la schizophrénie. [Cognitive remediation and cognitive assistive technologies in schizophrenia]. *Encephale*, 35(2), 160–167. doi:10.1016/j.encep.2008.02.010
- Schalock, R. L., and Luckasson, R. (2004). American Association on Mental Retardation's *Definition, Classification, and System of Supports* and its relation to international trends and issues in the field of intellectual disabilities. *Journal of Policy and Practice in Intellectual Disabilities*, 1(3–4), 136–146. doi:10.1111/j.1741-1130.2004.04028.x
- Scherer, M. J. (1986). Values in the Creation, Prescription, and Use of Technological Aids and Assistive Devices for People with Physical Disabilities. Doctoral Dissertation, University of Rochester and final report to the National Science Foundation. (University Microfilms No. ADG87-08247) Retrieved from <http://worldcat.org/z-wcorg/>
- Scherer, M. J. (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J. (2005). *Living in the State of Stuck: How Technologies Affect the Lives of People with Disabilities* (4th ed.). Cambridge, MA: Brookline Books.
- Scherer, M. J. (2012). *Assistive Technologies and Other Supports for People with Brain Impairment*. New York: Springer.
- Scherer, M. J., Hart, T., Kirsch, N., and Schulthesis, M. (2005). Assistive technologies for cognitive disabilities. *Critical Reviews™ in Physical and Rehabilitation Medicine*, 17(3), 195–215. doi:10.1615/CritRevPhysRehabilMed.v17.i3.30
- Scherer, M. J., Jutai, J., Fuhrer, M., Demers, L., and Deruyter, F. (2007). A framework for modelling the selection of assistive technology devices (ATDs). *Disability and Rehabilitation: Assistive Technology*, 2(1), 1–8. doi:10.1080/17483100600845414
- Scherer, M. J., and Sax, C. L. (2010). Measures of assistive technology predisposition and use. In E. Mpofu and T. Oakland (Eds.), *Rehabilitation and Health Assessment. Applying ICF Guidelines* (pp. 229–254). New York: Springer.
- Semerani, A. (2002). *Storia, Teorie e Tecniche Della Psicoterapia Cognitiva* [Cognitive Therapy: History, Theories and Techniques]. Bari, Italy: Laterza.
- Taylor, J. L. (2005). In support of psychotherapy for people who have mental retardation. *Mental Retardation*, 43(6), 450–453. doi:10.1352/0047-6765(2005)43[450:ISOPFP]2.0.CO;2
- Taylor, J. L., Lindsay, W. R., and Willner, P. (2008). CBT for people with intellectual disabilities: Emerging evidence, cognitive ability and IQ effects. *Behavioural and Cognitive Psychotherapy*, 36(06), 723. doi:10.1017/S1352465808004906
- Tsaousides, T., and Gordon, W. A. (2009). Cognitive rehabilitation following traumatic brain injury: Assessment to treatment. *Mount Sinai Journal of Medicine*, 76(2), 173–181. doi:10.1002/msj.20099
- United Nations (UN). (2006). *Convention on the Rights of Persons with Disabilities*. (A/RES/61/106). New York: UN. Retrieved from <http://www.un-documents.net/a61r106.htm>

- United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). (2010). *Training Manual on Disability Statistics*. Retrieved January 5, 2011 from <http://www.unescap.org/stat/disability/manual/Chapter2-Disability-Statistics.asp>
- von Bertalanffy, L. (1968). *General System Theory: Foundations, Development, Applications*. New York: G. Braziller.
- von Foerster, H. (1984). *Observing Systems*. Seaside, CA: Intersystems Publications.
- von Glasersfeld, E. (1984). An introduction to radical constructivism. In P. Watzlawick (Ed.), *The Invented Reality: How Do We Know What We Believe We Know? (Contributions to Constructivism)* (pp. 17–40). New York: Norton.
- Whitehouse, R. M., Tudway, J. A., Look, R., and Kroese, B. S. (2006). Adapting individual psychotherapy for adults with intellectual disabilities: A comparative review of the cognitive-behavioural and psychodynamic literature. *Journal of Applied Research in Intellectual Disabilities*, 19(1), 55–65. doi:10.1111/j.1468-3148.2005.00281.x
- Willner, P., and Hatton, C. (2006). CBT for people with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities*, 19(1), 1–3. doi:10.1111/j.1468-3148.2006.00300.x
- World Health Organization. (WHO). (2001). *International Classification of Functioning, Disability and Health (ICF)* Vol. 2010. Retrieved from <http://www.who.int/classifications/icf/en/>

7

The Special Educator

S. Zapf and G. Craddock*

CONTENTS

7.1	The Role of the Special Educator in Assistive Technology Assessment	131
7.2	Teaching Alternatives Using AT	134
7.3	Outcome Studies of Assistive Technology in the Educational Setting	136
7.4	Environmental Factors to Promote AT in the Classroom	136
7.5	Going Forward: Universal Design for Learning (UDL)	138
7.6	Case Evaluation	139
7.6.1	First Case Study: Zoey	139
7.6.2	Second Case Study: John	140
7.7	Conclusions	145
	Summary of the Chapter	146
	References	146

7.1 The Role of the Special Educator in Assistive Technology Assessment

The World Health Organization and the United Nations Global Disability report estimates that individuals with disabilities account for 15% of the world population, and there are approximately 150 million children with disabilities in the world (WHO 2010). The definition of special education varies worldwide because many countries use a social classification system similar to the International Classification System addressing the child's ability to participate across the educational domain, whereas other countries focus on a medical model for education that is based on specific categories of impairment or disabilities. Assistive technology (AT) has long been recognized as a tool for enabling independence and access for individuals with disabilities (Bowe 1995; Østensjø et al. 2005; Watson et al. 2010). Although changes in legislation have provided a positive shift to include the consideration of AT in the student's educational plan/setting, there still remains a deficiency in many developing countries for children with disabilities to have access to needed AT to assist with meeting their educational plan and participation in daily activities. The World Health Organization reports that only 5–15% of individuals with disabilities have access to AT in many developing countries. The United Nations Standard and World Health Organization Rule 4 (WHO 2010) promotes the training of personnel at various levels in AT to improve access for technology. The special educator can play a vital role in providing technology access and implementation of tools to be used with students in the educational setting.

* The views expressed by Dr. Ger Craddock are his own and are not of his employer, the National Disability Authority.

can determine use or nonuse of AT. Finally, as technology advances and AT is increasingly supported within the mainstream market, the authors outline the next stage of technology provision within the classroom—UDL. Ultimately, providing an educational environment where classrooms are designed to cater for all types of students regardless of their disability or special need is optimal. It is imperative for teachers to recognize that all students have varying ability, and it is a measure of their ability, not disability, that should determine how their education is supported. The classroom should provide a range of supports for any student who may have issues in accessing the curriculum—from reading difficulties to writing to understanding. A special educator should have the knowledge, skills, and competence backed up with the support of technologies to support all within the education environment.

Summary of the Chapter

This chapter describes the importance of assistive technology in education and the role of the special educator in the process of integrating assistive technology for students with disabilities into the educational system. The special educator is a crucial team member, providing knowledge of the students' educational capabilities and their daily interaction in the use of assistive technology. Assistive technology can provide many children and adolescents with disabilities the tools necessary to be more successful in school, at work, and at achieving independence in daily living. Unfortunately, many special educators do not receive training in the application of assistive technology nor do they have adequate resources to effectively assess, implement, and follow-up on the use of assistive technology in the classroom. This chapter will identify the special educator's role in the assessment and implementation of AT. Recommendations for future training needs for special educators will also be discussed.

References

- Bowe F. G. (1995). The political and economic issues that drive and derail assistive technology development. *Generations*, 19(1), 37–40.
- Bowser, G., and Reed, P. (1995). Education TECH points for assistive technology planning. *Journal of Special Education Technology*, 12(4), 325–338.
- British Educational Communications and Technology Agency (Becta). (2003). What the research says about ICT supporting special educational needs (SEN) and inclusion *What the Research Says Series*. Retrieved from Education.gov.uk website: <https://www.education.gov.uk/publications/eOrderingDownload/15009MIG2791.pdf>
- Case, D., and Lahm, E. A. (2003). *The Essential Elements of an Assistive Technology Assessment and Assessment Report*. Paper presented at the CSUN Technology and Persons with Disabilities Los Angeles, CA, US.
- Copley, J., and Ziviani, J. (2004). Barriers to the use of assistive technology for children with multiple disabilities. *Occupational Therapy International*, 11(4), 229–243. doi:10.1002/oti.213
- Craddock, G. (2003). Statement of Need (SON) in assistive technology service delivery system—implications for policy and practice in an Irish context. In G. M. Craddock, L. P. McCormack, R. B. Reilly and H. T. P. Knops (Eds.), *Assistive Technology—Shaping the Future* (pp. 385–388). Amsterdam, The Netherlands: IOS Press.

- Craddock, G. (2006). The AT continuum in education: Novice to power user. *Disability and Rehabilitation: Assistive Technology*, 1(1–2), 17–27. doi:10.1080/09638280500167118
- Craddock, G., and MacKeogh, T. (2004). *Inclusive Learning through Technology—the ILT Project*, Paper presented at the History of Education Society Conference, October 7–8, Trinity College, Dublin, Ireland.
- Craddock, G., and McCormack, L. (2002). Delivering an AT service: A client-focused, social and participatory service delivery model in assistive technology in Ireland. *Disability and Rehabilitation*, 24(1–3), 160–170. doi:10.1080/09638280110063869
- Craddock, G., and Scherer, M. J. (2002). Assessing individual needs for assistive technology. In C. L. Sax and C. A. Thoma (Eds.), *Transition Assessment: Wise Practices for Quality Lives*. Baltimore, MD: P.H. Brookes.
- Dalton, E. M. (2002). Assistive technology in education: A review of policies, standards, and curriculum integration from 1997 through 2000 involving assistive technology and the Individuals with Disabilities Education Act. *Issues in Teaching and Learning*, 1(1). Retrieved from http://www.ric.edu/itl/volume_01_articles.php#section10
- Erickson, K. (2006). What works for all students. Unpublished research outcome. Retrieved from <http://www.donjohnston.research.com>
- Iowa Department of Education. (2007). Summary of Iowa Text Reader Longitudinal Study 2006–2007. Unpublished. Retrieved from <http://www.kurzweiled.com/content/documents/Iowa%20Text%20Reader%20Study%20Final%20Report.pdf>
- Judge, S., Floyd, K., and Wood-Fields, C. (2010). Creating a technology-rich learning environment for infants and toddlers with disabilities. *Infants and Young Children*, 23(2), 84–92. doi:10.1097/IYC.0b013e3181d29b14
- Judge, S., and Simms, K. A. (2009). Assistive technology training at the pre-service level: A national snapshot of teacher preparation programs, teacher education, and special education. *Teacher Education and Special Education*, 32(1), 33–44. doi:10.1177/0888406408330868
- Lahm, E. A., and Sizemore, L. (2002). Factors that influence assistive technology decision-making. *Journal of Special Education Technology*, 17(1), 15–26.
- Lenker, J. A., and Paquet, V. L. (2003). A review of conceptual models for assistive technology outcomes research and practice. *Assistive Technology*, 15(1), 1–15. doi:10.1080/10400435.2003.10131885
- Louise-Bender Pape, T., Kim, J., and Weiner, B. (2002). The shaping of individual meanings assigned to assistive technology: a review of personal factors. *Disability and Rehabilitation*, 24(1–3), 5–20. doi:10.1080/0963828011006623 5
- Markussen, E. (2004). Special education: Does it help? A study of special education in Norwegian upper secondary schools. *European Journal of Special Needs Education*, 19(1), 33–48. doi:10.1080/0885625032000167133
- Millar, D. C., Light, J. C., and Schlosser, R. W. (2006). The impact of augmentative and alternative communication intervention on the speech production of individuals with developmental disabilities: A research review. *Journal of Speech, Language, and Hearing Research*, 49(2), 248–264. doi:10.1044/1092-4388(2006/021)
- Mirenda, P., Turoldo, K., and McAvoy, C. (2006). The impact of word prediction software on the written output of students with physical disabilities. *Journal of Special Education Technology*, 21(3), 5–12.
- Østensjø, S., Carlberg, E. B., and Vøllestad, N. (2005). The use and impact of assistive devices and other environmental modifications on everyday activities and care in young children with cerebral palsy. *Disability and Rehabilitation*, 27(14), 849–861. doi:10.1080/09638280400018619
- Schepis, M. M., Reid, D. H., Behrmann, M. M., and Sutton, K. A. (1998). Increasing communicative interactions of young children with autism using a voice output communication aid and naturalistic teaching. *Journal of Applied Behavior Analysis*, 31(4), 561–578. doi:10.1901/jaba.1998.31-561.
- Scherer, M. (1997). *Matching Assistive Technology and Child: A Process and Series of Assessments for Selecting and Evaluating Technologies Used by Infants and Young Children*. Webster, NY: Institute for Matching Person & Technology.

- Scherer, M. J. (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J. (2005). Assessing the benefits of using assistive technologies and other supports for thinking, remembering and learning. *Disability and Rehabilitation*, 27(13), 731–739. doi:10.1080/09638280400014816
- Scherer, M. J., and Craddock, G. (2002). Matching Person & Technology (MPT) assessment process. *Technology and Disability*, 3(14), 125–131. Retrieved from <http://iospress.metapress.com/content/g0eft4mnlwly8y8g>
- Scherer, M. J., Sax, C. L., Vanbiervliet, A., Cushman, L. A., and Scherer, J. V. (2005). Predictors of assistive technology use: The importance of personal and psychosocial factors. *Disability and Rehabilitation*, 27(21), 1321–1331. doi:10.1080/09638280500164800
- Scherer, M. J., and Zapf, S. (2008). Poster 50: Developing a measure to appropriately match students with disabilities and assistive technology devices. *Archives of Physical Medicine and Rehabilitation*, 89(10), e21-e22. doi:10.1016/j.apmr.2008.08.077
- Sigafoos, J., and Drasgow, E. (2001). Conditional use of aided and unaided AAC: A review and clinical case demonstration. *Focus on Autism and Other Developmental Disabilities*, 16(3), 152–161. doi:10.1177/108835760101600303
- Staples, A., Heying, K., McLellan, J. (1995). A study on the effects of Co:Writer word prediction Software on the writing achievement of students with learning disabilities. Retrieved from <http://www/donjohnston.com/djlearning/lftfrm.htm>
- Swanson, C. B. (2008). *Special Education in America: The State of Students with Disabilities*. Bethesda, MD: Editorial Projects in America.
- Sze, S. (2009). A literature review: Pre-service teachers' attitudes toward students with disabilities. *Education*, 130(1), 53–56.
- Texas Assistive Technology Network (TATN). (2007). *Considering Assistive Technology in the IEP Training Module and Resource Guide Supplement*. Retrieved from <http://www.texasat.net> and <http://techaccess.edb.utexas.edu>
- U.S. Department of Education Office of Special Education and Rehabilitative Services (OSERS). (1998). *20th Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act*. Retrieved from <http://www2.ed.gov/offices/OSERS/OSEP/Research/OSEP98AnlRpt/index.html>
- Watson, A. H., Ito, M., Smith, R. O., and Andersen, L. T. (2010). Effect of assistive technology in a public school setting. *The American Journal of Occupational Therapy*, 64(1), 18–29. doi:10.5014/ajot.64.1.18
- World Health Organization. (2010). *Disabilities & Rehabilitations*. Geneva, Switzerland: WHO. Retrieved from <http://www.who.int/disabilities/media/events/idpdinfo031209/en/index.html>
- Zapf, S. A., and Scherer, M. J. (2011). Matching assistive technology to child assessment: A pilot study. Manuscript submitted for publication.

8

The Psychologist

F. Meloni, S. Federici, A. Stella, C. Mazzeschi, B. Cordella, F. Greco, and M. Grasso

CONTENTS

8.1	The Languishing Psychologist's Role in Assistive Technology Assessment	149
8.2	Nothing about "Psycho" without Psychologists: The ICF and the Need for Its Revision	151
8.3	The Personal Factors of Functioning and Disability	153
8.4	Personal Factors and Assistive Solutions	154
8.5	The Psychologist in a Center for Technical Aid: The Specialist in Personal Factors	155
8.6	Outlining the Psychologist's Role in the ATA Process	157
8.6.1	When the Psychologist Role in the ATA Process Is Required	158
8.6.2	How a Psychologist Facilitates the Awareness of the User/Client's Context and Multidisciplinary Team Perspectives	160
8.6.2.1	Methodology	160
8.6.2.2	Goals	163
8.6.2.3	What a Psychologist Should Do in Promoting a User/Client Request	164
8.7	Psychologist "Know Thyself": Psychologist and Professional's Representations of the Disabled Users/Clients and Assistive Technologies	164
8.7.1	Professionals' Representation of Disability	165
8.7.2	New Approach in Psychological Practice	168
8.7.3	Psychological Professional Practice Guidelines in the ATA Process	168
8.7.3.1	The User	169
8.7.3.2	The Family	169
8.7.3.3	The Professionals' Multidisciplinary Team	170
8.8	Conclusions	170
	Summary of the Chapter	172
	Acknowledgments	172
	References	172

8.1 The Languishing Psychologist's Role in Assistive Technology Assessment

Psychology itself is dead. Or, to put it another way, psychology is in a funny situation. My college, Dartmouth, is constructing a magnificent new building for psychology. Yet its four stories go like this: The basement is all neuroscience. The first floor is devoted to classrooms and administration. The second floor houses social psychology, the third floor, cognitive science, and the fourth, cognitive neuroscience. Why is it called the psychology building? (Gazzaniga 1998, pp. xi-xii)

Summary of the Chapter

This chapter deals with the role and the competencies of the psychologist in a center for technical aid. The lapse of the psychologist's role in ATA is probably due to the noncoding of personal factors in the ICF. In viewing the psychologist as the "specialist" on personal factors, the authors call for a revision of the ICF so that in the biopsychosocial model, the "psycho" does not remain as just a prefix. The psychologist in the center has the goals to support the user's request in the user-driven process as well as to act as a mediator between users seeking solutions and the multidisciplinary team. He or she also acts to build a team spirit and enhance the relationship between the client and his or her home environment. Finally, an original study closes the chapter, focusing on psychologists and professionals' representations of disabled users/clients and ATs.

Acknowledgments

Fabio Meloni, Stefano Federici, and Aldo Stella contributed equally to this study, except for Section 8.6, which was edited by Claudia Mazzeschi, and Section 8.7, which was edited by Barbara Cordella, Francesca Greco, and Massimo Grasso.

References

- AAATE. (2003). *AAATE Position Paper: A 2003 View on Technology and Disability*. Retrieved from <http://www.aaate.net/>
- American Psychological Association (APA). (2010). *Ethical Principles of Psychologists and Code of Conduct*. Retrieved from <http://www.apa.org/ethics/code/index.aspx>
- Badley, E. M. (2006, June 5–7). *More than Facilitators and Barriers: Fitting the Full Range of Environmental and Personal Contextual Factors into the ICF Model*. Paper presented at the 12th annual North American Collaborating Centre Conference on ICF, Vancouver, Canada.
- Barker, D. J., Reid, D., and Cott, C. (2006). The experience of senior stroke survivors: Factors in community participation among wheelchair users. *Canadian Journal of Occupational Therapy, 73*(1), 18–25. doi:10.2182/cjot.05.0002
- Barry, P., and O'Leary, J. (1989). Roles of the psychologist on a traumatic brain injury rehabilitation team. *Rehabilitation Psychology, 34*(2), 83–90. doi:10.1037/h0091712
- Bickenbach, J. E., Chatterji, S., Badley, E. M., and Üstün, T. B. (1999). Models of disablement, universalism and the International Classification of Impairments, Disabilities and Handicaps. *Social Science and Medicine, 48*(9), 1173–1187. doi:10.1016/S0277-9536(98)00441-9
- Bodenheimer, T., Lorig, K., Holman, H., and Grumbach, K. (2002). Patient self-management of chronic disease in primary care. *Journal of the American Medical Association, 288*(19), 2469–2475. doi:10.1001/jama.288.19.2469
- Brown, M., and Gordon, W. A. (2004). Empowerment in measurement: "Muscle," "voice," and subjective quality of life as a gold standard. *Archives of Physical Medicine and Rehabilitation, 85*(Suppl. 2), S13–S20. doi:10.1016/j.apmr.2003.08.110

- Carli, R. (1993). *L'Analisi Della Domanda in Psicologia Clinica* [Demand Analysis in Clinical Psychology]. Milan, Italy: Giuffrè.
- Cherry, K. (2010). What Is Abnormal Psychology? Retrieved from <http://psychology.about.com/>
- Cordella, B., Cardarelli, L., and Pizzi, E. (2001). L'identità professionale dello psicologo: Competenze specifiche/capacità di orientarsi [The professional identity of psychologist: Specific skills/professional orientation abilities]. In M. Grasso (Ed.), *Modelli e Contesti dell'Intervento Psicologico* (p. 352). Rome: Kappa.
- Cordella, B., Greco, F., and Grasso, M. (2011, May 17–20). *Strategies of Development of a Vision Rehabilitation Service*. Paper presented at the 16th International Association of Psychology and Psychiatry for Adults and Children Conference: APPAC '11, Athens, Greece.
- Cruice, M. (2008). The contribution and impact of the International Classification of Functioning, Disability and Health on quality of life in communication disorders. *International Journal of Speech–Language Pathology*, 10(1–2), 38–49. doi:10.1080/17549500701790520
- Duchan, J. F. (2004). Where is the person in the ICF? *International Journal of Speech–Language Pathology*, 6(1), 63–65. doi:10.1080/14417040410001669444
- Farr, R. M., and Moscovici, S. (1984). *Social Representations*. Cambridge, MA: Cambridge University Press.
- Federici, S., and Meloni, F. (2010). WHODAS II: Disability self-evaluation in the ICF conceptual frame. In J. Stone, and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation* (pp. 1–22). Buffalo, NY: Center for International Rehabilitation Research Information and Exchange (CIRRIE). Retrieved from <http://cirrie.buffalo.edu/encyclopedia/en/article/299/>
- Federici, S., and Olivetti Belardinelli, M. (2006). Un difficile accordo tra prevenzione e promozione. [Hard-won agreement between prevention and promotion]. *Psicologia Clinica dello Sviluppo*, 10(2), 330–334.
- Finkelstein, V. (1998). Emancipating disability studies. In T. Shakespeare (Ed.), *The Disability Reader: Social Science Perspectives* (pp. 28–49). London: Cassell.
- Finn, S. E. (2003). Therapeutic assessment of a man with “ADD.” *Journal of Personality Assessment*, 80(2), 115–129. doi:10.1207/S15327752JPA8002_01
- Finn, S. E., and Fischer, C. T. (1997, Aug 15–19). *Therapeutic Psychological Assessment: Illustration and Analysis of Philosophical Assumptions*. Paper presented at the American Psychological Association Convention, Chicago, IL.
- Fischer, C. T. (1982). Intimacy in assessment. In M. Fisher, and G. Stricker (Eds.), *Intimacy* (pp. 443–460). New York: Plenum.
- Fougeyrollas, P., Cloutier, R., Bergeron, H., Cote, J., and St-Michel, G. (1999). *The Quebec Classification: Disability Creation Process*. Québec, Canada: International Network on the Disability Creation Process.
- Freda, M. F. (2009). *Narrazione e Intervento in Psicologia Clinica. Costruire, Pensare e Trasformare Narrazioni tra Logos e Pathos* [Narration and Intervention in Clinical Psychology. Building, Thinking and Transform Narratives Between Logos and Pathos]. Napoli, Italy: Liguori Editore.
- Gazzaniga, M. S. (1998). *The Mind's Past*. Berkeley, CA: University of California Press.
- Geyh, S., Peter, C., Müller, R., Bickenbach, J. E., Kostanjsek, N., Üstün, B. T., et al. (2011). The personal factors of the International Classification of Functioning, Disability and Health in the Literature—A systematic review and content analysis. *Disability and Rehabilitation*, 33(13–14), 1089–1102. doi:10.3109/09638288.2010.523104
- Girdler, S. J., Boldy, D. P., Dhaliwal, S. S., Crowley, M., and Packer, T. L. (2010). Vision self-management for older adults: A randomised controlled trial. *British Journal of Ophthalmology*, 94(2), 223. doi:10.1136/bjo.2008.147538
- Godshalk, A. N., Brown, G. C., Brown, H. C., and Brown, M. M. (2008). The power of hope: Being a doctor is more than relying solely on the numbers. *British Journal of Ophthalmology*, 92(6), 783–787. doi:10.1136/bjo.2008.141663
- Grasso, M. (2001). *Modelli e Contesti dell'Intervento Psicologico* [Models and Contexts of Psychological Intervention]. Rome: Kappa.
- Grasso, M. (2010). *La Relazione Terapeutica* [The Therapeutic Relationship]. Bologna, Italy: Il Mulino.

- Grasso, M., Cordella, B., and Pennella, A. R. (2003). *L'Intervento in Psicologia Clinica: Fondamenti Teorici* [Intervention in Clinical Psychology: Theoretical Foundations]. Roma, Italy: Carocci.
- Grasso, M., and Salvatore, L. (1997). *Pensiero e Decisionalità. Contributo alla Critica della Prospettiva Individualista in Psicologia* [Thinking and Decision-Making. A Contribution to the Critique of the Individualist Perspective in Psychology] (Vol. 134). Milan, Italy: Franco Angeli.
- Greco, F. (in press). *Resoconto Clinico di un Processo di Rieducazione in un CRPM di Parigi* [Clinical Report of a Rehabilitation Process in a CPMR in Paris]. Rome: Nuova Cultura.
- Gutenbrunner, C., Ward, A. B., and Chamberlain, M. A. (2007). White Book on Physical and Rehabilitation Medicine in Europe (Revised November 2009). *Journal of Rehabilitation Medicine*, 45(Suppl), 1–48. doi:10.2340/16501977-0028
- Hayeems, R. Z., Geller, G., Finkelstein, D., and Faden, R. R. (2005). How patients experience progressive loss of visual function: A model of adjustment using qualitative methods. *British Journal of Ophthalmology*, 89(5), 615–620. doi:10.1136/bjo.2003.036046
- Henderson, S., Skelton, H., and Rosenbaum, P. (2008). Assistive devices for children with functional impairments: Impact on child and caregiver function. *Developmental Medicine and Child Neurology*, 50(2), 89–98. doi:10.1111/j.1469-8749.2007.02021.x
- Holman, H., and Lorig, K. (2000). Patients as partners in managing chronic disease. Partnership is a prerequisite for effective and efficient health care. *British Medical Journal*, 320(7234), 526–527. doi:10.1136/bmj.320.7234.526
- Howe, T. J. (2008). The ICF contextual factors related to speech–language pathology. *International Journal of Speech–Language Pathology*, 10(1–2), 27–37. doi:10.1080/14417040701774824
- Hunsley, J., and Meyer, G. J. (2003). The incremental validity of psychological testing and assessment: Conceptual, methodological, and statistical issues. *Psychological Assessment*, 15(4), 446–455. doi:10.1037/1040-3590.15.4.446
- Jahiel, R. I., and Scherer, M. J. (2010). Initial steps towards a theory and praxis of person–environment interaction in disability. *Disability and Rehabilitation*, 32(17), 1467–1474. doi:10.3109/09638280802590637
- Kandel, E. R. (2000). From nerve cells to cognition: The internal cellular representation required for perception and action. In E. R. Kandel, J. H. Schwartz, and T. M. Jessell (Eds.), *Principles of Neural Science* (4th ed., pp. 381–403). New York: McGraw-Hill.
- Kayes, N. M., and McPherson, K. M. (2010). Measuring what matters: Does ‘objectivity’ mean good science? *Disability and Rehabilitation*, 32(12), 1011–1019. doi:10.3109/09638281003775501
- Khan, F., and Pallant, J. F. (2007). Use of the International Classification of Functioning, Disability and Health (ICF) to identify preliminary comprehensive and brief core sets for multiple sclerosis. *Disability and Rehabilitation*, 29(3), 205–213. doi:10.1080/09638280600756141
- Lancia, F. (2004). *Strumenti per l'Analisi dei Testi. Introduzione all'Uso di T-LAB* [Tools for the Analysis of Texts. An Introduction to the Use of T-LAB]. Milan, Italy: Franco Angeli.
- Lehman, C. A. (2003). Idiopathic intracranial hypertension within the ICF model: A review of the literature. *Journal of Neuroscience Nursing*, 35(5), 263–269. doi:10.1097/01376517-200310000-00004
- Lenker, J. A., and Paquet, V. L. (2004). A new conceptual model for assistive technology outcomes research and practice. *Assistive Technology*, 16(1), 1–10. doi:10.1080/10400435.2004.10132069
- Matte Blanco, I. (1975). *The Unconscious as Infinite Sets: An Essay in Bi-logic*. London: Gerald Duckworth & Co.
- McInerney, R. G., and Walker, M. M. (2002). Toward a method of neurophenomenological assessment and intervention. *Humanistic Psychologist*, 30(3), 180–193. doi:10.1080/08873267.2002.9977034
- Meloni, F., Federici, S., and Stella, A. (2011). The Psychologist's Role: A Neglected Presence in the Assistive Technology Assessment Process. In G. J. Gelderblom, M. Soede, L. Adriaens & K. Miesenberger (Eds.), *Everyday Technology for Independence and Care: AAATE 2011* (Vol. 29, pp. 1199–1206). Amsterdam, NL: IOS Press. doi:10.3233/978-1-60750-814-4-1199
- Meyer, G. J., Finn, S. E., Eyde, L. D., Kay, G. G., Moreland, K. L., Dies, R., et al. (2001). Psychological testing and psychological assessment: A review of evidence and issues. *American Psychologist*, 56(2), 128–165. doi:10.1037/0003-066X.56.2.128

- Mitani, S., Fujisawa, S., Mima, A., Shiota, H., Yanashima, K., Takahara, M., et al. (2007). The importance of measuring medical and psychological characteristics in visibility measurement of persons with low visual capability. In G. Eizmendi, J. M. Azkoitia, and G. Craddock (Eds.), *Challenges for Assistive Technology: AAATE 07* (pp. 331–335). Amsterdam: IOS Press.
- Moscovici, S. (1961). *La Psychanalyse, son Image et Son Public* [Psychoanalysis: Its Image and Its Public]. Paris: Presses Universitaires de France.
- Nair, K. P. S. (2003). Life goals: The concept and its relevance to rehabilitation. *Clinical Rehabilitation*, 17(2), 192–202. doi:10.1191/0269215503cr599oa
- Neisser, U. (1989). *Concepts and Conceptual Development: Ecological and Intellectual Factors in Categorization*. Cambridge, MA: Cambridge University Press.
- Nihei, M., Inoue, T., Kaneshige, Y., and Fujie, M. G. (2007). Proposition of a new mobility aid for older persons: Reducing psychological conflict associated with the use of assistive technologies. In G. Eizmendi, J. M. Azkoitia, and G. Craddock (Eds.), *Challenges for Assistive Technology: AAATE 07* (pp. 80–84). Amsterdam: IOS Press.
- Olkin, R. (1999). The personal, professional and political when clients have disabilities. *Women and Therapy*, 22(2), 87–103. doi:10.1300/J015v22n02_07
- Pape, T. L.-B., Kim, J., and Weiner, B. (2002). The shaping of individual meanings assigned to assistive technology: A review of personal factors. *Disability and Rehabilitation*, 24(1–3), 5–20. doi:10.1080/09638280110066235
- Pfeiffer, D. (1998). The ICDH and the need for its revision. *Disability and Society*, 13(4), 503–523.
- Philips, B., and Zhao, H. (1993). Predictors of assistive technology abandonment. *Assistive Technology*, 5(1), 36–45. doi:10.1080/10400435.1993.10132205
- Plante, T. G. (2005). *Contemporary Clinical Psychology* (2nd ed.). New York: Wiley & Sons.
- Poston, J. M., and Hanson, W. E. (2010). Meta-analysis of psychological assessment as a therapeutic intervention. *Psychological Assessment*, 22(2), 203–212. doi:10.1037/A001s679
- Ricœur, P. (1976). *Interpretation Theory: Discourse and the Surplus of Meaning*. Fort Worth, TX: Texas Christian Press.
- Riemer-Reiss, M. L., and Wacker, R. (2000). Factors associated with assistive technology discontinuance among individuals with disabilities. *Journal of Rehabilitation*, 66(3), 44–50.
- Roulstone, A. (1998). Researching a disabling society: The case of employment and new technology. In T. Shakespeare (Ed.), *The Disability Reader: Social Science Perspectives* (pp. 110–128). London: Cassell.
- Scherer, M. J. (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J. (2000). *Living in the State of Stuck: How Technologies Affect the Lives of People with Disabilities* (3rd ed.). Cambridge, MA: Brookline Books.
- Scherer, M. J. (Ed.). (2002). *Assistive Technology: Matching Device and Consumer for Successful Rehabilitation*. Washington, DC: American Psychological Association.
- Scherer, M. J. (2005). *Cross-Walking the ICF to a Measure of Assistive Technology Predisposition and Use*. Paper presented at the 11th Annual North American Collaborating Center (NACC) Conference on the International Classification of Functioning, Disability and Health (ICF), Rochester, NY.
- Scherer, M. J., Blair, K. L., Banks, M. E., Brucker, B., Corrigan, J., and Wegener, S. (2004). Rehabilitation psychology. In W. E. Craighead and C. B. Nemeroff (Eds.), *The Concise Corsini Encyclopedia of Psychology and Behavioral Science* (3rd ed., pp. 801–802). Hoboken, NJ: John Wiley & Sons.
- Scherer, M. J., Craddock, G., and MacKeogh, T. (2011). The relationship of personal factors and subjective well-being to the use of assistive technology devices. *Disability and Rehabilitation*, 33(10), 811–817. doi:10.3109/09638288.2010.511418
- Scherer, M. J., and Cushman, L. A. (2001). Measuring subjective quality of life following spinal cord injury: A validation study of the assistive technology device predisposition assessment. *Disability and Rehabilitation*, 23(9), 387–393. doi:10.1080/09638280010006665

- Scherer, M. J., Cushman, L. A., and Federici, S. (2004, Jun 2). *Measuring Participation and the Disability Experience with the "Assistive Technology Device Predisposition Assessment."* Paper presented at the American Collaborating Center (NACC) Conference on ICF: Advancing a Research Agenda for ICF. Retrieved from http://www.icfconference.com/downloads/Marcia_Scherer.pdf.
- Scherer, M. J., and Dicowden, M. A. (2008). Organizing future research and intervention efforts on the impact and effects of gender differences on disability and rehabilitation: The usefulness of the International Classification of Functioning, Disability and Health (ICF). *Disability and Rehabilitation*, 30(3), 161–165. doi:10.1080/09638280701532292
- Scherer, M. J., Sax, C. L., Vanbiervliet, A., Cushman, L. A., and Scherer, J. V. (2005). Predictors of assistive technology use: The importance of personal and psychosocial factors. *Disability and Rehabilitation*, 27(21), 1321–1331. doi:10.1080/09638280500164800
- Sen, A. (2002). Health: Perception versus observation. *British Medical Journal (Clinical Research Edition)*, 324(7342), 860–861. doi:10.1136/bmj.324.7342.860
- Söderström, S., and Ytterhus, B. (2010). The use and non-use of assistive technologies from the world of information and communication technology by visually impaired young people: A walk on the tightrope of peer inclusion. *Disability and Society*, 25(3), 303–315. doi:10.1080/09687591003701215
- Steiner, W. A., Ryser, L., Huber, E., Uebelhart, D., Aeschlimann, A., and Stucki, G. (2002). Use of the ICF model as a clinical problem-solving tool in physical therapy and rehabilitation medicine. *Physical Therapy*, 82(11), 1098–1107.
- Stephens, D., and Kerr, P. (2000). Auditory disablements: An update. *Audiology*, 39(6), 322–332. doi:10.3109/00206090009098013
- Telfener, U. (2011). *Apprendere I Contesti. Strategie Per Inserirsi in Nuovi Ambiti Di Lavoro* [Learning the Contexts. Strategies to Fit into New Contexts of Work]. Milan, Italy: Raffaello Cortina.
- Tharinger, D. J., Finn, S. E., Gentry, L., Hamilton, A., Flower, J., Matson, M., et al. (2009). Therapeutic assessment with children: A pilot study of treatment acceptability and outcome. *Journal of Personality Assessment*, 91(3), 238–244. doi:10.1080/00223890902794275
- Threats, T. T. (2003). The conceptual framework of ASHA's new scope of practice for speech–language pathology. *Speech Pathology Online*. Retrieved from <http://www.speechpathology.com>
- Threats, T. T. (2007). Access for persons with neurogenic communication disorders: Influences of personal and environmental factors of the ICF. *Aphasiology*, 21(1), 67–80. doi:10.1080/02687030600798303
- Ueda, S., and Okawa, Y. (2003). The subjective dimension of functioning and disability: What is it and what is it for? *Disability and Rehabilitation*, 25(11–12), 596–601. doi:10.1080/0963828031000137108
- Ugazio, V. (1989). *La Costruzione della Conoscenza: L'Approccio Europeo alla Cognizione del Sociale* [The Construction of Knowledge: The European Approach to Social Cognition]. Milan, Italy: Franco Angeli.
- Uppal, S. (2006). Impact of the timing, type and severity of disability on the subjective well-being of individuals with disabilities. *Social Science and Medicine*, 63(2), 525–539. doi:10.1016/j.socscimed.2006.01.016
- Verbrugge, L. M., and Jette, A. M. (1994). The disablement process. *Social Science and Medicine*, 38(1), 1–14. doi:10.1016/0277-9536(94)90294-1
- Verza, R., Carvalho, M. L. L., Battaglia, M. A., and Uccelli, M. M. (2006). An interdisciplinary approach to evaluating the need for assistive technology reduces equipment abandonment. *Multiple Sclerosis*, 12(1), 88–93. doi:10.1191/1352458506ms1233oa
- Viol, M., Grotkamp, S., van Treeck, B., Nuchtern, E., Hagen, T., Manegold, B., et al. (2006). Personal contextual factors, Part I—A first attempt at a systematic, commented listing of personal contextual factors for sociomedical expertise in the German-speaking region. *Gesundheitswesen*, 68(12), 747–759. doi:10.1055/s-2006-927328
- Wade, D. T. (2000). Personal context as a focus for rehabilitation. *Clinical Rehabilitation*, 14(2), 115–118. doi:10.1191/026921500672636483
- Waldron, D., and Layton, N. (2008). Hard and soft assistive technology: Defining roles for clinicians. *Australian Occupational Therapy Journal*, 55(1), 61–64. doi:10.1111/j.1440-1630.2007.00707.x

- Weigl, M., Cieza, A., Cantista, P., Reinhardt, J. D., and Stucki, G. (2008). Determinants of disability in chronic musculoskeletal health conditions: A literature review. *European Journal of Physical and Rehabilitation Medicine, 44*(1), 67–79.
- World Health Organization (WHO). (1980). *ICIDH: International Classification of Impairments, Disabilities, and Handicaps. A Manual of Classification Relating to the Consequences of Disease*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2007). *ICF-CY: International Classification of Functioning, Disability, and Health—Children and Youth Version*. Geneva, Switzerland: WHO.
- World Health Organization (WHO), and World Bank. (2011). *World Report on Disability*. Geneva, Switzerland: WHO.
- Zimmer, Z., and Chappell, N. L. (1999). Receptivity to new technology among older adults. *Disability and Rehabilitation, 21*(5–6), 222–230. doi:10.1080/096382899297648
- Zola, I. K. (1989). Toward the necessary universalizing of a disability policy. *Milbank Quarterly, 67*(Suppl. 2 Pt. 2), 401–428. doi:10.2307/3350151
- Zola, I. K. (1993). Disability statistics, what we count and what it tells us: A personal and political analysis. *Journal of Disability Policy Studies, 4*(2), 9–39. doi:10.1177/104420739300400202

9

The Psychotechnologist: A New Profession in the Assistive Technology Assessment

K. Miesenberger, F. Corradi, and M. L. Mele

CONTENTS

9.1	Introduction	180
9.2	The Psychotechnologist and the AT Assessment Process	181
9.3	Case Example: Application of Models and Measurements	184
9.3.1	Medical Case.....	185
9.3.1.1	Motor Evaluation.....	185
9.3.1.2	Neuropsychological Test.....	185
9.3.1.3	Communication Strategy	186
9.3.1.4	Evaluation of Visual, Perceptive, and Motor Functions	186
9.3.1.5	Aids and Assistance	186
9.3.1.6	Request	186
9.3.2	The ATA Process.....	186
9.3.2.1	Multidisciplinary Team Meeting.....	186
9.3.2.2	Setting Set-Up.....	187
9.3.2.3	Matching Process	187
9.3.2.4	Assistive Solution Multidisciplinary Team Evaluation.....	187
9.3.2.5	User Support.....	188
9.3.2.6	Follow-Up.....	188
9.4	The AT Assignment Process in a Center for Technical Aid and the Psychotechnologist	188
9.5	Psychotechnology Education: An Example	190
9.5.1	The Context of the Profession “Psychotechnologist”	190
9.5.2	Psychotechnologist—The Need for Education	191
9.5.3	The Assistec Program	192
9.5.4	The Curriculum.....	193
9.5.5	eLearning System.....	194
9.5.6	Graduates—Psychotechnologists	195
9.5.7	Impact.....	196
9.6	Conclusions.....	197
	Summary of the Chapter.....	197
	References.....	198

emulates, extends, amplifies and modifies sensory-motor, psychological or cognitive functions of the mind” (Federici 2002), highlighting in this way the intrasystemic relation between the artifact and the user. Starting from these suggestions, the primary role of psychotechnologist is to follow a systemic approach to allow users a better autonomy (TeleMate 2011). This goal is only possible by taking into account the users’ needs, their reached autonomy degree, and the environment in which they live. In this work, we have explained in more detail two fields of application of this new professional figure: the AT assignment process in a center for technical aid and the ICT-based systems and services, i.e., *eSystems* and *eServices*.

References

- Bonk, C. J., and Graham, C. R. (2006). *The Handbook of Blended Learning: Global Perspectives, Local Designs*. San Francisco: Pfeiffer.
- Bruner, J. S. (1977). *The Process of Education: A Landmark in Educational Theory*. Cambridge, MA: Harvard University Press.
- Chisholm, W., Vanderheiden, G., and Jacobs, I. (1999). Web Content Accessibility Guidelines 1.0—W3C Recommendation. Retrieved from <http://www.w3.org/TR/WAI-WEBCONTENT/>
- Crombie, D., Lenoir, R., McKenzie, N., and Miesenberger, K. (2004). Interfacing the interface: Unification through separation. In C. Stary and C. Stephanidis (Eds.), *User-Centered Interaction Paradigms for Universal Access in the Information Society* (Vol. 3196, pp. 125–132). Berlin: Springer. doi:10.1007/978-3-540-30111-0_10
- CSUN. (2011). AT training program. Retrieved from <http://www.csun.edu/cod/training/index.php>
- Darzentas, J., and Miesenberger, K. (2005). Design for all in information technology: A universal concern. In K. V. Andersen, J. Debenham, and R. Wagner (Eds.), *Database and Expert Systems Applications* (Vol. 3588, pp. 406–420). Berlin: Springer. doi:10.1007/11546924_40
- De Kerckhove, D. (1990). *La Civilisation Vidéo-Crétienne*. Paris: Retz/Atelier Alpha Blue.
- De Kerckhove, D. (1991a). *Brainframes. Technology, Mind and Business*. Utrecht, The Netherlands: Bosch & Keuning.
- De Kerckhove, D. (1991b). Communication arts for a new spatial sensibility. *Leonardo*, 24(2), 131–135. doi:10.2307/1575281
- De Kerckhove, D. (1995). *The Skin of Culture: Investigating the New Electronic Reality*. Toronto, Canada: Somerville.
- De Kerckhove, D. (2001). *The Architecture of Intelligence*. Berlin: Birkhäuser.
- Demers, L., Weiss-Lambrou, R., and Ska, B. (2000). Item analysis of the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST). *Assistive Technology*, 12(2), 96–105. doi:10.1080/10400435.2000.10132015
- Demers, L., Weiss-Lambrou, R., and Ska, B. (2002). The Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0): An Overview and Recent Progress. *Technology and Disability*, 14(3), 101–105. Retrieved from <http://iospress.metapress.com/content/b23egtty2mph84b0/>
- Federici, S. (2002). *Linee-Guida di Psicotecnologie [Guidelines on Psychotechnology]*. Graduate course on Psychotechnology for learning. Department of Psychology. Sapienza University of Rome, Rome, Italy. Retrieved from <http://www.psicologia1.uniroma1.it/cgilocal/didattica.cgi?FileManager=60>
- Federici, S., Corradi, F., Mele, M. L., and Miesenberger, K. (2011). *From cognitive ergonomist to psychotechnologist: A new professional profile in a multidisciplinary team in a centre for technical aids*. In G. J. Gelderblom, M. Soede, L. Adriaens and K. Miesenberger (Eds.), *Everyday Technology for Independence and Care: AAATE 2011* (Vol. 29, pp. 1178–1184). Amsterdam, NL: IOS Press. doi:10.3233/978-1-60750-814-4-1178

- Federici, S., and Borsci, S. (2010). Usability evaluation: models, methods, and applications. In J. Stone and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation*. Buffalo, NY: Center for International Rehabilitation Research Information and Exchange (CIRRIE). Retrieved from <http://cirrie.buffalo.edu/encyclopedia/article.php?id=277&language=en>
- Federici, S., Borsci, S., Mele, M. L., and Stamerra, G. (2010). Web Popularity: An Illusory Perception of a Qualitative Order in Information. *Universal Access in the Information Society*, 9(4), 375–386. doi:10.1007/s10209-009-0179-7
- Federici, S., Micangeli, A., Ruspantini, I., Borgianni, S., Corradi, F., Pasqualotto, E., et al. (2005). Checking an integrated model of web accessibility and usability evaluation for disabled people. *Disability and Rehabilitation*, 27(13), 781–790. doi:10.1080/09638280400014766
- Federici, S., Scherer, M. J., Micangeli, A., Lombardo, C., and Olivetti Belardinelli, M. (2003). A Cross-cultural analysis of relationships between disability self-evaluation and individual predisposition to use assistive technology. In G. M. Craddock, L. P. McCormack, R. B. Reilly and H. T. P. Knops (Eds.), *Assistive Technology—Shaping the Future* (pp. 941–946). Amsterdam: IOS Press.
- Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Gustavsson, A., and Zakrzewska-Manterys, E. (1997). *Social Definitions of Disability*. Kraków, Poland: Wydawnictwo “Żak.”
- Halasz, F. G., and Moran, T. P. (1983). *Mental Models and Problem Solving in Using a Calculator*. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Boston, MA.
- Koffka, K. (Ed.). (1935). *Principles of Gestalt Psychology*. New York: Harcourt, Brace.
- Lewis, C. (1982). *Using the “Thinking Aloud” Method in Cognitive Interface Design*. (RC-9265 (#40713)). Retrieved from <http://www.watson.ibm.com/index.shtml>
- Lifetool. (2004). *Informations- und Kommunikationstechnologie für Menschen im Alter*. Retrieved from http://www.lifetool.at/rte/upload/6_Fachforum/IKT_studie_2004_Endbericht.pdf
- Matausch, K., Hengstberger, B., and Miesenberger, K. (2006). “Assistec”—A university course on assistive technologies. In K. Miesenberger, J. Klaus, W. Zagler, and A. Karshmer (Eds.), *Computers Helping People with Special Needs* (Vol. 4061, pp. 361–368). Berlin: Springer. doi:10.1007/11788713_54
- Miesenberger, K. (1998). *Informatik für Sehgeschädigte, Soziale Aufgabenstellung einer Technischen Disziplin*. Doctoral Dissertation, Universität Linz, Linz, Austria.
- Miesenberger, K. (2004). Equality = e-quality. “Design for all” und “accessibility” als Grundlage für eine demokratische, offene und inklusive Gesellschaft. In E. Feyerer and W. Pammer (Eds.), *Qual-I-Tät und Integration. Beiträge Zum 8. Praktikerinnenforum* (Vol. 16, pp. 405–416). Linz, Austria: Universitätsverlag Rudolf Trauner.
- Miesenberger, K. (2006, Sep 13–15). *BFWD and Assistec: Two University Degrees Relevant to Design for All: Accessible Web Design and Assistive Technologies*. Paper presented at the International Design for All Conference, Rovaniemi, Finland. Retrieved from <http://dfasuomi.stakes.fi/EN/dfa2006/rovaniemi/>
- Miesenberger, K. (2009a). Best practice in design for all. In C. Stephanidis (Ed.), *The Universal Access Handbook* (p. 58). Boca Raton, FL: CRC Press.
- Miesenberger, K. (2009b). Design for all principles. In C. Sik Lányi (Ed.), *Principles and Practice in Europe for e-Accessibility* (pp. 15–25). Veszprém, Hungary: EDeAN Publication 2009, Panonia University Press.
- Miesenberger, K., Hengstberger, B., and Batusic, M. (2010). Web_Access: Education on Accessible Web Design. In K. Miesenberger, J. Klaus, W. Zagler and A. Karshmer (Eds.), *Computers Helping People with Special Needs* (Vol. 6179, pp. 404–407). Berlin: Springer. doi:10.1007/978-3-642-14097-6_64
- MOODLE. (2011). Open Source Course Management System. Retrieved from <http://moodle.org/>
- Norman, D. A. (1983). Some observations on mental models. In D. Gentner and A. L. Steven (Eds.), *Mental Models* (pp. 7–14). Hillsdale, NJ: Lawrence Earlbaum Associates.
- Olivetti Belardinelli, M. (1973). *La Costruzione della Realtà* [The construction of reality]. Torino, Italy: Boringhieri.

- SART. (1999). Sommerakademie für Rehabilitationstechnik. Retrieved from <http://www.is.tuwien.ac.at/fortec/reha.d/projects/sart/sart.html>
- Scherer, M. J. (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J. (2005). *Living in the State of Stuck: How Technologies Affect the Lives of People with Disabilities* (4th ed.). Cambridge, MA: Brookline Books.
- SIVA. (2011). Educational Activities. Retrieved from <http://www.siva.it/eng/education/default.htm>
- TeleMate. (2011). TeleMate: Assistive Technology Devices. Retrieved from <http://www.telemate.org/>
- W3C/WAI. (2011). Policies Relating to Web Accessibility. Retrieved from <http://www.w3.org/WAI/Policy/>
- Wharton, C., Rieman, J., Lewis, C., and Polson, P. G. (1994). The cognitive walkthrough method: A practitioner's guide. In J. Nielsen and R. L. Mack (Eds.), *Usability Inspection Methods* (pp. 105–140). New York: John Wiley & Sons.
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2007). *ICF-CY: International Classification of Functioning, Disability, and Health—Children and Youth Version*. Geneva, Switzerland: WHO.

10

The Optometrist

M. Orlandi and R. Amantis

CONTENTS

10.1	Introduction.....	201
10.2	Vision and the Role of the Optometrist in ATA.....	202
10.2.1	The Complexity of the Visual Process from Eye to Brain.....	202
10.2.2	The Visual Abilities in Behavioral Optometry.....	208
10.2.2.1	Visual Acuity.....	208
10.2.2.2	Fixation.....	211
10.2.2.3	Slow Pursuit.....	212
10.2.2.4	Saccadic Movements.....	213
10.2.2.5	Binocular Vision.....	214
10.2.2.6	Convergence.....	214
10.2.2.7	Accommodation.....	215
10.2.2.8	Refraction.....	216
10.2.2.9	The Field of Vision.....	218
10.2.2.10	Superior Perceptive Abilities.....	219
10.3	The Role of Optometrists in the ATA Process.....	220
10.4	Evaluation of Visual, Perceptive, and Motor Functions: Clinical Case 1.....	222
10.5	Evaluation of Visual, Perceptive, and Motor Functions: Clinical Case 2.....	224
10.6	Visual Training.....	225
10.7	Conclusions.....	225
	Summary of the Chapter.....	226
	Acknowledgments.....	226
	References.....	227
	Suggested Reading.....	227

10.1 Introduction

The choice of the appropriate assistive technology is conditioned by the visual skills of the subject. Visual perception is a complex process in which various subprocesses participate and in which various anatomic structures are involved. It is therefore necessary that the assessment protocol used permits having a clear picture of all of the visual abilities and skills of the patient as well as his/her limits. A detailed analysis of the visual skills permits the assistive technology assessment (ATA) team to plan specific test settings to be used with the patient without having to make random attempts, which usually prove themselves not only to be useless, but also to be frustrating for the patient and the family.

References

- Adler, P. (2002). Efficacy of treatment for convergence insufficiency using vision therapy. *Ophthalmic & Physiology Optics*, 22(6), 565–571.
- Bardini, R. (1982). *La Funzione Visiva Nell'analisi Optometrica*. Società Italiana d'Optometria. Asti.
- Birnbaum, M. H. (1985). Nearpoint visual stress: Clinical implications. *Journal of the American Optometric Association*, 56(6), 480–490.
- Birnbaum M. H. (1993). *Optometric Management of Nearpoint Vision Disorders*. Oxford, UK: Butterworth Heinemann.
- Catalano, F. (2006). *Elementi di Ottica Generale*. Bologna, Italy: Zanichelli.
- Contreras, R., Ghajar, J., Bahar, S., and Suh, M. (2011). Effect of cognitive load on eye-target synchronization during smooth pursuit eye movement. *Brain Research*, 1398, 55–63.
- Denes, G., and Pizzamiglio, L. (1996). *Manuale Di Neuropsicologia*. Bologna, Italy: Zanichelli.
- Gallaway, M. (2002). Optometric vision therapy. *Binocular Vision & Strabismus Quarterly*, 17(2), 82.
- Greene, H. H., Pollatsek, A., Masserang, K., Lee, Y. J., & Rayner, K. (2010). Directional processing within the perceptual span during visual target localization. *Vision Research*, 50(13), 1274–1282.
- Griffin, J. (1982). *Binocular Anomalies Procedures for Vision Therapy*. Oxford, UK: Butterworth-Heinemann.
- Hubel, D. H. (1995). *Eye, Brain and Vision*. Scientific American Library, No. 22. New York: WH Freeman.
- Leslie, S. (2004). The optometrist's role in learning difficulties and dyslexia. *Clinical and Experimental Optometry Journal*, 87(1), 1–3.
- Liuzzi, L., and Bartoli, F. (2002). *Manuale di Oftalmologia*. Torino, Italy: Minerva Medica.
- Martinoli, C., and Delpino, E. (2009). *Manuale di Riabilitazione Visiva per Ciechi ed Ipovedenti*. Milan, Italy: FrancoAngelo.
- Orlandi, M. (2003). I Deficit Visivi nella Dislessia. *Acta Phoniatica Latina*, XXV, 85–95.
- Padula V. W. (1996). *Neuro-Optometric Rehabilitation*, Santa Ana, CA: Optometric Extension Program.
- Phillips, M. H., and Edelman, J. A. (2008). The dependence of visual scanning performance on search direction and difficulty. *Vision Research*, 48(21), 2184–2192.
- Rossetti, A., and Gheller, P. (1997). *Manuale di Optometria e Contattologia*. Bologna, Italy: Zanichelli.
- Sabbadini, G., Bianchi P. E., Fazzi E., and Sabbadini M. (2000). *Manuale di Neurooftalmologia dell'età Evolutiva*. Milan, Italy: Franco Angeli.
- Sabel, B. A., and Kasten, E. (2000). Restoration of vision by training of residual functions. *Current Opinion in Ophthalmology*, 11(6), 430–436.
- Saunders, K. J., Little, J. A., McClelland, J. F., and Jackson, A. J. (2010). Profile of refractive errors in cerebral palsy: Impact of severity of motor impairment (GMFCS) and CP subtype on refractive outcome. *Investigative Ophthalmology and Visual Science*, 51(6), 2885–2890.
- Shainberg, M. J. (2010). Vision therapy and orthoptics. *The American Orthoptic Journal*, 60, 28–32.
- Traccis, S. (1992). *Il Nistagmo Fisiologico e Patologico*. Bologna, Italy: Pàtron Editore.
- Traccis, S., and Zambbarbieri D. (1992). *I Movimenti Saccadici*. Bologna, Italy: Pàtron Editore.
- Traccis, S., and Zambbarbieri D. (1996). *Le Interazioni Visuo-Vestibolari*. Bologna, Italy: Pàtron Editore.
- Yeotikar, N. S., Khuu, S. K., Asper, L. J., and Suttle, C. M. (2011). Configuration specificity of crowding in peripheral vision. *Vision Research*, 51(11), 1239–1248.

Suggested Reading

- American Academy of Ophthalmology. (2001). *Complementary Therapy Assessment: Vision Therapy for Learning Disabilities*, Retrieved from http://one.aao.org/CE/PracticeGuidelines/Therapy_Content.aspx?cid=8021c013-7e4b-43f3-aa1a-698307ae526c

- American Academy of Ophthalmology. (2004). *Complementary Therapy Assessment. Visual Training for Refractive Errors*. Retrieved from <http://one.aaopt.org/asset.axd?id=2907836b-705a-4509-b86f-e2c493b7ca0>
- Bankes, J. L. (1974). Eye defects of mentally handicapped children. *British Medical Journal*, 8(5918), 533–535.
- Barrett, B. T. (2009). A critical evaluation of the evidence supporting the practice of behavioral vision therapy. *Ophthalmic & Physiological Optics*, 29(1), 4–25.
- Birnbaum, M. H., Soden, R., and Cohen, A. H. (1999). Efficacy of vision therapy for convergence insufficiency in an adult male population. *Journal of the American Optometric Association*, 70, 225–232.
- Di Blasi, F. D., Elia, F., Buono, S., Ramakers, G. J., and Di Nuovo, S. F. (2007). Relationships between visual-motor and cognitive abilities in intellectual disabilities. *Perceptual and Motor Skills*, 104(3 Pt 1), 763–772.
- Forrest, E. B. (1976). Clinical manifestations of visual information processing. *Journal of the American Optometric Association*, 47(1), 73–80.
- Harris, J. M., Nefs, H. T., and Grafton, C. E. (2008). Binocular vision and motion-in-depth. *Spatial Vision*, 21(6), 531–547.
- Jennings, J. A. M. (2000). Behavioral optometry: A critical review. *Optometric Practice*, 1, 67.
- Judica, A., De Luca, M., Di Pace, E., Orlandi, M., Spinelli, D., and Zoccolotti, P. (1998). Dislessia superficiale in un soggetto adulto: Analisi del comportamento di lettura e trattamento riabilitativo. *Archivio di Psicologia Neurologia e Psichiatria*, LIX, 729–755.
- Lavrich, J. B. (2010). Convergence insufficiency and its current treatment. *Current Opinion in Ophthalmology*, 21(5), 356–360.
- Sabbadini, G., Bonini P., Pezzarossa B., and Pierro M. (1978). *Paralisi Cerebrali e Condizioni Affini*. Rome: Il Pensiero Scientifico Editore.
- Scheiman, M. (2002). *Understanding and Managing Vision Deficits: A Guide for Occupational Therapists*, 2nd ed. Philadelphia: Slack Inc.
- Scheiman, M., Mitchell, G. L., Cotter, S., Kulp, M. T., Cooper, J., Rouse, M., et al. (2005). A randomized clinical trial of vision therapy/orthoptics versus pencil pushups for the treatment of convergence insufficiency in young adults. *Optometry and Vision Science*, 123(1), 14–24.
- Scheiman, M. M., and Rouse, M. W. (2006). *Optometric Management of Learning-Related Vision Problems*, 2nd ed. St. Louis, MO: Mosby Elsevier.
- Scheiman, M., Rouse, M., Kulp, M. T., Cotter, S., Hertle, R., and Lynn, M. G. (2009). Treatment of convergence insufficiency in childhood: A current perspective. *Optometry and Vision Science*, 86(5), 420–428.
- Skeffington, A. M. (1964). *Introduction to Clinical Optometry*. Optometric Extension Programme Continuing Education Courses, Vol. 37. Santa Ana, CA: Optometric Extension Program.
- Solt, I. (2001). The representation of the egocentric space in the posterior parietal cortex. *Harefuah*, 140(6), 553–557.
- Stein, J. F. (1989). Representation of egocentric space in the posterior parietal cortex. *Quarterly Journal of Experimental Physiology*, 74(5), 583–606.
- U.S. Preventive Services Task Force. (2004). Screening for visual impairment in children younger than age 5 years: Recommendation statement. *Annals of Family Medicine*, 2(3), 263–266.
- Vera-Diaz, F. A., Gwiazda, J., Thorn, F., and Held, R. (2004). Increased accommodation following adaptation to image blur in myopes. *Journal of Vision*, 4(12), 1111–1119.
- Vora, U., Khandekar, R., Natrajan, S., and Al-Hadrami, K. (2010). Refractive error and visual functions in children with special needs compared with the first grade school students in Oman. *Middle East African Journal of Ophthalmology*, 17(4), 297–302.
- Zoccolotti, P., Angelelli, P., Colombini, M. G., De Luca, M., Di Pace, E., Judica, A., et al. (1997). Caratteristiche della dislessia superficiale evolutiva nella lingua italiana. *Archivio di Neurologia e Psichiatria*, LVIII, 253–284.

11

The Occupational Therapist: Enabling Activities and Participation Using Assistive Technology

D. de Jonge, P. M. Wielandt, S. Zapf, and A. Eldridge

CONTENTS

11.1 Occupational Therapist's Perspective	229
11.2 Overview of Interventions Used by Occupational Therapists and the Place of AT Within These.....	231
11.3 The Definition and Role of AT	232
11.4 Overview of the Process Involved in Selecting and Using AT	233
11.5 Overview of the Process Involved in Selecting and Using AT Case Studies	236
11.5.1 Case Study Number 1: ZA.....	236
11.5.1.1 Person	236
11.5.1.2 Current Status	237
11.5.1.3 Environment.....	238
11.5.1.4 Occupation.....	238
11.5.2 Case Study Number 2: AB.....	239
11.5.2.1 Person	239
11.5.2.2 Current Status	240
11.6 Conclusions.....	242
Summary of the Chapter.....	242
References.....	243

11.1 Occupational Therapist's Perspective

Occupational therapists use a holistic approach in which they recognize the transaction among the person, the activities they need or want to engage in, and the environments in which these activities are undertaken. Occupation, or activity engagement and participation, is seen as playing an essential role in human life and influencing people's state of health (Kielhofner 2004). Disruption to occupation or activity engagement affects people's quality of life, restricts their development, reduces capacity, and leads to maladaptive reactions (Kielhofner 2004). In contrast, removing barriers to participation allows people to engage in necessary and desired occupations, which result in improved health (Kielhofner 2004).

Each person is seen as simultaneously fulfilling various roles that require them to perform a diversity of activities in a range of environments. Activities range from personal care and household activities to work, leisure, and social participation. People have personal preferences, interests, and expectations that influence their choice of activities and the way they undertake activities. Activities are invariably performed in

and the environments in which these activities are undertaken. In doing so, they can identify the specific requirements of the technology and ensure that it is able to meet the goals and skills of the person as well as the demands of current and future activities and environments. A detailed understanding of these requirements also enables the therapist to customize the technology to ensure it can be used efficiently and effectively. Occupational therapists also work with the AT user to promote his or her understanding of the technology and its application so that he or she can monitor its ongoing utility.

References

- Alliance for Technology Access. (2005). *Computer and Web Resources for People with Disabilities*. Berkeley, CA: Hunter House.
- Bain, B. K., and Leger, D. (1997). *Assistive Technology: An Interdisciplinary Approach*. New York, NY, US: Churchill Livingstone.
- Baum, C. M. (1998). Achieving effectiveness with a client centred approach: A person-environment interaction. In D. B. Gray, L. A. Quatrano and M. L. Lieberman (Eds.), *Designing and Using Assistive Technology* (pp. 137–147). Baltimore, MD: Paul H. Brookes.
- Brown, C. E. (2009). Ecological models in occupational therapy. In E. B. Crepeau, E. S. Cohn, and B. A. Boyt Schell (Eds.), *Willard and Spackman's Occupational Therapy* (11th ed., pp. 435–445). Philadelphia: Wolters Kluwer Lippincott Williams & Wilkins.
- Christiansen C. H., and Baum, C. M. (1997). Person-environment occupational performance: A conceptual model for practice, In C. H. Christiansen, and C. M. Baum (Eds.), *Occupational Therapy: Enabling Function and Well-Being* (2nd ed., pp. 46–71). Thorofare, NJ: Slack Inc.
- Cook, A. M., Polgar, J. M., and Hussey, S. M. (2007). *Cook & Hussey's Assistive Technologies: Principles and Practice* (3rd ed.). St. Louis, MO: Mosby Elsevier.
- Cowan, D., and Turner-Smith, A. (1999). The user's perspective on the provision of electronic assistive technology: Equipped for life? *British Journal of Occupational Therapy*, 62(1), 2–6.
- de Jonge, D., Scherer, M. J., and Rodger, S. (2007). *Assistive Technology in the Workplace*. St. Louis, MO: Mosby Elsevier.
- Dunn, W., Brown, C., and McGuigan, A. (1994). The ecology of human performance: A framework for considering the impact of context. *American Journal of Occupational Therapy*, 48, 595–607.
- Enders, A. and Leech, P. (1996). Low-technology aids for daily living and do-it-yourself devices. In J. C. Galvin and M. J. Scherer (Eds.), *Evaluating, Selecting and Using Appropriate Assistive Technology* (pp. 30–39). Gaithersburg, MD: Aspen Publishers, Inc.
- Kelker, K., and Holt, R. (2000). *Family Guide to Assistive Technology*. Cambridge, MA: Brookline Books.
- Kielhofner, G. (2004). The development of occupational therapy knowledge. In G. Kielhofner (Ed.), *Conceptual Foundations of Occupational Therapy* (3rd ed., pp. 27–63). Philadelphia: F. A. Davis.
- Law, M., and Baum, C. M. (2005). Measurement in occupational therapy. In M. Law, C. Baum, and W. Dunn (Eds.), *Measuring Occupational Performance: Supporting Best Practice in Occupational Therapy* (pp. 3–20). Thorofare, NJ: SLACK Inc.
- Law, M., Baptiste, S., Carswell, A., McColl, M., Polatajko, H., and Pollock, N. (1994). *Canadian Occupational Performance Measure* (2nd ed.). Toronto, Ontario, Canada: Canadian Association of Occupational Therapists.
- Law, M., Cooper, B., Strong, S., Stewart, D., Rigby, P., and Letts, L. (1996). The Person-Environment-Occupation Model: A transactive approach to occupational performance. *Canadian Journal of Occupational Therapy*, 63(1), 9–23.
- Litvak, S. and Enders, A. (2001). Support systems: The interface between individuals and environments. In G.L. Albrecht, K. D. Seelman, and M. Bury (Eds.), *Handbook of Disability Studies* (pp. 711–733). Thousand Oaks, CA: Sage Publications.

- Long, T. M., and Perry, D. F. (2008). Pediatric physical therapists' perceptions of their training in assistive technology. *Physical Therapy*, 88(5), 629–639. doi:10.2522/ptj.20060356
- Long, T. M., Woolverton, M., Perry, D. F., and Thomas, M. J. (2007). Training needs of pediatric occupational therapists in assistive technology. *The American Journal of Occupational Therapy*, 61(3), 345–354. doi:10.5014/ajot.61.3.345
- Malec, J. (1999). Goal attainment scaling in rehabilitation. *Neuropsychological Rehabilitation*, 9(3), 253–275. doi:10.1080/096020199389365
- Nochajski, S. M., and Oddo, C. R. (1995). Technology in the workplace. In W. C. Mann and J. P. Lane (Eds.), *Assistive Technology for People with Disabilities* (2nd ed., pp. 197–261). Bethesda, MD: AOTA.
- Ostenso, S., Carlberg, E. B., and Vollestad, N. (2005). The use and impact of assistive devices and other environmental modifications on everyday activities and care in young children with cerebral palsy. *Disability and Rehabilitation*, 27(14), 849–861. doi:10.1080/09638280400018619
- Patterson, D. R., Jensen, M., and Engel-Knowles, J. (2002). Pain and its influence on assistive technology use. In M. J. Scherer (Ed.), *Assistive Technology: Matching Device and Consumer for Successful Rehabilitation* (pp. 59–76). Washington, DC: American Psychological Association.
- Scherer, M. J. (2000). *Living In a State of Stuck: How Technology Impacts the Lives on People with Disabilities* (3rd ed.). Cambridge, MA: Brookline Books.
- Scherer, M. J. (2005). Assessing the benefits of using assistive technologies and other supports for thinking, remembering and learning. *Disability and Rehabilitation*, 27(13), 731–739. doi:10.1080/09638280400014816
- Scherer, M. J., and Galvin, J. C. (1996). An outcomes perspective to quality pathways to the most appropriate technology. In J. C. Galvin and M. Scherer (Eds.), *Evaluating, Selecting, and Using Appropriate Assistive Technology* (pp. 1–26). Gaithersburg, MD: Aspen.
- Scherer, M. J., and Vitaliti, L. T. (1997). Functional approach to technological factors and their assessment in rehabilitation. In S. S. Dittmar and G. E. Gresham (Eds.), *Functional Assessment and Outcome Measures for the Health Rehabilitation Professional* (pp. 69–88). Gaithersburg, MD: Aspen.
- Sprigle, S., and Abdelhamied, A. (1998). The relationship between ability measures and assistive technology selection, design and use. In D. B. Gray, L. A. Quatrano, and M. L. Lieberman (Eds.), *Designing and Using Assistive Technology: The Human Perspective* (pp. 229–248). Baltimore, MD: Paul H. Brookes.
- Waldron, D., and Layton, N. (2008). Hard and soft assistive technology: Defining roles for clinicians. *Australian Occupational Therapy Journal*, 55(1), 61–64. doi:10.1111/j.1440-1630.2007.00707.x
- Wessels, R., Persson, J., Lorentsen, Ø., Andrich, R., Ferrario, M., Oortwijn, W., et al. (2002). IPPA: Individually prioritised problem assessment. *Technology and Disability*, 14(3), 141–145. Retrieved from <http://iospress.metapress.com/content/2bm793b7pbdah9bw/>
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2004). *A Glossary of Terms for Community Health Care and Services for Older Persons*. (WHO/WKC/Tech.Ser./04.2). Retrieved from http://whqlibdoc.who.int/wkc/2004/WHO_WKC_Tech.Ser._04.2.pdf.

12

Pediatric Specialists in Assistive Solutions

L. W. Braga, I. L. de Camillis Gil, K. S. Pinto, and P. S. Siebra Beraldo

CONTENTS

12.1 Pediatric Specialists in the Process of Development and Rehabilitation	245
12.2 Pediatric Specialists in Assistive Solutions	248
12.3 Assistive Solutions and the Interdisciplinary Team Approach	248
12.4 AT Resources Applied to the Daily Life of the Child and Family	250
12.5 AT and Learning	251
12.6 Case Evaluation in an Interprofessional Team	253
12.6.1 Case 1—Michael (Cerebral Palsy)	253
12.6.1.1 Case History	253
12.6.1.2 Motor Evaluation	253
12.6.1.3 Neuropsychological Evaluation	254
12.6.1.4 Communication Strategy	254
12.6.1.5 Evaluation of Visual, Auditive, and Perceptive Functions	254
12.6.1.6 Neurorehabilitation Team Approach	254
12.6.2 Case 2—John (Traumatic Brain Injury)	260
12.6.2.1 Case History	260
12.6.2.2 Motor Evaluation	260
12.6.2.3 Neuropsychological Evaluation	260
12.6.2.4 Communication Strategy	261
12.6.2.5 Evaluation of Visual, Auditive, and Perceptive Functions	261
12.6.2.6 Neurorehabilitation Team Approach	261
12.7 Conclusions	264
Summary of the Chapter	265
References	265

12.1 Pediatric Specialists in the Process of Development and Rehabilitation

The development or neurorehabilitation process of the child with impairments requires an approach involving different areas of specialization because these children may present difficulties or challenges in various developmental domains (sensorial, motor, neuropsychological, communication, and socialization, among others). This generates the need for assessments and interventions by interprofessional teams of physicians (pediatricians, orthopedic surgeons, neurologists, geneticists, psychiatrists, and other specialists); nurses; physical, occupational, and speech therapists; psychologists; special educators; technologists such as engineers; and prosthetics/orthotics technicians.



FIGURE 12.11
(See color insert.) AT resources that facilitate social interaction.

Summary of the Chapter

This chapter describes the role of the pediatric specialist in the neurorehabilitation process of the child that incorporates AT and its uses, applications, and indications. Two case studies, a child with CP and one with TBI, illustrate how AT impacted the children's development, recovery, and progress and how the pediatric specialist played an essential role in this process.

References

- Bakeit, A. M. (1996). Effective teamwork in rehabilitation. *International Journal of Rehabilitation Research*, 19, 301–306.
- Blackstone, S., Williams, M., and Wilkins, D. (2007). Key principles underlying AAC research. *Augmentative and Alternative Communication*, 23(3), 191–203. doi:10.1080/07434610701553684
- Bottos, M., Feliciangeli, A., Sciuto, L., Gericke, C., and Vianello, A. (2001). Functional status of adults with cerebral palsy and implications for treatment of children. *Developmental Med Child Neurology*, 43(8), 516–528. doi:10.1017/S0012162201000950
- Braga, L. W. (2000). Family participation in the rehabilitation of the child with traumatic brain injury. *Journal of Neuropsychology Society*, 6, 388.
- Braga, L. W. (2006). The context-sensitive family-based approach: Basic principles. In L. W. Braga, and A. Campos da Paz, Jr, (Eds.), *The Child with Traumatic Brain Injury or Cerebral Palsy: A Context-Sensitive, Family-Based Approach to Development* (pp. 1–16). Oxford, UK: Taylor & Francis.
- Braga, L. W. (2009). Should we empower the family? *Developmental Neurorehabilitation*, 12(4), 179–180. doi:10.1080/17518420903102001

- Braga, L. W., and Campos da Paz, Jr, A. (2006). *The Child with Traumatic Brain Injury or Cerebral Palsy: A Context-Sensitive, Family-Based Approach to Development*. Oxford, UK: Taylor & Francis.
- Braga L. W., da Paz Júnior, A. C., and Ylvisaker, M. (2005). Direct clinician-delivered versus indirect family-supported rehabilitation of children with traumatic brain injury: a randomized controlled trial. *Brain Injury*, 19(10), 819–831. doi:10.1080/02699050500110165
- Branson, D., and Demchak, M. (2009). The use of augmentative and alternative communication methods with infants and toddlers with disabilities: A research review. *Augmentative and Alternative Communication*, 25(4), 274–286. doi:10.3109/07434610903384529
- Campos da Paz, Jr, A., Burnett, S. M., and Nomura, A. M. (1996). Cerebral palsy. In R. B. Duthie, *Mercers's Orthopedic Surgery*. London: Arnold.
- Cattalani R, L. F. (1998). Traumatic brain injury in childhood: Intellectual, behavioural and social outcome into adulthood. *Brain Injury*, 12(4), 283–296. doi:10.1080/026990598122584
- Copley, J., and Ziviani, J. (2007). Use of a team-based approach to assistive technology assessment and planning for children with multiple disabilities: A pilot study. *Assistive Technology*, 19(3), 109–125. doi:10.1080/10400435.2007.10131869
- Fallon, K. A., Light, J., and Achenbach, A. (2003). The semantic organization patterns of young children: Implications for augmentative and alternative communication. *AAC Augmentative and Alternative Communication*, 19(2), 74–85. doi:10.1080/0743461031000112061
- Fallon, K. A., Light, J. C., and Paige, T. K. (2001). Enhancing vocabulary selection for preschoolers who require augmentative and alternative communication (AAC). *American Journal Speech and Language Pathology*, 10(1), 81–94. doi:10.1044/1058-0360(2001/010)
- Halper, A. S. (1993). Teams and teamwork: health care settings. *ASHA*, 35(6–7), 34–48.
- Hinojosa, J., Sproat, C. T., Mankhetwit, S., and Anderson, J. (2002). Shifts in parent-therapist partnerships: Twelve years of change. *American Journal of Occupational Therapy*, 56(5), 556–563. doi:10.5014/ajot.56.5.556
- Huang, I., Sugden, D., and Beveridge, S. (2009). Children's perceptions of their use of assistive devices in home and school settings. *Disability and Rehabilitation: Assistive Technology*, 4(2), 95–105. doi:10.1080/17483100802613701
- Jahiel, R. I., and Scherer, M. J. (2010). Initial steps towards a theory and praxis of person-environment interaction in disability. *Disability and Rehabilitation*, 32(17), 1467–1474. doi:10.3109/09638280802590637
- Jans, L. H., and Scherer, M. J. (2006). Assistive technology training: Diverse audiences and multidisciplinary content. *Disability and Rehabilitation: Assistive Technology*, 1(1–2), 69–77. doi:10.1080/09638280500167290
- Kellegrew, D. (2000). Constructing daily routines: A qualitative examination of mothers with young children with disabilities. *American Journal Occupational Therapy*, 54(3), 252–259. doi:10.5014/ajot.54.3.252
- Ketelaar, M, Vermeer, A., Hart, H., van Petegem-van Beek, E., and Helders, P. J. (2001). Effects of a functional therapy program on motor abilities of children with cerebral palsy. *Physical Therapy*, 81(9), 1534–1545.
- King, J., Nelson, T., and Heye ML, Turturro, T. C., and Titus, M. N. D. (1998). Prescriptions, referrals, order writing, and the rehabilitation team function. In J. A. DeLisa, and Bruce M. Gans (Eds.), *Rehabilitation Medicine: Principles and Practice* (pp. 269–285). Philadelphia: Lippincott-Raven.
- King, S., Teplicky, R., King, G., and Rosenbaum, P. (2004). Family-centered service for children with cerebral palsy and their families: A review of the literature. *Seminars in Pediatric Neurology*, 11(1), 78–86. doi:10.1016/j.spen.2004.01.009
- Körner, M. (2010). Interprofessional teamwork in medical rehabilitation: A comparison of multidisciplinary and interdisciplinary team approach. *Clinical Rehabilitation*, 24(8), 745–754. doi:10.1177/0269215510367538
- Leontiev, A. N. (1978). *O Desenvolvimento do Psiquismo*. Lisbon, Portugal: Livros Horizonte.
- Lindsay, S., and Tsybina, I. (2011). Predictors of unmet needs for communication and mobility assistive devices among youth with a disability: The role of socio-cultural factors. *Disability and Rehabilitation: Assistive Technology*, 6(1), 10–21. doi:10.3109/17483107.2010.514972

- McDougall, J., Wright, V., and Rosenbaum, P. (2010). The ICF model of functioning and disability: Incorporating quality of life and human development. *Developmental Neurorehabilitation*, 13(3), 204–211. doi:10.3109/17518421003620525
- McDougall, J., Wright, V., Schmidt, J., Miller, L., and Lowry, K. (2011). Applying the ICF framework to study changes in quality-of-life for youth with chronic conditions. *Developmental Neurorehabilitation*, 14(1), 41–53. doi:10.3109/17518423.2010.521795
- McNaughton, D., Rackensperger, T., Benedek-Wood, E., Krezman, C., Williams, B., and Light, J. (2008). “A child needs to be given a chance to succeed”: Parents of individuals who use AAC describe the benefits and challenges of learning AAC technologies. *AAC Augmentative and Alternative Communication*, 24(1), 43–55. doi:10.1080/07434610701421007
- Murchland, S., and Parkyn, H. (2010). Using assistive technology for schoolwork: The experience of children with physical disabilities. *Disability and Rehabilitation: Assistive Technology*, 5(6), 438–447. doi:10.3109/17483107.2010.481773
- Murphy, J., Markova, I., Collins, S., and Moodie, E. (1996). AAC systems: Obstacles to effective use. *European Journal of Disorders of Communication*, 31(1), 31–44. doi:10.3109/13682829609033150
- OPS/OMS. (2008). *Classificação Internacional de Funcionalidade, Incapacidade e Saúde*. São Paulo, Brazil: EDUSP.
- Ostensjo S, C. E. (2003). Everyday functioning in young children with cerebral palsy: Functional skills, caregiver assistance, and modifications of the environment. *Developmental Medicine and Child Neurology*, 45(9), 603–612. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12948327>
- Pennington, L., Goldbart, J., and Marshall, J. (2004). Speech and language therapy to improve the communication skills of children with cerebral palsy. *International Journal of Language & Communication Disorders*, 39(2), 151–170. doi:10.1080/13682820310001625598
- Pueyo-Benito, R., and Vendrell-Gomez, P. (2002). [Neuropsychology of cerebral palsy]. *Revista de Neurología*, 34, 1080–1087.
- Puyuelo, M. S. (2001). Problemas de linguagem na paralisia cerebral: diagnóstico e tratamento. In M. S. Puyuelo, P. Póo, C. Basil, and M. Le Métayer, (Eds.), *A Fonoaudiologia na Paralisia Cerebral: Diagnóstico e Tratamento* (pp. 17–80). São Paulo, Brazil: Santos Livraria Editora.
- Raghavendra, P., Bornman, J., Grandlund, M., and Björck-Akesson, E. (2007). The World Health Organization’s International Classification of Functioning, Disability and Health: Implications for clinical and research practice in the field of augmentative and alternative communication. *Augmentative and Alternative Communication*, 23(4), 349–361. doi:10.1080/07434610701650928
- Ripat, J., and Woodgate, R. (2011). The intersection of culture, disability and assistive technology. *Disability and Rehabilitation: Assistive Technology*, 6(2), 87–96. doi:10.3109/17483107.2010.507859
- Scherer, M. J. (1996). Outcomes of assistive technology use on quality of life. *Disability and Rehabilitation*, 18(9), 439–448. doi:10.3109/09638289609165907
- Scherer, M. J. (2004). The matching person and technology model. In M. J. Scherer, (Ed.), *Connecting to Learn: Educational and Assistive Technology for People with Disabilities* (pp. 183–201). Washington, DC: American Psychological Association.
- Scherer, M. J. (2005). Assessing the benefits of using assistive technologies and other supports for thinking, remembering and learning. *Disability and Rehabilitation*, 27(13), 731–739. doi:10.1080/09638280400014816
- Scherer, M. J., and Craddock, G. M. (2002). Matching Person and Technology (MPT) assessment process. *Technology & Disability*, 3(14), 125–131. Retrieved from <http://iospress.metapress.com/content/g0eft4mnlwly8y8g>
- Scherer, M. J., Craddock, G., and MacKeogh, T. (2011). The relationship of personal factors and subjective well-being to the use of assistive technology devices. *Disability and Rehabilitation*, 33(10), 811–817. doi:10.3109/09638288.2010.511418
- Scherer, M. J., Sax, C. L., Vanbiervliet, A., Cushman, L. A., and Scherer, J. V. (2005). Predictors of assistive technology use: The importance of personal and psychosocial factors. *Disability and Rehabilitation*, 27(21), 1321–1331. doi:10.1080/09638280500164800
- Skär, L. (2002). Disabled children’s perceptions of technical aids, assistance and peers in play situations. *Scandinavian Journal of Caring Sciences*, 16(1), 27–33. doi: 10.1046/j.1471-6712.2002.00047.x

- Stoner, J. B., Maureen, E., and Angell, R. L. (2010). Implementing augmentative and alternative communication in inclusive educational settings: A case study. *AAC Augmentative and Alternative Communication*, 26(2), 122–135. doi:10.3109/07434618.2010.481092
- Strauss, D., Ojdana, K., Shavelle, R., and Rosenbloom, L. (2004). Decline in function and life expectancy of older persons with cerebral palsy. *Neurorehabilitation*, 19, 69–78. Retrieved from <http://iospress.metapress.com/content/egevj8d1dyv9wpr7/>
- Vygotsky, L. V. (1984). *A Formação Social da Mente*. São Paulo, Brazil: Martins Fontes.
- Vygotsky, L. V. (1991). *Pensamento e Linguagem*. São Paulo, Brazil: Martins Fontes.
- Warzak, W. J., Allan, T. M., Ford, L. A., and Stefans, V. (1995). Common obstacles to the daily functioning of pediatric traumatically brain injured patients: Perceptions of caregivers and psychologists. *Child Health Care*, 24(2), 133–141. doi:10.1207/s15326888chc2402_5
- Wilson, D. J., Mitchell, J. M., Kemp, B. J., Adkins, R. H., and Mann, W. (2009). Effects of assistive technology on functional decline in people aging with a disability. *Assistive Technology*, 21(4), 208–217. doi:10.1080/10400430903246068
- Ylvisaker, M. (1998). *Traumatic Brain Injury Rehabilitation: Children and Adolescents*. Woburn, MA: Butterworth-Heinemann.

13

The Geriatrician

M. Pigliautile, L. Tiberio, P. Mecocci, and S. Federici

CONTENTS

13.1 Introduction.....	269
13.2 Analysis of the Older Patient: Diseases, Disability, and Frailty.....	270
13.2.1 Disease.....	270
13.2.2 Disability.....	271
13.2.3 Frailty.....	272
13.3 Geriatric Assessment.....	273
13.4 Geriatric Rehabilitation.....	275
13.5 Assistive Solutions: A Challenge in Geriatric Rehabilitation.....	277
13.5.1 Technological Devices for Elderly People With Cognitive Impairments	278
13.5.2 Technological Devices for Elderly People With Motor Disability	279
13.5.3 Socially Assistive Robotics Systems.....	280
13.6 Acceptance, Rejection, or Abandonment of an Assistive Technology.....	281
13.7 The Role of the Geriatrician in the Assistive Technology Assessment Process	282
13.8 Case Study and the ATA Process	287
13.8.1 The Role of the Geriatrician in the ATA Process for the User A.B.	288
13.9 Conclusions.....	291
Summary of the Chapter.....	292
References.....	293

13.1 Introduction

The word “geriatrics” was coined by Ignatz Leo Nascher (1863–1944), a Viennese man who worked as a physician in New York and who claimed that aging is not a disease but a period of life with its own physiology, requiring the need to treat geriatric medicine as a separate entity, as is done for pediatrics (Achenbaum 1995; Morley 2004). In the 1930s, Marjory Warren developed the principles of modern geriatric medicine in the United Kingdom by enhancing the environment, introducing active rehabilitation programs, and emphasizing the importance of the older person’s motivation (Morley 2004).

Over time, geriatric medicine developed core values, a knowledge base, and clinical skills to improve the health, functioning, and well-being of older people and to afford appropriate palliative care, for which a marked expansion over the past three decades occurred to meet the growing needs for care of the aging population (American Geriatrics Society Core Writing Group of the Task Force on the Future of Geriatric Medicine 2005). In fact, the U.S. Census Bureau data (Kinsella and He 2009) reports an extraordinary demographic and epidemiological change that can be seen as a success story for public health policies

dimensions. Rehabilitation is the goal of the geriatric assessment, and the introduction of assistive solutions in geriatric rehabilitation makes possible a scenario in which the functioning of elderly people with physical or cognitive limitations is improved. This chapter provides an overview of the areas where technological systems may offer support to the everyday life of the elderly and their caregivers. The contribution of a geriatrician in a center for technical aid is described, linking the comprehensive geriatric assessment with the ICF model. The lack of implementation of the ICF and the requirement of training in assistive solutions for geriatricians and caregivers are discussed.

References

- AAATE. (2003). AAATE position paper: A 2003 view on Technology and Disability Retrieved from <http://www.aaate.net/>
- Abellan van Kan, G., Rolland, Y., Houles, M., Gillette-Guyonnet, S., Soto, M., and Vellas, B. (2010). The assessment of frailty in older adults. *Clinics in Geriatric Medicine*, 26(2), 275–286. doi:10.1016/j.cger.2010.02.002.
- Achenbaum, W. A. (1995). *Crossing Frontiers: Gerontology Emerges as a Science*. New York: Cambridge University Press.
- Alexopoulos, G. S. (2005). Depression in the elderly. *Lancet*, 365(9475), 1961–1970. doi:10.1016/S0140-6736(05)66665-2.
- Alexopoulos, G. S., Buckwalter, K., Olin, J., Martinez, R., Wainscott, C., and Krishnan, K. R. R. (2002). Comorbidity of late life depression: An opportunity for research on mechanisms and treatment. *Biological Psychiatry*, 52(6), 543–558. doi:10.1016/S0006-3223(02)01468-3.
- Alqasemi, R. M., McCaffrey, E. J., Edwards, K. D., and Dubey, R. V. (2005, Jun 28-Jul 1). *Analysis, Evaluation and development of Wheelchair-Mounted Robotic Arms*. Paper presented at the 9th International Conference on Rehabilitation Robotics: ICORR '05, Chicago. doi:10.1109/ICORR.2005.1501144.
- American Geriatrics Society Core Writing Group of the Task Force on the Future of Geriatric Medicine. (2005). Caring for older Americans: The future of geriatric medicine. *Journal of American Geriatrics Society*, 53(Suppl 6), S245-S256. doi:10.1111/j.1532-5415.2005.53350.x.
- Arthanat, S., and Lenker, J. A. (2004). *Evaluating the ICF as a Framework for Clinical Assessment of Persons for Assistive Technology Device Recommendation*. Paper presented at the 10th North American Collaborating Centre (NACC) Conference on ICF, Halifax, Nova Scotia. Retrieved from http://secure.cihi.ca/cihiweb/en/downloads/SajayArthanat_paper.pdf.
- Asplund, K., Carlberg, B., and Sundström, G. (1992). Stroke in the elderly. *Cerebrovascular Diseases*, 2(3), 152-157. doi:10.1159/000109007.
- Batstra, L., Bos, E. H., and Neeleman, J. (2002). Quantifying psychiatric comorbidity—Lessons from chronic disease epidemiology. *Social Psychiatry and Psychiatric Epidemiology*, 37(3), 105–111. doi:10.1007/s001270200001.
- Brandtstädter, J., and Renner, G. (1990). Tenacious goal pursuit and flexible goal adjustment: Explication and age-related analysis of assimilative and accommodative strategies of coping. *Psychology and Aging*, 5(1), 58–67. doi:10.1037/0882-7974.5.1.58.
- Brown, C. J., and Peel, C. (2009). Rehabilitation. In J. B. Halter, J. G. Ouslander, M. E. Tinetti, S. Studenski, K. P. High, and S. Asthana (Eds.), *Hazzard's Geriatric Medicine and Gerontology* (6th ed., pp. 343–358). New York: McGraw-Hill.
- Cesta, A., Bahadori, S., Cortellessa, G., Grisetti, G., Giuliani, M., Locchi, L., et al. (2003, Jun 26–29). *The Robocare Project Cognitive Systems for the Care of the Elderly*. Paper presented at the International Conference on Aging, Disability and Independence: ICADI '03, Washington, DC.

- Cesta, A., Cortellessa, G., Rasconi, R., Pecora, F., Scopelliti, M., and Tiberio, L. (2011). Monitoring elderly people with the Robocare Domestic Environment: Interaction synthesis and user evaluation. *Computational Intelligence*, 27(1), 60–82. doi:10.1111/j.1467-8640.2010.00372.x.
- Chiu, C., W. Y., and Man, D. W. K. (2004). The effect of training older adults with stroke to use home-based assistive devices. *OTJR: Occupation, Participation and Health*, 24(3), 113–120.
- Christensen, K., Doblhammer, G., Rau, R., and Vaupel, J. W. (2009). Ageing populations: The challenges ahead. *Lancet*, 374(9696), 1196–1208. doi:10.1016/S0140-6736(09)61460-4.
- Cole, E. (1999). Cognitive prosthetics: An overview to a method of treatment. *NeuroRehabilitation*, 12(1), 39–51. Retrieved from <http://iospress.metapress.com/content/fbkx9tj118q5tcga/>
- Colombo, M. (2004). Assistive technology: Mind the user! *Gerontechnology*, 3(1), 1–4. doi:10.4017/gt.2004.03.01.001.00.
- Corey-Bloom, J. (2004). Alzheimer's disease. *Continuum*, 10(1), 29–57.
- Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., et al. (2006). Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and Aging*, 21(2), 333–352. doi:10.1037/0882-7974.21.2.333.
- Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, 38(3), 475–487. doi:10.1006/imms.1993.1022.
- de Groot, V., Beckerman, H., Lankhorst, G. J., and Bouter, L. M. (2003). How to measure comorbidity. A critical review of available methods. *Journal of Clinical Epidemiology*, 56(3), 221–229. doi:10.1016/S0895-4356(02)00585-1.
- DeVaul, R. W. (2004). *The Memory Glasses: Wearable Computing for Just-In-Time Memory Support*. Doctoral Dissertation, Massachusetts Institute of Technology, Cambridge, MA. Retrieved from <http://devaul.net/~rich/DeVaulDissertation.pdf>.
- Driessen, B., Evers, H., and van Woerden, J. (2001). MANUS—A wheelchair-mounted rehabilitation robot. *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine*, 215(3), 285–290. doi:10.1243/0954411011535876.
- Elliot, R. (1991). *Assistive Technology for the Frail Elderly: An Introduction and Overview*. Philadelphia: University of Pennsylvania.
- Feigin, V. L., Lawes, C. M., Bennett, D. A., and Anderson, C. S. (2003). Stroke epidemiology: A review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century. *Lancet Neurology*, 2(1), 43–53. doi:10.1016/S1474-4422(03)00266-7.
- Feinstein, A. R. (1970). The pre-therapeutic classification of co-morbidity in chronic disease. *Journal of Chronic Diseases*, 23(7), 455–468. doi:10.1016/0021-9681(70)90054-8.
- Freedman, V. A. (2009). Adopting the ICF language for studying late-life disability: A field of dreams? *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 64(11), 1172–1174; discussion 1175–1176. doi:10.1093/gerona/64.11.1172.
- Freedman, V. A., Martin, L. G., and Schoeni, R. F. (2002). Recent trends in disability and functioning among older adults in the United States: A systematic review. *Journal of the American Medical Association*, 288(24), 3137–3146. doi:10.1001/jama.288.24.3137.
- Fried, L. P. (1994). Frailty. In W. R. Hazzard, J. G. Ouslander, J. Blass, J. B. Halter and M. E. Tinetti (Eds.), *Principles of Geriatric Medicine and Gerontology* (3rd ed., pp. 1149–1155). New York: McGraw-Hill.
- Fried, L. P. (2000). Epidemiology of aging. *Epidemiologic Reviews*, 22(1), 95–106.
- Fried, L. P., Ferrucci, L., Darer, J., Williamson, J. D., and Anderson, G. (2004). Untangling the concepts of disability, frailty, and comorbidity: Implications for improved targeting and care. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 59(3), M255–M263. doi:10.1093/gerona/59.3.M255.
- Fried, L. P., and Guralnik, J. M. (1997). Disability in older adults: Evidence regarding significance, etiology, and risk. *Journal of American Geriatrics Society*, 45(1), 92.
- Fried, L. P., Tangen, C. M., Walston, J. D., Newman, A. B., Hirsch, C., Gottdiener, J., et al. (2001). Frailty in older adults: Evidence for a phenotype. *Journals of Gerontology*, 56A(3), M146–M156.

- Fried, L. P., Walston, J. D., and Ferrucci, L. (2009). Frailty. In J. B. Halter, J. G. Ouslander, M. E. Tinetti, S. Studenski, K. P. High and S. Asthana (Eds.), *Hazzard's Geriatric Medicine and Gerontology* (6th ed., pp. 631–646). New York: McGraw-Hill.
- Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *New England Journal of Medicine*, 303(3), 130–135. doi:10.1056/NEJM198007173030304.
- Geriatric Medicine Section of UEMS. (2008). *Geriatric Medicine*. Retrieved from <http://www.uems-geriatric-medicine.org>
- Gijssen, R., Hoeymans, N., Schellevis, F. G., Ruwaard, D., Satariano, W. A., and van den Bos, G. A. M. (2001). Causes and consequences of comorbidity: A review. *Journal of Clinical Epidemiology*, 54(7), 661–674. doi:10.1016/s0895-4356(00)00363-2.
- Gill, T. M., Gahbauer, E. A., Han, L., and Allore, H. G. (2010). Trajectories of disability in the last year of life. *New England Journal of Medicine*, 362(13), 1173–1180. doi:10.1056/NEJMoa0909087.
- Gitlin, L. N. (1995). Why older people accept or reject assistive technology. *Generations*, 19(1), 41–46.
- Gorman, P., Dayle, R., Hood, C.-A., and Rumrell, L. (2003). Effectiveness of the ISAAC cognitive prosthetic system for improving rehabilitation outcomes with neurofunctional impairment. *NeuroRehabilitation*, 18(1), 57–67. Retrieved from <http://iospress.metapress.com/content/qb93q7w4qfh3r47y/>
- Graf, B., Hans, M., and Schraft, R. D. (2004). Care-O-Bot II—Development of a next generation robotic home assistant. *Autonomous Robots*, 16(2), 193–205. doi:10.1023/B:AURO.0000016865.35796.e9.
- Grill, E., and Stucki, G. (2011). Criteria for validating comprehensive ICF Core Sets and developing brief ICF Core Set versions. *Journal of Rehabilitation Medicine*, 43(2), 87–91. doi:10.2340/16501977-0616.
- Guralnik, J. M. (1996). Assessing the impact of comorbidity in the older population. *Annals of Epidemiology*, 6(5), 376–380. doi:10.1016/S1047-2797(96)00060-9.
- Guralnik, J. M., and Ferrucci, L. (2009). The challenge of understanding the disablement process in older persons: Commentary responding to Jette AM. Toward a common language of disablement. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 64A(11), 1169–1171. doi:10.1093/gerona/64p094.
- Harman, D. (2001). Aging: Overview. *Annals of the New York Academy of Sciences*, 286(928), 1–21. doi:10.1111/j.1749-6632.2001.tb05631.x.
- Hazzard, W. R. (2004). I am a geriatrician. *Journal of the American Geriatrics Society*, 52(1), 161. doi:10.1111/j.1532-5415.2004.52041.x.
- Heron, M., Hoyert, D. L., Murphy, S. L., Xu, J., Kochanek, K. D., and Tejada-Vera, B. (2009). Deaths: Final data for 2006. *National Vital Statistics Report*, 57(14), 1–134.
- Hok Kwee, H. (1998). Integrated control of MANUS manipulator and wheelchair enhanced by environmental eocking. *Robotica*, 16(5), 491–498. doi:10.1017/S0263574798000642.
- International Standards Organization (ISO). (2007). *ISO 9999:2007 Assistive Products for Persons with Disability—Classification and Terminology*. Geneva, Switzerland: ISO.
- InTouch Health. (2004). Advanced technology solutions for healthcare service providers Retrieved from <http://www.intouch-health.com/index.html>.
- Iwarsson, S., and Slaug, B. (2001). *The Housing Enabler: An Instrument for Assessing and Analysing Accessibility Problems in Housing*. Staffanstorp, Sweden: Vetem & Skapen & Slaug Data Management.
- Jagger, C. (2000). Compression or expansion of morbidity: What does the future hold? *Age and Ageing*, 29(2), 93–94. doi:10.1093/ageing/29.2.93.
- Jette, A. M. (2006). Toward a common language for function, disability, and health. *Physical Therapy*, 86(5), 726–734. Retrieved from <http://www.phyther.org/content/86/5/726.full.pdf+html>.
- Jette, A. M. (2009). Toward a common language of disablement. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 64(11), 1165–1168. doi:10.1093/gerona/64p093.

- Karmarkar, A., Chavez, E., and Cooper, R. A. (2008). Technology for successful aging and disabilities. In A. Helal, M. Mokhtari and B. Abdulrazak (Eds.), *The Engineering Handbook of Smart Technology for Aging, Disability, and Independence* (pp. 27–48). Hoboken, NJ: John Wiley & Sons, Inc., doi:10.1002/9780470379424.ch1.
- Kinsella, K., and He, W. (2009). *An Aging World: 2008. International Population Report*. Retrieved from <http://www.census.gov/prod/2009pubs/p95-09-1.pdf>.
- Kramer, M. (1980). The rising pandemic of mental disorders and associated chronic diseases and disabilities. *Acta Psychiatrica Scandinavica*, 62(S285), 382–397. doi:10.1111/j.1600-0447.1980.tb07714.x.
- Krebs, H., Ferraro, M., Buerger, S., Newbery, M., Makiyama, A., Sandmann, M., et al. (2004). Rehabilitation robotics: Pilot trial of a spatial extension for MIT-Manus. *Journal of NeuroEngineering and Rehabilitation*, 1(1), 5. doi:10.1186/1743-0003-1-5.
- Lacey, G., and Dawson-Howe, K. M. (1998). The application of robotics to a mobility aid for the elderly blind. *Robotics and Autonomous Systems*, 23(4), 245–252. doi:10.1016/s0921-8890(98)00011-6.
- Landi, F., Liperoti, R., Russo, A., Capoluongo, E., Barillaro, C., Pahor, M., et al. (2010). Disability, more than multimorbidity, was predictive of mortality among older persons aged 80 years and older. *Journal of Clinical Epidemiology*, 63(7), 752–759. doi:10.1016/j.jclinepi.2009.09.007.
- Lauriks, S., Reinersmann, A., Van der Roest, H. G., Meiland, F. J., Davies, R. J., Moelaert, F., et al. (2007). Review of ICT-based services for identified unmet needs in people with dementia. *Ageing Research Reviews*, 6(3), 223–246. doi:10.1016/j.arr.2007.07.002.
- Levinson, R. (1997). The Planning and Execution Assistant and Trainer (PEAT). *Journal of Head Trauma Rehabilitation*, 12(2), 85–91. doi:10.1097/00001199-199704000-00010.
- Lezak, M. D., Howieson, D. B., Loring, D. W., Hannay, H. J., and Fischer, J. S. (2004). *Neuropsychological assessment* (4th ed.). New York: Oxford University Press.
- Manton, K. G. (1982). Changing concepts of morbidity and mortality in the elderly population. *Milbank Memorial Fund Quarterly. Health and Society*, 60(2), 183–244. doi:10.2307/3349767.
- Marengoni, A., Angleman, S., Melis, R., Mangialasche, F., Karp, A., Garmen, A., et al. (2011). Aging with multimorbidity: A systematic review of the literature. *Ageing Research Reviews*. doi:10.1016/j.arr.2011.03.003.
- Marengoni, A., Rizzuto, D., Wang, H. X., Winblad, B., and Fratiglioni, L. (2009). Patterns of chronic multimorbidity in the elderly population. *Journal of American Geriatrics Society*, 57(2), 225–230. doi:10.1111/j.1532-5415.2008.02109.x.
- McCreadie, C., and Tinker, A. (2005). The acceptability of assistive technology to older people. *Ageing and Society*, 25(1), 91–110. doi:10.1017/S0144686X0400248X.
- McGarry Logue, R. (2002). Self-medication and the elderly: How technology can help. *American Journal of Nursing*, 102(7), 51–55.
- Mecocci, P., von Strauss, E., Cherubini, A., Ercolani, S., Mariani, E., Senin, U., et al. (2005). Cognitive impairment is the major risk factor for development of geriatric syndromes during hospitalization: Results from the GIFA study. *Dementia and Geriatric Cognitive Disorders*, 20(4), 262–269. doi:10.1159/000087440.
- Mihailidis, A., Barbenel, J. C., and Fernie, G. (2004). The efficacy of an intelligent cognitive orthosis to facilitate handwashing by persons with moderate to severe dementia. *Neuropsychological Rehabilitation*, 14(1–2), 135–171. doi:10.1080/09602010343000156.
- Mihailidis, A., Boger, J., Craig, T., and Hoey, J. (2008). The COACH prompting system to assist older adults with dementia through handwashing: An efficacy study. *BMC Geriatrics*, 8(1), 28. doi:10.1186/1471-2318-8-28.
- Morley, J. E. (2004). A brief history of geriatrics. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 59(11), 1132–1152. doi:10.1093/gerona/59.11.1132.
- Mosqueda, L. A. (1993). Assessment of rehabilitation potential. *Clinics in Geriatric Medicine*, 9(4), 689–703.
- Muir, A. J., Sanders, L. L., Wilkinson, W. E., and Schmader, K. (2001). Reducing medication regimen complexity: A controlled trial. *Journal of General Internal Medicine*, 16(2), 77–82. doi:10.1046/j.1525-1497.2001.016002077.x.

- Nagi, S. Z. (1964). A study in the evaluation of disability and rehabilitation potential: Concepts, methods, and procedures. *American Journal of Public Health and the Nation's Health*, 54(9), 1568–1579. doi:10.2105/ajph.54.9.1568.
- Nagi, S. Z. (1965). Some conceptual issues in disability and rehabilitation. In M. B. Sussman (Ed.), *Sociology and Rehabilitation* (pp. 100–113). Washington, DC: American Sociological Association.
- Nagi, S. Z. (1991). Disability concepts revisited: Implications for prevention. In A. M. Pope and A. R. Tarlov (Eds.), *Disability in America: Toward a National Agenda for Prevention* (pp. 309–327). Washington, DC: National Academy Press.
- Nakayama, H., Jorgensen, H. S., Raaschou, H. O., and Olsen, T. S. (1994). The influence of age on stroke outcome. The Copenhagen Stroke Study. *Stroke*, 25(4), 808–813. doi:10.1161/01.STR.25.4.808.
- NIH Consensus Development Program. (1987). *Geriatric Assessment Methods for Clinical Decision Making. NIH Consensus Statement*. (6/13). Retrieved from <http://consensus.nih.gov/1987/1987GeriatricAssessment065html.htm>.
- Parnes, R. B. (2010). *GPS Technology and Alzheimer's Disease: Novel Use for an Existing Technology*. Retrieved from <http://www.thirdage.com/>
- Patrick, L., Knoefel, F., Gaskowski, P., and Rexroth, D. (2001). Medical comorbidity and rehabilitation efficiency in geriatric inpatients. *Journal of American Geriatrics Society*, 49(11), 1471–1477. doi:10.1046/j.1532-5415.2001.4911239.x.
- Philipose, M., Fishkin, K. P., Perkowitz, M., Patterson, D. J., Fox, D., Kautz, H., et al. (2004). Inferring activities from interactions with objects. *Pervasive Computing, IEEE*, 3(4), 50–57. doi:10.1109/MPRV.2004.7.
- Pollack, M. E., Brown, L., Colbry, D., McCarthy, C. E., Orosz, C., Peintner, B., et al. (2003). Autominder: An intelligent cognitive orthotic system for people with memory impairment. *Robotics and Autonomous Systems*, 44(3–4), 273–282. doi:10.1016/S0921-8890(03)00077-0.
- Qiu, C., De Ronchi, D., and Fratiglioni, L. (2007). The epidemiology of the dementias: An update. *Current Opinion in Psychiatry*, 20(4), 380–385. doi:10.1097/YCO.0b013e32816ebc7b.
- Rejeski, W. J., Ip, E. H., Marsh, A. P., Miller, M. E., and Farmer, D. F. (2008). Measuring disability in older adults: The International Classification System of Functioning, Disability and Health (ICF) framework. *Geriatrics and Gerontology International*, 8(1), 48–54. doi:10.1111/j.1447-0594.2008.00446.x.
- Reuben, D. B., and Rosen, S. (2009). Principles of geriatric assessment. In J. B. Halter, J. G. Ouslander, M. E. Tinetti, S. Studenski, K. P. High and S. Asthana (Eds.), *Hazzard's Geriatric Medicine and Gerontology* (6th ed., pp. 141–152). New York: McGraw-Hill.
- Reuben, D. B., Shekelle, P. G., and Wenger, N. S. (2003). Quality of care for older persons at the dawn of the third millennium. *Journal of American Geriatrics Society*, 51(Suppl 7), S346–S350. doi:10.1046/j.1365-2389.2003.51346.x.
- Rockwood, K., Hogan, D. B., and MacKnight, C. (2000). Conceptualisation and measurement of frailty in elderly people. *Drugs and Aging*, 17(4), 295–302. doi:10.2165/00002512-200017040-00005.
- Rockwood, K., Stadnyk, K., MacKnight, C., McDowell, I., Hebert, R., and Hogan, D. B. (1999). A brief clinical instrument to classify frailty in elderly people. *Lancet*, 353(9148), 205–206. doi:10.1016/S0140-6736(98)04402-X.
- Rubenstein, L. Z. (1995). An overview of comprehensive geriatric assessment: Rationale, history, programs models, basic components. In L. Z. Rubenstein, D. Wieland and R. Bernabei (Eds.), *Geriatric Assessment Technology: The State of the Art* (pp. 1–9). New York: Oxford University Press.
- Ruchinskas, R. A., and Curyto, K. J. (2003). Cognitive screening in geriatric rehabilitation. *Rehabilitation Psychology*, 48(1), 14–22. doi:10.1037/0090-5550.48.1.14.
- Scherer, M. J. (Ed.). (1998). *Matching Person & Technology. A Series of Assessments for Evaluating Predispositions to and Outcomes of Technology Use in Rehabilitation, Education, the Workplace & Other Settings*. Webster, NY: The Institute for Matching Person & Technology, Inc.
- Scherer, M. J. (2002). Introduction. In M. J. Scherer (Ed.), *Assistive Technology: Matching Device and Consumer for Successful Rehabilitation* (pp. 3–13). Washington, DC: American Psychological Association.

- Scherer, M. J. (2005). *Cross-Walking the ICF to a Measure of Assistive Technology Predisposition and Use*. Paper presented at the 11th World Health Organization (WHO) North American Collaborating Centre (NACC) Conference on the International Classification of Functioning, Disability and Health (ICF), Rochester, MN.
- Scherer, M. J., and Craddock, G. (2002). Matching Person & Technology (MPT) assessment process. *Technology & Disability*, 3(14), 125–131. Retrieved from <http://iospress.metapress.com/content/g0eft4mnlwly8y8g>.
- Scherer, M. J., Federici, S., Tiberio, L., Pigliautile, M., Corradi, F., and Meloni, F. (2011). ICF Core set for Matching Older Adults with Dementia and Technology. *Ageing International*, 36. doi:10.1007/s12126-010-9093-9.
- Searle, S. D., Mitnitski, A., Gahbauer, E. A., Gill, T. M., and Rockwood, K. (2008). A standard procedure for creating a frailty index. *BMC Geriatrics*, 8(24), 1–10. doi:10.1186/1471-2318-8-24
- Slangen-de Kort, Y. A. W., Midden, C. J. H., and van Wagenberg, A. F. (1998). Predictors of the adaptive problem-solving of older persons in their homes. *Journal of Environmental Psychology*, 18(2), 187–197. doi:10.1006/jev.1998.0083.
- Song, X., Mitnitski, A., and Rockwood, K. (2010). Prevalence and 10-year outcomes of frailty in older adults in relation to deficit accumulation. *Journal of American Geriatrics Society*, 58(4), 681–687. doi:10.1111/j.1532-5415.2010.02764.x.
- Stier-Jarmer, M., Grill, E., Muller, M., Strobl, R., Quittan, M., and Stucki, G. (2011). Validation of the comprehensive ICF Core Set for patients in geriatric post-acute rehabilitation facilities. *Journal of Rehabilitation Medicine*, 43(2), 102–112. doi:10.2340/16501977-0617.
- Straus, S. E., and Tinetti, M. E. (2009). Evaluation, management, and decision making with the older patient. In J. B. Halter, J. G. Ouslander, M. E. Tinetti, S. Studenski, K. P. High and S. Asthana (Eds.), *Hazzard's Geriatric Medicine and Gerontology* (6th ed., pp. 133–140). New York: McGraw-Hill.
- Stucki, G., Ewert, T., and Cieza, A. (2002). Value and application of the ICF in rehabilitation medicine. *Disability and Rehabilitation*, 24(17), 932–938. doi:10.1080/09638280210148594.
- Stucki, G., Üstün, T. B., and Melvin, J. (2005). Applying the ICF for the acute hospital and early post-acute rehabilitation facilities. *Disability and Rehabilitation*, 27(7/8), 349–352. doi:10.1080/09638280400013941.
- Tas, U., Verhagen, A. P., Bierma-Zeinstra, S. M., Hofman, A., Odding, E., Pols, H. A., et al. (2007). Incidence and risk factors of disability in the elderly: The Rotterdam Study. *Preventive Medicine*, 44(3), 272–278. doi:10.1016/j.ypmed.2006.11.007.
- Toseland, R. W., O'Donnell, J. C., Engelhardt, J. B., Hendler, S. A., Richie, J. T., and Jue, D. (1996). Outpatient geriatric evaluation and management. Results of a randomized trial. *Medical Care*, 34(6), 624–640. doi:10.1097/00005650-199606000-00011.
- Tsukuda, R. A. (1990). Interdisciplinary collaboration: Teamwork in geriatrics. In C. K. Cassel, D. E. Riesenber, L. B. Sorensen and J. R. Walsh (Eds.), *Geriatric Medicine* (2nd ed., pp. 668–675). New York: Springer-Verlag.
- van Breemen, A., Yan, X., and Meerbeek, B. (2005, Jul 25–29). *iCat: An Animated User-Interface Robot with Personality*. Paper presented at the 4th International Joint Conference on Autonomous Agents and Multiagent Systems: AAMAS '05, Utrecht, The Netherlands. doi:10.1145/1082473.1082823.
- Verbrugge, L. M., and Jette, A. M. (1994). The disablement process. *Social Science and Medicine*, 38(1), 1–14. doi:10.1016/0277-9536(94)90294-1.
- Wade, D. T. (1992). Stroke: Rehabilitation and long-term care. *The Lancet*, 339(8796), 791–793. doi:10.1016/0140-6736(92)91906-o.
- Wade, D. T. (1999). Rehabilitation therapy after stroke. *Lancet*, 354(9174), 176–177. doi:10.1016/S0140-6736(99)90064-8.
- Wells, J. L., Seabrook, J. A., Stolee, P., Borrie, M. J., and Knoefel, F. (2003a). State of the art in geriatric rehabilitation. Part I: Review of frailty and comprehensive geriatric. *Archives of Physical Medicine and Rehabilitation*, 84(6), 890–897. doi:10.1016/S0003-9993(02)04929-8.

- Wells, J. L., Seabrook, J. A., Stolee, P., Borrie, M. J., and Knoefel, F. (2003b). State of the art in geriatric rehabilitation. Part II: clinical challenges. *Archives of Physical Medicine and Rehabilitation*, 84(6), 898–903. doi:10.1016/S0003-9993(02)04930-4.
- World Health Organization (WHO). (1980). *ICIDH: International Classification of Impairments, Disabilities, and Handicaps. A Manual Of Classification Relating to the Consequences of Disease*. Geneva, Switzerland: WHO.
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- Yu, H., Spenko, M., and Dubowsky, S. (2003). An adaptive shared control system for an intelligent mobility aid for the elderly. *Autonomous Robots*, 15(1), 53–66. doi:10.1023/a:1024488717009.

14

Role of Speech–Language Pathologists in Assistive Technology Assessments

K. Hill and V. Corsi

CONTENTS

14.1 Description of the Professional Profile	301
14.1.1 Assistive Technology Teams and the SLP	303
14.1.2 Evidence-Based Practice and SLPs	304
14.1.3 AT Assessments and the SLP	307
14.1.4 Matching Persons With Technology and SLPs.....	308
14.1.5 Evaluation of the Effectiveness and Usefulness of the AT	311
14.1.6 Development and Implementation of AT Intervention Plans	313
14.1.7 The SLP’s Role in Advocacy	313
14.1.8 Specific Learning Disabilities	313
14.2 Case Evaluation in a Multidisciplinary Team or as a Professional Consultant.....	320
14.2.1 Characterizing the Client	320
14.2.2 Step 1: Asking Meaningful EBP Questions.....	320
14.2.3 Step 2: Collecting Clinical and Personal Evidence	321
14.2.4 Step 3: Locating and Reviewing Research Evidence	321
14.2.5 Step 4: Using the Evidence.....	321
14.3 Conclusions.....	322
Summary of the Chapter.....	323
Acknowledgments.....	324
References.....	324

14.1 Description of the Professional Profile

A speech–language pathologist (SLP) is a professional trained to evaluate and treat people who have communication and swallowing disorders. A person must have the required academic training and clinical experience to be certified or licensed as an SLP. The SLP is then able to diagnose and treat disorders across the life span pertaining to speech, language, voice, or swallowing. The specific course requirements and extent of clinical training vary internationally across curricula and awarded degrees. In some countries, professionals may practice as speech therapists with a 2- or 4-year degree. However, the more accepted standard for delivering clinical SLP services requires completion of a Master’s degree. In North America, SLPs become independent practitioners after earning a Master’s degree in communication science and disorders, completing a clinical fellowship year, and receiving a Certificate of Clinical Competence from the American Speech–Language–Hearing Association (ASHA). An advanced degree may be earned through a clinical doctorate

and environments. Personal well-being and life experience are directly related to an individual's ability to communicate as effectively as possible.

Acknowledgments

Katya Hill contributed to the entire study except for Section 14.1.8, which was reviewed by Corsi Valerio.

References

- AAC Institute. (2001). *Performance Report Tool (PeRT)* [computer software]. Pittsburgh, PA: AAC Institute.
- AAC Institute. (2009). *KeyLAM* [computer software]. Pittsburgh, PA: AAC Institute.
- American Speech–Language–Hearing Association (ASHA). (2001). *Roles and Responsibilities of Speech–Language Pathologists with Respect to Reading and Writing in Children and Adolescents* [Guidelines]. Retrieved from <http://www.asha.org/policy>
- American Speech–Language–Hearing Association (ASHA). (2002a). *Augmentative and Alternative Communication: Knowledge and Skills for Service Delivery* [Knowledge and Skills]. Retrieved from <http://www.asha.org/policy>
- American Speech–Language–Hearing Association (ASHA). (2002b). *Knowledge and Skills Needed by Speech–Language Pathologists with Respect to Reading and Writing in Children and Adolescents* [Knowledge and Skills]. Retrieved from <http://www.asha.org/policy>
- American Speech–Language–Hearing Association (ASHA). (2004a). *Preferred Practice Patterns for the Profession of Speech–Language Pathology* [Preferred Practice Patterns]. Retrieved from <http://www.asha.org/policy>
- American Speech–Language–Hearing Association (ASHA). (2004b). *Roles and Responsibilities of Speech–Language Pathologists with Respect to Augmentative and Alternative Communication: Technical Report* [Technical Report]. Retrieved from <http://www.asha.org/policy>
- American Speech–Language–Hearing Association (ASHA). (2007). *Scope of Practice in Speech–Language Pathology* [Scope of Practice]. Retrieved from <http://www.asha.org/policy>
- American Speech–Language–Hearing Association (ASHA). (2010). *Code of Ethics* [Ethics]. Retrieved from <http://www.asha.org/policy>
- American Psychiatric Association (APA). (2000). *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR*. Arlington, VA: APA.
- Beukelman, D., and Mirenda, P. (2005). *Augmentative and Alternative Communication: Management of Severe Communication Disorders in Children and Adults* (3rd ed.). Baltimore: Paul H. Brookes Publishing Co.
- Bodine, C., and Melonis, M. (2005). Teaming and assistive technology in educational settings. In D. Edyburn, K. Higgins, and R. Boone, (Eds.), *Handbook of Special Education* (pp. 209–227). Whitefish Bay, WI: Knowledge by Design, Inc.
- Coltheart, M. (1987). *Attention and Performance XII: The Psychology of Reading*. London: Psychology Press.
- Cook, A. M., and Hussey, S. M. (2002). *Assistive Technologies: Principles and Practice* (2nd ed.). St. Louis, MO: Mosby.
- Cooper, R. A. (2007). Introduction. In R. R. Cooper, H. Ohnabe, and D. A. Hobson, (Eds.), *An Introduction to Rehabilitation Engineering* (pp. 1–18). New York: Taylor & Francis Group.

- Cooper, R. A., Roberts, B. R., Hill, K., Karg, P., Karmarkar, A., Lane, A. K., et al. (2009). Seating, assistive technology, and equipment. In J. Stein, R. L. Harvey, R. F. Macko, C. J. Winstein, and R. D. Zorowitz, (Eds.), *Stroke Recovery and Rehabilitation* (pp. 543–568). New York: Demos Medical Publishing.
- Cooper, R. A., Ohnabe, H., and Hobson, A. D. (2007). *An Introduction to Rehabilitation Engineering*. Boca Raton, FL: CRC Press.
- Creech, R. (1995). Outcomes: Choosing our directions—Our freedom is the field’s reason for being. In *Proceedings of the Third Annual Pittsburgh Employment Conference*. Pittsburgh, PA: SHOUT Press, 3, pp. 9–12.
- Daniel, S. S., Walsh, A. K., Goldston, D. B., Arnold, E. M., Reboussin, B. A., and Wood, F. B. (2006). Suicide, school dropout, and reading problems among adolescents. *Journal of Learning Disabilities*, 39(6), 507–514. doi:10.1177/00222194060390060301
- Dollaghan, C. A. (2007). *The Handbook for Evidence-Based Practice in Communication Disorders*. Baltimore, MD: Paul H. Brookes Publishing Co.
- Dollaghan, C. A., Campbell T. F., and Tomlin, R. (1990). Video narration as a language sampling context. *Journal of Speech and Hearing Disorders*, 55, 582–590.
- Duchan, J. (1991). Everyday events: Their role in language assessment and intervention. In T. Gallaher, (Ed.), *Pragmatics of Language: Clinical Practice Issues* (pp. 43–98). San Diego: Singular.
- Esgate, A., Groome, D., and Baker, K. (2005). *An Introduction to Applied Cognitive Psychology*. London: Psychology Press.
- Fodor, J. A. (1983). *The Modularity of Mind*. Cambridge, MA: MIT Press.
- Gibbs, L. B. (2003). *Evidence-Based Practice for Helping Professions: A Practical Guide with Integrated Multimedia*. Pacific Grove, CA: Thompson Brookes/Cole.
- Haines, L., and Robertson, G. (2005). Teamwork needs technology. In D. Edybum, K. Higgins, and R. Boone, (Eds.), *Handbook of Special Education Technology Research and Practice* (pp. 455–480). Whitefish Bay, WI: Knowledge by Design.
- Hill, K. (2001). *The Development of a Model for Automated Performance Measurement and the Establishment of Performance Indices for Augmented Communicators under Two Sampling Conditions*. Dissertation Abstracts International, 62(05), 2293 (UMI No. 3103368).
- Hill, K. (2004). AAC evidence-based practice and language activity monitoring. *Topics in Language Disorders: Language and Augmented Communication*, 24, 18–30.
- Hill, K. (2006). A case study model for augmentative and alternative communication. *Assistive Technology Outcomes and Benefits*, 3(1).
- Hill, K. (2009). Data collection and monitoring AAC intervention in the schools. *ASHA Perspectives on Augmentative and Alternative Communication* 18, 58–64. doi:10.1044/aac18.2.58
- Hill, K. J., Baker, B., and Romich, B.A. (2007). Augmentative and alternative communication technology. In R. A. Cooper, H. Ohnabe, and D. A. Hobson, (Eds.), *An Introduction to Rehabilitation Engineering* (pp. 355–384). Boca Raton, FL: Taylor & Francis.
- Hill, K., Dollaghan, C., and Nyberg, E. (2000). *AAC Language Sample Library for Intervention, Outcomes Measurement, and Research*. Presented at the Annual American Speech–Language–Hearing (ASHA) Annual Convention. Washington DC. November 16–19.
- Hill, K., Glennen, S., and Lytton, R. (1998). The Role of Manufacturers’ Consultants in Delivering AAC Services. In *Proceedings of the 8th ISAAC Biennial Conference*. Dublin, Ireland.
- Hill, K., and Romich, B. (2001). A language activity monitor for supporting AAC evidence-based clinical practice. *Assistive Technology*, 13, 12–22.
- Hill, K. and Romich, B. (2003). *AAC Evidence-Based Clinical Practice: A Model for Success*. Pittsburgh, PA: AAC Institute Press.
- Hill, K., and Romich, B. (2007). *AAC Evidence-Based Practice: Four Steps to Optimized Communication*. Pittsburgh, PA: AAC Institute Press.
- Hill, K., Romich, B. and Hurd, R. (2007). *Family and Consumer Perceptions of AAC Evidence-Based Practice*. Poster at the 8th Annual Conference of the ASHA Division on AAC. Atlanta, GA.
- Hill, K., and Scherer, M. (2008). Matching Persons & Technology: Data-Driven AAC Assessment. *Proceedings of the Twenty-Third Annual Conference “Technology and Persons with Disabilities,”* California State University, Northridge, CA.

- HMSO. (1995). *Disability Discrimination Act*. Retrieved from <http://www.legislation.hmso.gov.uk/>
- Huer, M. D., and Hill, K. (2007). *AAC and the Rights and dignity of Persons with Disabilities*. Workshop at the 2007 RESNA Annual Conference. Phoenix, AZ. June 15–19.
- Huer, M., Hill, K., and Loncke, F. (2006). International Policy Trends and AAC. In *Proceedings of the ISAAC Biennial 2006 Conference*. Dusseldorf, Germany. July 29–August 5, 2006.
- Hunt, P., Soto, G., Maier, J., Liboiron, N., and Bae, S. (2004). Collaborative teaming to support preschoolers with severe disabilities who are placed in general education early childhood programs. *Topics in Early Childhood Special Education*, 24(3), 123–142.
- Kangas, K., and Lloyd, L. (1988). Early cognitive skills as prerequisites to augmentative and alternative communication use: What are we waiting for? *Augmentative and Alternative Communication*, 4, 211–221.
- Karmiloff-Smith, A. (1992). *Beyond Modularity: A Developmental Perspective on Cognitive Science*. Cambridge, MA: MIT Press.
- Koester, H. H., LoPresti, E., Ashlock, G., McMillan, W., Moore, P., and Simpson, R. (2003). Compass: Software for Computer Skills Assessment. In *Proceedings of CSUN 2003 International Conference on Technology and Persons with Disabilities*, Los Angeles, CA. March 2003.
- Koester Performance Research. (2007). COMPASS [computer software]. Ann Arbor, MI: Koester Performance Research.
- Kovach, T. M. (2009). *Augmentative and Alternative Communication Profile: A Continuum of Learning*. East Moline, IL: LinguSystems.
- Lagae, L. (2008). Learning disabilities: definitions, epidemiology, diagnosis, and intervention strategies. *Pediatric Clinics of North America*, 55(6), 1259–1268. doi:10.1016/j.pcl.2008.08.001
- Law, M. L., and MacDermid, J. (2008). *Evidence-Based Rehabilitation*. Thorofare, NJ: SLACK Inc.
- Lieber, J., Beckman, P. J., Hanson, M. J., Janko, S., Marquart, J. M., Horn, E., et al. (1997). The impact of changing roles on the relationships between professionals in inclusive programs for young children. *Early Education and Development*, 8, 67–82.
- Light, J. (1989). Toward a definition of communicative competence for individuals using augmentative and alternative communication systems. *Augmentative and Alternative Communication*, 5, 137–144.
- Light, J., and Binger, C. (1998). *Building Communicative Competence with Individuals Who Use Augmentative and Alternative Communication*. Baltimore, MD: Paul H. Brookes Publishing Co.
- Manis, F.R., Seidenberg, M.S., Doi, L.M., McBride-Chang, C., and Petersen, A. (1996). On the bases of two subtypes of development dyslexia. *Cognition*, 58(2), 157–195. doi:10.1016/0010-0277(95)00679-6.
- McKibbon, K.A., Wilczynski, N., Hayward, R.S., Walker-Dilks, C., and Haynes, R.B. (1995). *The Medical Literature As a Resource for Evidence Based Care. Working Paper from the Health Information Research Unit*, McMaster University, Ontario, Canada.
- McNeil, M. R., Doyle, P. J., Park, G. H., Fossett, T. R. D., Brodsky, M. B. (2002). Increasing the sensitivity of the Story Retell Procedure for the discrimination of normal elderly subjects from persons with aphasia. *Aphasiology*, 16(8), 815–822.
- Morgan, P. L., and Fuchs, D. (2007). Is there a bidirectional relationship between children's reading skills and reading motivation? *Exceptional Children*, 73(2), 165–183.
- Moscovitch, M., and Umiltà, C. (1990). Modularity and neuropsychology: Modules and central processes in attention and memory. In M. F. Schwartz, (Ed.), *Modular Deficits in Alzheimer-Type Dementia* (pp. 1–59). Cambridge, MA: MIT Press.
- National Joint Committee for the Communicative Needs of Persons with Severe Disabilities (NJC). (2002). Access to communication services and supports: Concerns regarding the application of restrictive "eligibility." *Communication Disorders Quarterly*, 23(2), 145–153.
- Ninni, K. M., Brownstein, L. (1999). Patient outcome as a selection criterion in determining treatment mode. *Perfusion*, 14(3), 213–218.
- Pain, K., Dunn, M., Anderson, G., Darrach, J., and Kratochvil, M. (1998). Quality of life: What does it mean in rehabilitation? *Journal of Rehabilitation*, 64(2), 5–11.
- Paul, R. (1997). Facilitating transitions in language development for children using AAC. *Augmentative and Alternative Communication*, 13, 141–148.

- Paul, R. (2007). *Language Disorders from Infancy through Adolescence* (3rd ed.). St. Louis, MO: Mosby Elsevier.
- Prasher, V. P., and Kapadia, H. M. (2006). Epidemiology of learning disability and comorbid conditions. *Psychiatry*, 5(9), 302–305. doi:10.1053/j.mppsy.2006.06.010
- Repubblica Italiana. (2010). Legge 170/10: Nuove norme in materia di disturbi specifici di apprendimento in ambito scolastico (10G0192). *Gazzetta Ufficiale della Repubblica Italiana—Serie Generale*, 244, 1–3.
- Romich, B., and Hill, K. (1999). A language activity monitor for AAC and writing systems: Clinical intervention, outcomes measurements, and research. In *Proceedings for the RESNA '99 Annual Conference*. Long Beach, CA. pp 19–21.
- Romich, B., Hill, K., Seagull, A., Ahmad, N., Strecker, J., and Gotla, K. (2003). AAC Performance Report Tool. In *Proceedings of the RESNA 2001 Annual Conference* [CD-ROM]. Atlanta, GA: RESNA Press.
- Romich, B., Vanderheiden, G., and Hill, K. (2005). Augmentative communication. In J. D. Bronzino, (Ed.), *The Biomedical Engineering Handbook*, (3rd ed). Boca Raton, FL: CRC Press.
- Rourke, B. P., and Fuerst, D. R. (1991). *Learning Disabilities and Psychosocial Functioning: A Neuropsychological Perspective*. New York: Guilford Press.
- Sackett, D. L., Strauss, S. E., Richardson, W. S., Rosenberg, W., and Haynes, R. B. (2000). Evidence-based medicine: How to practice and teach EBM. Edinburgh, Scotland: Churchill Livingstone.
- Sackett, D. L., Rosenberg, W. McGray, J. M., Haynes, R. B., and Richardson, W. S. (1996). Evidence-based medicine: What it is and what it isn't. *British Medical Journal*, 321, 71–72.
- Scherer, M. J. (Ed.). (2002). *Assistive Technology: Matching Device and Consumer for Successful Rehabilitation*. Washington, DC: APA Books.
- Scherer, M. J. (2004). The Matching Person and Technology Model. In Scherer, M.J. (Ed.), *Connecting to Learn: Educational and Assistive Technology for People with Disabilities* (pp. 183–201). Washington, DC: APA.
- Scherer, M. J., and Craddock, G. M. (2002). Matching Person and Technology (MPT) assessment process. *Technology & Disability*, 3(14), 125–131.
- Segalowitz, S. J., and Rapin, I. (2002). *Handbook of Neuropsychology: Child Neuropsychology* (Vol. 8 Pt. 1). Amsterdam, The Netherlands: Elsevier Health Sciences.
- Shadden, B. B., Burnette, R. B., Eikenberry, B. R., and DiBrezzo, R. (1991). All discourse tasks are not created equal. *Clinical Aphasiology*, 20, 327–341.
- Shallice, T. (1988). *From Neuropsychology to Mental Structure*. Cambridge, UK: Cambridge University Press.
- Swengel, K., and Marquette, J. (1997). Service delivery in AAC. In S. L. Glennon, and D. Decoste, (Eds.), *Handbook of Augmentative and Alternative Communication* (pp. 21–57). San Diego: Singular Publishing Group.
- Ukrainetz, T. A., and Fresquez, E. F. (2003). “What isn't language?” A qualitative study of the role of the school Speech–Language pathologist. *Language, Speech, and Hearing Services in Schools*, 34, 284–298.
- U.S. Government (US). (2004). *Individuals with Disabilities Education Act*. Public Law 108–446, December 3, 2004.
- World Health Organization (WHO). (1992). *ICD-10: International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (Vol. 1–3). Geneva, Switzerland: WHO.
- Zabel, R. H., and Nigro, F. A. (1999). Juvenile offenders with behavioral disorders, learning disabilities, and no disabilities: Self-reports of personal, family, and school characteristics. *Behavioral Disorders*, 25(1), 22–40.
- Zorzi, M. (2005). Computational models of reading. In G. Houghton, (Ed.), *Connectionist Models in Cognitive Psychology* (pp. 403–444). London: Psychology Press.

Section III

Assistive Technology Devices and Services

S. Federici and M. J. Scherer

Introduction

Today much information about assistive technologies (ATs) can be obtained from many databases and web sites on the World Wide Web (WWW).^{*} However, we can make a clear distinction between databases and web sites: AT web sites mostly aim to present a catalogue of technologies for a specific kind of disability, such as the American Printing House for the Blind (<http://www.aph.org/>), or for other specific groups of disabilities, such as the Cambium Learning Technology Company web site (<http://www.intellitools.com/>). Databases are more focused on the diffusion of technical information about equipment by collecting a very extensive list of ATs.

The two largest and most complete databases of devices are[†]

- AbleData.com (<http://www.abledata.com>): Supported by the National Institute on Disability and Rehabilitation Research in 1996, this database currently provides information on approximately 40,000 products classified into 20 areas. It also offers information on noncommercial prototypes, customized and one-of-a-kind products, and do-it-yourself designs.
- The European Assistive Technology Information Network (EASTIN, <http://www.eastin.info>): In 2003, some of the best-known expert information providers in Europe joined together to create a comprehensive information service on AT, which currently offers information on 66,269 products.

^{*} A complete list of AT databases and web sites can be found at <http://www.a4access.org/atia.htm>.

[†] The number of products on <http://www.abledata.com> and <http://www.eastin.info> was retrieved in May 2011.

References

- Akoumianakis, D., and Stephanidis, C. (2001). *Universal Design in HCI: A Critical Review of Current Research and Practice*. Paper presented at the ACM Conference on Human Factors in Computing Systems: Universal Design: Towards Universal Access in the Information Society: CHI 2001, Seattle, WA. Retrieved from <http://www.ics.forth.gr/hci/files/ch12001/akoumianakis.pdf>
- Berners-Lee, T., and Fischetti, M. (1999). *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by Its Inventor*. London: Orion Business.
- Federici, S., and Borsci, S. (2010). Usability evaluation: Models, methods, and applications. In J. Stone and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation*. Buffalo, NY: Center for International Rehabilitation Research Information and Exchange (CIRRIE). Retrieved from <http://cirrie.buffalo.edu/encyclopedia/article.php?id=277&language=en>
- Halverson, L., and Belknap, K. A. (1996). *Informed Consumer's Guide to Assistive Technology for People with Spinal Cord Injuries*. Retrieved from http://www.abledata.com/abledata_docs/icg-spin.htm
- Haynes, B. (1999). Can it work? Does it work? Is it worth it? *British Medical Journal*, 319(7211), 652–653
- International Standards Organization (ISO). (1998). *ISO 9241–11: Ergonomic Requirements for Office Work with Visual Display Terminals*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2008). *ISO 9241–171: Ergonomics of Human-System Interaction—Part 171: Guidance on Software Accessibility*. Geneva, Switzerland: ISO.
- Kramer, G., Walker, B., Bonebright, T., Cook, P., Flowers, J., Miner, N., et al. (1997). *Sonification Report: Status of the Field and Research Agenda*. Retrieved from <http://sonify.psych.gatech.edu/publications/pdfs/1999-NSF-Report.pdf>
- Marley, J. E. (2000). Efficacy, effectiveness, efficiency. *Australian Prescriber*, 23(6), 114–115.
- Norman, D. A., and Draper, S. W. (1986). *User-Centered System Design: New Perspectives on Human-Computer Interaction*. London: Lawrence Erlbaum Associates.
- Roulstone, A. (1998). Researching a disabling society: The case of employment and new technology. In T. Shakespeare (Ed.), *The Disability Reader: Social Science Perspectives* (pp. 110–128). London: Cassell.
- Web Accessibility Initiative (WAI). (2006). Introduction to Web Accessibility. Retrieved from <http://www.w3.org/WAI/intro/accessibility.php>
- World Health Organization (WHO), and World Bank. (2011). *World Report on Disability*. Geneva, Switzerland: WHO.

15

Systemic User Experience

S. Borsci, M. Kurosu, M. L. Mele, and S. Federici

CONTENTS

15.1	Introduction.....	337
15.2	From Accessibility and Usability of Systems to the Users' Experience of Systems.....	340
15.2.1	The Relationship Between Accessibility and Usability.....	340
15.2.2	An Overview of the Usability Standards.....	341
15.3	Evaluation of Systems.....	343
15.3.1	A Conceptual Framework: An Integrated Model of Interaction Evaluation.....	343
15.4	Example of the UX Concept Application in Design Systems for Rehabilitation....	348
15.4.1	UX in the Assistive Technology Assessment Process.....	348
15.4.2	Sonification of the System.....	351
15.4.2.1	Application of a UX Framework for Designing a Sonified Visual Web Search Engine.....	353
15.5	Conclusions.....	354
	Summary of the Chapter.....	355
	References.....	355

15.1 Introduction

The term User eXperience (UX), proposed in the 1990s by Donald A. Norman and colleagues (1995) is focused on pleasure, value, and on performance during a human-system interaction. In the design process of the interaction, the usability of the system is a necessary but not sufficient condition for obtaining (designing or evaluating) a good level of UX; indeed, although usability is a dimension of the interaction, UX is a holistic perspective on how a user feels about using a system. There are various definitions regarding UX, including the one provided by Norman in explaining the UX term as “all aspects of the user’s interactions with the product: how it is perceived, learned and used. It includes ease of use and, most important of all, the needs that the product fulfils” (1998, p. 47), and the definition provided by Garrett, “how the product behaves and is used in the real world” (2003, p. 17). Recently, the International Organization for Standardization (ISO) 9241-210 (1999) defined it as “a person’s perceptions and responses that result from the use or anticipated use of a product, system or service.” The ISO also states that

User experience is a consequence of the presentation, functionality, system performance, interactive behaviour, and assistive capabilities of an interactive system, both hardware and software [...]. It is also a consequence of the user’s prior experiences, attitudes, skills, habits and personality (ISO 1999).

the redesign of a sonificated web search engine is presented as an example of the growing need of the UX approach in the AT design.

Summary of the Chapter

This chapter discusses the relation and the role of the constructs of accessibility and usability under the user experience theoretical approach. An integrated model of interaction evaluation, a new evaluation perspective based on the user experience, is presented as a framework not only to set up an evaluation of the users' interaction with assistive technology, but also to organize and evaluate the Assistive Technology Assessment process.

References

- Amedi, A., Stern, W. M., Camprodon, J. A., Bermpohl, F., Merabet, L., Rotman, S., et al. (2007). Shape conveyed by visual-to-auditory sensory substitution activates the lateral occipital complex. *Nature Neuroscience*, *10*(6), 687–689. doi:10.1038/nn1912
- Annett, J. (2002). Subjective rating scales in ergonomics: A reply. *Ergonomics*, *45*(14), 1042–1046. doi:10.1080/00140130210166762
- Avraamides, M. N., Loomis, J. M., Klatzky, R. L., and Golledge, R. G. (2004). Functional equivalence of spatial representations derived from vision and language: Evidence from allocentric judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30*(4), 801–814. doi:10.1037/0278-7393.30.4.804
- Barfield, W., Rosenberg, C., and Levasseur, G. (1991). The use of icons, earcons, and commands in the design of an online hierarchical menu. *IEEE Transactions on Professional Communication*, *34*(2), 8. doi:10.1109/47.87619
- Benjamin, J. M. J. (1973). *The New C-5 Laser Cane for the Blind*. Paper presented at the Proceedings of the 1973 Carnahan Conference on Electronic Prosthetics, New York.
- Benjamin, J. M. J. (1974). The laser cane. *Bulletin of Prosthetics Research*, *11*(2), 443–450.
- Bickenbach, J. E., Chatterji, S., Badley, E. M., and Üstün, T. B. (1999). Models of disablement, universalism and the international classification of impairments, disabilities and handicaps. *Social Science and Medicine*, *48*(9), 1173–1187. doi:10.1016/S0277-9536(98)00441-9
- Blattner, M. M., Sumikawa, D. A., and Greenberg, R. M. (1989). Earcons and icons: Their structure and common design principles. *Human-Computer Interaction*, *4*(1), 11–44. doi:10.1207/s15327051hci0401_1
- Brewster, S. A. (1997). Using non-speech sound to overcome information overload. *Displays*, *17*(3–4), 179–189. doi:10.1016/S0141-9382(96)01034-7
- Brewster, S. A. (1998). Using nonspeech sounds to provide navigation cues. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *5*(3), 224–259. doi:10.1145/292834.292839
- Brunetti, M., Belardinelli, P., Caulo, M., Del Gratta, C., Della Penna, S., Ferretti, A., et al. (2005). Human brain activation during passive listening to sounds from different locations: An fMRI and MEG study. *Human Brain Mapping*, *26*(4), 251–261. doi:10.1002/hbm.20164
- Brunetti, M., Della Penna, S., Ferretti, A., Del Gratta, C., Cianflone, F., Belardinelli, P., et al. (2008). A frontoparietal network for spatial attention reorienting in the auditory domain: A human fMRI/MEG study of functional and temporal dynamics. *Cerebral Cortex*, *18*(5), 1139–1147. doi:10.1093/cercor/bhm145

- Bryant, D. J. (1992). A spatial representation system in humans. *Psychology*, 3(16). Retrieved from <http://www.cogsci.ecs.soton.ac.uk/cgi/psyc/psummary?3.16>
- Bryant, D. J. (1997). Representing space in language and perception. *Mind and Language*, 12(3–4), 239–264. doi:10.1111/j.1468-0017.1997.tb00073.x
- Craik, K. (1943). *The Nature of Exploration*. Cambridge, UK: Cambridge University Press.
- Decety, J., and Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews*, 3(2), 71–100. doi:10.1177/1534582304267187
- Delogu, F., Palmiero, M., Federici, S., Zhao, H., Plaisant, C., and Olivetti Belardinelli, M. (2010). Non-visual exploration of geographic maps: Does sonification help? *Disability and Rehabilitation: Assistive Technology*, 5(3), 164–174. doi:10.3109/17483100903100277
- Di Blas, N., Paolini, P., and Speroni, M. (2004). “Usable Accessibility” to the Web for blind Users. Paper presented at the 8th ERCIM Workshop: User Interfaces for All, Vienna, Austria. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.110.8239>. doi:10.1.1.110.8239
- Di Giacomo, E., Didimo, W., Grilli, L., and Liotta, G. (2007). Graph visualization techniques for web clustering engines. *IEEE Transactions on Visualization and Computer Graphics*, 13(2), 294–304. doi:10.1109/TVCG.2007.40
- Farmer, L. W., and Smith, D. L. (1998). Adaptive technology. In B. B. Blasch, W. R. Wiener, and R. Welsh (Eds.), *Foundations of Orientation and Mobility* (2nd ed., pp. 231–259). New York: American Foundation for the Blind Press.
- Federici, S., and Borsci, S. (2010). Usability evaluation: Models, methods, and applications. In J. Stone and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation* (pp. 1–17). Buffalo, NY: Center for International Rehabilitation Research Information and Exchange (CIRRIE). Retrieved from <http://cirrie.buffalo.edu/encyclopedia/article.php?id=277&language=en>
- Federici, S., Borsci, S., and Mele, M. L. (2010a). Usability evaluation with screen reader users: A video presentation of the PCTA’s experimental setting and rules. *Cognitive Processing*, 11(3), 285–288. doi:10.1007/s10339-010-0365-9
- Federici, S., Borsci, S., Mele, M. L., and Stamera, G. (2008). Global Rank: Tra popolarità e qualità dei siti Web. [Global Rank: Between popularity and quality of web sites]. *Psicotech*, 6(1), 7–23. doi:10.1400/113633
- Federici, S., Borsci, S., Mele, M. L., and Stamera, G. (2010b). Web popularity: An illusory perception of a qualitative order in information. *Universal Access in the Information Society*, 9(4), 375–386. doi:10.1007/s10209-009-0179-7
- Federici, S., Borsci, S., and Stamera, G. (2010c). Web usability evaluation with screen reader users: Implementation of the Partial Concurrent Thinking Aloud technique. *Cognitive Processing*, 11(3), 263–272. doi:10.1007/s10339-009-0347-y
- Federici, S., Micangeli, A., Ruspantini, I., Borgianni, S., Corradi, F., Pasqualotto, E., et al. (2005). Checking an integrated model of web accessibility and usability evaluation for disabled people. *Disability and Rehabilitation*, 27(13), 781–790. doi:10.1080/09638280400014766
- Garrett, J. J. (2003). *The Elements of User Experience: User-Centered Design for the Web*. New York: New Riders Press.
- Gaver, W. W. (1986). Auditory icons: Using sound in computer interfaces. *Human-Computer Interaction*, 2(2), 167. doi:10.1207/s15327051hci0202_3
- Golledge, R. G., Loomis, J. M., Klatzky, R. L., Flury, A., and Yang, X. L. (1991). Designing a personal guidance system to aid navigation without sight: progress on the GIS component. *International Journal of Geographical Information Systems*, 5(4), 373–395. doi:10.1080/02693799108927864
- GSA’s IT Accessibility and Workforce (ITAW). (2010). Resources for understanding and implementing Section 508. Retrieved from <http://www.section508.gov>
- Hassenzahl, M., and Tractinsky, N. (2006). User experience—A research agenda. *Behaviour & Information Technology*, 25(2), 91–97. doi:10.1080/01449290500330331
- Heyes, A. D. (1984). Sonic Pathfinder: A programmable guidance aid for the blind. *Electronics & Wireless World*, 90(1579), 26–29 and 62.
- Horton, S. (2005). *Access by Design: A Guide to Universal Usability for Web Designers*. New York: New Riders Press.

- International Standards Organization (ISO). (1998). *ISO 9241-11: Ergonomic Requirements for Office Work with Visual Display Terminals*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (1999). *ISO 13407: Human-Centred Design Processes for Interactive Systems*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2000). *ISO/TR 18529: Ergonomics—Ergonomics of Human-System Interaction—Human-Centred Lifecycle Process Descriptions*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2001). *ISO/IEC Guide 71: Guidelines for Standards Developers to Address the Needs of Older Persons and Persons with Disabilities*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2002). *ISO/TR 16982: Ergonomics of Human-System Interaction—Usability Methods Supporting Human-Centred Design*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2003). *ISO/PAS 18152: Ergonomics of Human-System Interaction – Specification for the Process Assessment of Human-System Issues*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2006a). *ISO 20282-1: Ease of Operation of Everyday Products—Part 1: Design Requirements for Context of Use and User Characteristics*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2006b). *ISO 20282-2: Ease of Operation of Everyday Products—Part 2: Test Method for Walk-Up-and-Use Products*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2006c). *ISO/IEC 25062: Software Engineering—Software Product Quality Requirements and Evaluation (SQuaRE)—Common Industry Format (CIF) for Usability Test Reports*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2007a). *ISO/PAS 20282-3: Ease of Operation of Everyday Products—Part 3: Test Methods for Consumer Products*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2007b). *ISO/PAS 20282-4: Ease of Operation of Everyday Products—Part 4: Test Method for the Installation of Consumer Products*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2008). *ISO 9241-171: Ergonomics of Human-System Interaction—Part 171: Guidance on Software Accessibility*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2009). *ISO 9241-20: Ergonomics of Human-System Interaction—Part 20: Accessibility Guidelines for Information/Communication Technology (ICT) Equipment and Services*. Geneva, Switzerland: ISO.
- International Standards Organization (ISO). (2010). *ISO 9241-210: Ergonomics of Human-System Interaction—Part 210: Human-Centred Design for Interactive Systems*. Geneva, Switzerland: ISO.
- Japanese Standards Association (JSA). (2006). *JIS X 8341-5*. Tokyo: JSA.
- Kay, L. (1964). An ultrasonic sensing probe as a mobility aid for the blind. *Ultrasonics*, 2(2), 53–59. doi:10.1016/0041-624X(64)90382-8
- Kay, L. (1974). A sonar aid to enhance spatial perception of the blind: Engineering design and evaluation. *Radio and Electronic Engineer*, 44(11), 605–627. doi:10.1049/ree.1974.0148
- Kay, L. (2000). Auditory perception of objects by blind persons, using a bioacoustic high resolution sonar. *Journal of the Acoustical Society of America*, 107(6), 3266–3275.
- Kay, L. (2001). Bioacoustic spatial perception by humans: A controlled laboratory measurement of spatial resolution without distal cues. *The Journal of the Acoustical Society of America*, 109(2), 803–808. doi:10.1121/1.1336138
- Kirakowski, J. (2002). Is ergonomics empirical? *Ergonomics*, 45(14–15), 995–997. doi:10.1080/00140130210166889
- Kramer, G., Walker, B., Bonebright, T., Cook, P., Flowers, J., Miner, N., et al. (1997). Sonification report: Status of the field and research agenda. Retrieved from <http://sonify.psych.gatech.edu/publications/pdfs/1999-NSF-Report.pdf>
- Kurosu, M. (2010). *Concept Structure of UX (User Experience) and Its Measurement*. Paper presented at the APCHI & Ergofuture 2010: Joint International Conference of APCHI (Asia Pacific Computer Human Interaction) 2010 and Ergofuture 2010, Bali, Indonesia. Retrieved from <http://iea.cc/upload/Ergofuture%202010%20Brochure.pdf>

- Kurosu, M., and Ando, M. (2008). *The Psychology of Non-Selection and Waste: A Tentative Approach for Constructing the User Behavior Theory Based on the Artifact Development Analysis*. Paper presented at the 74th Annual Convention of Japanese Psychological Association, Osaka University, Japan. Retrieved from <http://www.wdc-jp.biz/jpa/conf2010/>
- Lakatos, S. (1993). Recognition of complex auditory-spatial patterns. *Perception*, 22(3), 363–374.
- Law, E. L.-C., Vermeeren, A. P. O. S., Hassenzahl, M., and Blythe, M. (2007, September 3–7). *Towards a UX Manifesto*. Paper presented at the Proceedings of the 21st British HCI Group Annual Conference on People and Computers: HCI '07, University of Lancaster, UK.
- Lazar, J. (Ed.). (2007). *Universal Usability: Designing Computer Interfaces for Diverse User Populations*. West Sussex, UK: Wiley and Sons.
- Mast, F., Jäncke, L., Loomis, J. M., Klatzky, R. L., Avraamides, M., Lippa, Y., et al. (2007). *Functional Equivalence of Spatial Images Produced by Perception and Spatial Language*. Berlin: Springer. doi:10.1007/978-0-387-71978-8_3
- Meijer, P. B. L. (1992). An experimental system for auditory image representations. *Biomedical Engineering, IEEE Transactions on*, 39(2), 112–121. doi:10.1109/10.121642
- Mele, M. L., Borsci, S., Rugo, A., Federici, S., Liotta, G., Trotta, F., et al. (2009). An accessible web searching: An on-going research project. In P. L. Emiliani, L. Burzagli, A. Como, F. Gabbanini and A.-L. Salminen (Eds.), *Assistive Technology from Adapted Equipment to Inclusive Environments: AAATE '09* (Vol. 25, p. 854). Florence, Italy: IOS Press. doi:10.3233/978-1-60750-042-1-854
- Mele, M. L., Federici, S., Borsci, S., and Liotta, G. (2010). Beyond a visuocentric way of a visual web search clustering engine: The sonification of *WhatsOnWeb*. In K. Miesenberger, J. Klaus, W. Zagler and A. Karshmer (Eds.), *Computers Helping People with Special Needs* (Vol. 1, pp. 351–357). Berlin: Springer. doi:10.1007/978-3-642-14097-6_56
- Meltzoff, A. N., and Decety, J. (2003). What imitation tells us about social cognition: A rapprochement between developmental psychology and cognitive neuroscience. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 358(1431), 491–500. doi:10.1098/rstb.2002.1261
- Merabet, L., Pogge, D., Stern, W. M., Bhatt, E., Hemond, C., Maguire, S., et al. (2008). *Activation of Visual Cortex Using Crossmodal Retinotopic Mapping*. Paper presented at the 14th Annual Meeting of the Organization for Human Brain Mapping (OHBM): HBM '08, Melbourne, Australia. Retrieved from <http://www.seeingwithsound.com/hbm2008.html>
- Millar, S. (1994). *Understanding and Representing Space: Theory and Evidence from Studies with Blind and Sighted Children*. New York: Oxford University Press.
- Morrisette, D. L., Goodrich, G. L., and Hennessey, J. J. (1981). A follow-up study of the Mowat Sensor's applications, frequency of use, and maintenance reliability. *Journal of Visual Impairment and Blindness*, 75(6), 244–247.
- Norman, D. A. (1983). Some observations on mental models. In D. Gentner and A. L. Steven (Eds.), *Mental Models* (pp. 7–14). Hillsdale, NJ: Lawrence Earlbaum Associates.
- Norman, D. A. (1998). *The Invisible Computer: Why Good Products Can Fail, the Personal Computer is So Complex, and Information Appliances are the Solution*. Cambridge, MA: MIT Press.
- Norman, D. A., Miller, J., and Henderson, A. (1995, May 7–11). *What You See, Some of What's in the Future, and How We Go about Doing It: HI at Apple Computer*. Paper presented at the Conference Companion on Human Factors in Computing Systems: CHI '95, Denver, CO. doi:10.1145/223355.223477
- Olivetti Belardinelli, M., Federici, S., Delogu, F., and Palmiero, M. (2009). Sonification of spatial information: Audio-tactile exploration strategies by normal and blind subjects. In C. Stephanidis (Ed.), *Universal Access in HCI, Part II, HCII 2009, LNCS 5615* (pp. 557–563). Berlin: Springer-Verlag. doi:10.1007/978-3-642-02710-9_62
- Olivetti Belardinelli, M., Santangelo, V., Botta, F., and Federici, S. (2007). Are vertical meridian effects due to audio-visual interference? A new confirmation with deaf subjects. *Disability and Rehabilitation*, 29(10), 797–804. doi:10.1080/09638280600919780
- Petrie, H., and Bevan, N. (2009). The evaluation of accessibility, usability, and user experience. In C. Stephanidis (Ed.), *The Universal Access Handbook* (pp. 299–314). Boca Raton, FL: CRC Press.

- Petrie, H., and Kheir, O. (2007). *The Relationship between Accessibility and Usability of Websites*. Paper presented at the Proceedings of the SIGCHI conference on Human Factors in Computing Systems, San Jose, CA. Retrieved from <http://doi.acm.org/10.1145/1240624.1240688>. doi:10.1145/1240624.1240688
- Roto, V., Law, E., Vermeeren, A., and Hoonhout, J. (2011). *User Experience White Paper. Result from Dagstuhl Seminar on Demarcating User Experience, September 15–18, 2010*. Retrieved from <http://www.allaboutux.org/files/UX-WhitePaper.pdf>
- Roulstone, A. (2010). Access and accessibility. In J. Stone and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation* (pp. 1–12). Buffalo, NY: Center for International Rehabilitation Research Information and Exchange (CIRRIE). Retrieved from <http://cirrie.buffalo.edu/encyclopedia/article.php?id=153&language=en>
- Rugo, A., Mele, M. L., Liotta, G., Trotta, F., Di Giacomo, E., Borsci, S., et al. (2009). A visual sonified web search clustering engine. *Cognitive Processing*, 10(Suppl 2), 286–289. doi:10.1007/s10339-009-0317-4
- Scherer, M. J., and DiCowden, M. A. (2008). Organizing future research and intervention efforts on the impact and effects of gender differences on disability and rehabilitation: The usefulness of the International Classification of Functioning, Disability and Health (ICF). *Disability and Rehabilitation*, 30(3), 161–165. doi:10.1080/09638280701532292
- Shinn-Cunningham, B. G., Zurek, P. M., Stutman, E. R., and Berkovitz, R. (1996). *Perception of Azimuth for Sources Simulated Using Two Loudspeakers in Natural Listening Environments*. Paper presented at the 19th Association for Research in Otolaryngology Midwinter Meeting, St. Petersburg Beach, FL.
- Shneiderman, B. (2003). *Leonardo's Laptop: Human Needs and the New Computing Technologies*. Cambridge, MA: MIT Press.
- Sumikawa, K. A., Blattner, M. M., Joy, K. I., and Greenberg, R. M. (1985). *Guidelines for the Syntactic Design of Audio Cues in Computer Interfaces*. (UCRL-93464).
- Thinus-Blanc, C., and Gaunet, F. (1997). Representation of space in blind persons: Vision as a spatial sense? *Psychological Bulletin*, 121(1), 20–42. doi:10.1037/0033-2909.121.1.20
- Ungar, S., Blades, M., and Spencer, C. (1997). Strategies for knowledge acquisition from cartographic maps by blind and visually impaired adults. *Cartographic Journal*, 34(2), 93–110.
- Web Accessibility Initiative (WAI). (2006). Introduction to Web Accessibility. Retrieved from <http://www.w3.org/WAI/intro/accessibility.php>
- World Health Organization (WHO). (2001). *ICF: International Classification of Functioning, Disability, and Health*. Geneva, Switzerland: WHO.
- World Health Organization (WHO), and World Bank. (2011). *World Report on Disability*. Geneva, Switzerland: WHO.
- Zhao, H., Plaisant, C., and Shneiderman, B. (2005). "I Hear the Pattern": *Interactive Sonification of Geographical Data Patterns*. Paper presented at the CHI '05 extended abstracts on Human factors in computing systems, Portland, OR. Retrieved from <http://portal.acm.org/citation.cfm?doid=1056808.1057052>
- Zhao, H., Plaisant, C., Shneiderman, B., and Duraiswami, R. (2004, July 6–9). *Sonification of Geo-Referenced Data for Auditory Information Seeking: Design Principle and Pilot Study*. Paper presented at the 10th Meeting of the International Conference on Auditory Display: ICAD '04, Sydney, Australia. doi:10.1.1.140.8467-1
- Zhao, H., Plaisant, C., Shneiderman, B., and Lazar, J. (2008). Data sonification for users with visual impairment. *ACM Transactions on Computer-Human Interaction*, 15(1), 1–28. doi:10.1145/1352782.1352786
- Zimmer, H. D. (2001). The interface between language and visuo-spatial representations. In M. Denis, R. Logie, C. Cornoldo, M. de Vega and J. Engelkamp (Eds.), *Imagery, Language and Visuo-Spatial Thinking* (pp. 109–136). London: Psychology Press.
- Zola, I. K. (1989). Toward the necessary universalizing of a disability policy. *Milbank Quarterly*, 67(Suppl 2 Pt. 2), 401–428. doi:10.2307/3350151

16

Web Solutions for Rehabilitation and Daily Life

G. Liotta, E. Di Giacomo, R. Magni, and F. Corradi

CONTENTS

16.1	Introduction	361
16.2	The Simplification of the World Wide Web for Disabled Users: The WhatsOnWeb Search Engine	362
16.2.1	Introduction	362
16.2.2	The Interaction Model	363
16.2.3	The Information Visualization Approach	365
16.2.3.1	The Application Information Visualization Approach: The Web Accessibility for Disabled Users	366
16.2.3.2	A Sonification Example	367
16.2.3.3	A Usability Evaluation	368
16.3	The Telemedicine: The Nu!Reha Desk	369
16.3.1	Introduction to Telemedicine	369
16.3.2	Telerehabilitation	370
16.3.3	The Nu!Reha Platform	370
16.3.4	Proposed Approach	371
16.3.5	Clinical Evaluation	372
16.3.5.1	Results and Discussion	373
16.3.6	Future Evolutions	374
16.4	Conclusions	375
	Summary of the Chapter	376
	References	376

16.1 Introduction

This chapter presents two studies: the first one discusses the design and the evaluation process of a tool for extending the possibility for disabled users to search and access the information on the Internet; the second discusses the development of a telemedicine tool for rehabilitation. Both the tools are created by a User Centered Design perspective (Norman, 1983) with a test–retest process:

- The first tool, called WhatsOnWeb, is a sonified clustering web search engine that makes use of visualization techniques to improve the effectiveness and efficiency of web searching. The whole information is presented to the user simultaneously in an interactive and sonified visual map, simplifying the user’s ability to access and find information. This technology is very important in a world in which more than two Exabytes of new information are created every year (Lyman and Varian, 2003).

Summary of the Chapter

This chapter presents two studies: the first one discusses the design and the evaluation process of a tool for extending the possibility for disabled users to search and access the information on the Internet (WhatsOnWeb); the second discusses the development of a telemedicine tool for rehabilitation (Nu!Reha). WhatsOnWeb can widen the ability of web users to search and access information through a semantic and spatial organization of information. This tool, by its sonification algorithm, becomes an important tool for visually impaired users because it allows this kind of user to explore the spatial organization of the retrieved information without performance differences to those of nonimpaired users. Also, the use of the user-centered perspective allows the designer to set up the WhatsOnWeb technology for brain-computer interface use with locked-in subjects to spread the semantic web possibility of searching in the World Wide Web. The second technology, the Nu!Reha Desk, is a telemedicine system that can include in the rehabilitation process disabled users without easy access to practitioners. The analysis of the user experience of this technology, and in particular the ease of learning perceived by the users, is the core for the implementation of this tool to optimize access to the rehabilitation process.

References

- Atkinson, R. C., and Shiffrin, R. M. (1971). The control of short-term memory. *Scientific American*, 225(2), 82–90.
- Avraamides, M. N., Loomis, J. M., Klatzky, R. L., and Golledge, R. G. (2004). Functional equivalence of spatial representations derived from vision and language: Evidence from allocentric judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 30(4), 801–814.
- Balch, D., Rosenthal, D., and Taylor, C. (2006). *The 2005 "Last Chance Bravo" Bioterrorism Exercise: A Report on the Efficacy of Communications Technologies and Telemedicine for Disaster Response*. Paper presented at the SAIS 2006 Proceedings. Paper 9. <http://aisel.aisnet.org/sais2006/9>
- Balch, D. C., and Tichenor, J. M. (1997). Telemedicine expanding the scope of health care information. *Journal of the American Medical Informatics Association:JAMIA*, 4(1), 1–5.
- Brooke, J. (1996). SUS: A quick and dirty usability scale. In P. W. Jordan, B. Thomas, B. A. Weerdmeester and A. L. McClelland (Eds.), *Usability Evaluation in Industry*. Boca Raton, FL: CRC Press.
- Bryant, D. J. (1992). A spatial representation system in humans. *Psychology*, 3(16).
- Chin, C., Barreto, A., and Alonso, M. (2006). Electromyogram-based cursor control system for users with motor disabilities. In K. Miesenberger, J. Klaus, W. Zagler and A. Karshmer (Eds.), *Computers Helping People with Special Needs* (Vol. 4061, pp. 905–912). Berlin/Heidelberg: Springer.
- de Vega, M., Cocude, M., Denis, M., Rodrigo, M. J., and Zimmer, H. D. (2001). The interface between language and visuo-spatial representations. In M. Denis, R. H. Logie, C. Cornoldi, M. de Vega and J. Engelkamp (Eds.), *Imagery, Language and Visuo-Spatial Thinking*. Hove, UK: Psychology Press.
- Di Giacomo, E., Didimo, W., Grilli, L., and Liotta, G. (2007). Graph visualization techniques for web clustering engines. *IEEE Transactions on Visualization and Computer Graphics*, 13(2), 294–304. doi: 10.1109/PACIFICVIS.2008.4475473
- Di Giacomo, E., Liotta, G., and Federici, S. (2010). *Information Visualization Techniques for Motion Impaired People*. Paper presented at the 3rd International Conference on Health Informatics (HEALTHINF 2010). <http://www.scitepress.org/DigitalLibrary/User/ViewPaper.aspx>. doi: 10.5220/0002758403610366

- Fejtová, M., Fejt, J., and Štěpánková, O. (2006). Eye as an actuator. In K. Miesenberger, J. Klaus, W. Zagler and A. Karshmer (Eds.), *Computers Helping People with Special Needs* (Vol. 4061, pp. 954–961), Berlin/Heidelberg: Springer.
- Hauber, R. P., Vesmarovich, S., and Dufour, L. (2002). The use of computers and the Internet as a source of health information for people with disabilities. *Rehabilitation Nursing*, 27(4), 142–145.
- Hermens, H., Huijgen, B., Giacomozzi, C., Ilsbroukx, S., Macellari, V., Prats, E., et al. (2007). Clinical assessment of the HELLODOC tele-rehabilitation service. *Annali dell'Istituto Superiore di Sanita*, 44(2), 154–163.
- Hersh, W. R., Hickam, D. H., Severance, S. M., Dana, T. L., Pyle Krages, K., and Helfand, M. (2006). Diagnosis, access and outcomes: Update of a systematic review of telemedicine services. *Journal of Telemedicine and Telecare*, 12(Suppl 2), 3–31. doi: 10.1258/135763306778393117
- Huijgen, B. C., Vollenbroek-Hutten, M. M., Zampolini, M., Opisso, E., Bernabeu, M., Van Nieuwenhoven, J., et al. (2008). Feasibility of a home-based telerehabilitation system compared to usual care: Arm/hand function in patients with stroke, traumatic brain injury and multiple sclerosis. *Journal of Telemedicine and Telecare*, 14(5), 249–256. doi: 10.1258/jtt.2008.080104
- Hwang, F., Keates, S., Langdon, P., and Clarkson, P. J. (2003). *Multiple Haptic Targets for Motion-Impaired Computer Users*. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Ft. Lauderdale, FL.
- Itoh, K. (2006). Light spot operated mouse emulator for cervical spinal-cord injured PC users. In K. Miesenberger, J. Klaus, W. Zagler and A. Karshmer (Eds.), *Computers Helping People with Special Needs* (Vol. 4061, pp. 973–980–980), Berlin/Heidelberg: Springer.
- Kramer, G. (1994). *Auditory Display: Sonification, Audification, and Auditory Interfaces*. Reading, MA: Addison Wesley.
- Kramer, G., Walker, B., Bonebright, T., Cook, P., Flowers, J., Miner, N., and Neuhoff, J. (1997). *Sonification Report: Status of the Field and Research Agenda*, International Community for Auditory Display. Retrieved from <http://sonify.psych.gatech.edu/publications/pdfs/1999-nsf-report.pdf>
- Lathan, C. E., Kinsella, A., Rosen, M. J., Winters, J., and Trepagnier, C. (1999). Aspects of human factors engineering in home telemedicine and telerehabilitation systems. *Telemedicine Journal*, 5(2), 169–175. doi: 10.1089/107830299312131
- Llewellyn, C. (1995). The role of telemedicine in disaster medicine. *Journal of Medical Systems*, 19(1), 29–34. doi: 10.1007/bf02257188
- Lyman, P., and Varian, H. R. (2003). *How Much Information 2003*. Berkeley, CA: University of California at Berkeley, School of Information Management and Systems.
- Mair, F., Whitten, P., May, C., and Doolittle, G. C. (2000). Patients' perceptions of a telemedicine specialty clinic. *Journal of Telemedicine and Telecare*, 6(1), 36–40. doi: 10.1258/1357633001933925
- Manaris, B., McGivers, M., and Lagoudakis, M. (2002). A listening keyboard for users with motor impairments—A usability study. *International Journal of Speech Technology*, 5(4), 371–388. doi: 10.1.1.13.8194
- Mele, M. L., Borsci, S., Rugo, A., Federici, S., Liotta, G., Trotta, F., and Di Giacomo, E. (2009). *An Accessible Web Searching: An On-Going Research Project* (Assistive Technology Research Series ed. Vol. 25). Amsterdam: IOS press. doi: 10.3233/978-1-60750-042-1-854.
- Mele, M. L., Federici, S., Borsci, S., and Liotta, G. (2010). *Beyond A Visuocentric Way of a Visual Web Search Clustering Engine: The Sonification of WhatsOnWeb*. Paper presented at the Proceedings of the 12th International Conference on Computers Helping People with Special Needs: Part I, Vienna, Austria. doi: 10.1007/978-3-642-14097-6_56.
- Michelle, J. J., Kimberly, J. W., John, A., Dominic, N., Elaine, S., Judith, K., et al. (2007). Task-oriented and purposeful robot-assisted therapy. In S. S. Kommu (Ed.), *Rehabilitation Robotics*. Vienna, Austria: InTech.
- Nielsen, J. (1994). *Enhancing the Explanatory Power of Usability Heuristics*. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Celebrating Interdependence, Boston, MA.

- Norman, D. A. (1983). Some observations on mental models. In D. Gentner and A. Steven (Eds.), *Mental Models* (pp. 7–14). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Ntoa, S., Savidis, A., and Stephanidis, C. (2004). FastScanner: An accessibility tool for motor impaired users. In K. Miesenberger, J. Klaus, W. Zagler, and D. Burger (Eds.), *Computers Helping People with Special Needs* (Vol. 3118, pp. 626–626). Berlin/Heidelberg: Springer.
- Pettersen, S., Uldal, S. B., Baardsgard, A., Amundsen, M., Myrvang, R., Nordvag, D., and Stenmarkl, H. (1999). The North Norwegian Health Net. *Journal of Telemedicine and Telecare*, 5(Suppl 1), 34–36. doi: 10.1258/1357633991932469
- Roberts, J., Slattey, O., and Kardos, D. (2000). 49.2: Rotating-wheel Braille display for continuous refreshable Braille. *SID Symposium Digest of Technical Papers*, 31(1), 1130–1133. doi: 10.1889/1.1832864
- Roulstone, A. (2010). Access and accessibility. In J. H. Stone and M. Blouin (Eds.), *International Encyclopedia of Rehabilitation*.
- Rugo, A., Mele, M., Liotta, G., Trotta, F., Di Giacomo, E., Borsci, S., and Federici, S. (2009). A visual sonificated web search clustering engine. *Cognitive Processing*, 10(0), 286–289. doi: 10.1007/s10339-009-0317-4.
- Salvador, C. H., Carrasco, M. P., de Mingo, M. A. G., Carrero, A. M., Montes, J. M., Martin, L. S., Monteagudo, J. L. (2005). Airmed-cardio: A GSM and Internet services-based system for out-of-hospital follow-up of cardiac patients. *Information Technology in Biomedicine, IEEE Transactions on* 9(1), 73. doi:10.1109/TITB.2004.840067
- Scattareggia, M. S., Nowe, A., Zaia, A., Cucinotta, A., Magni, R., Magnino, F., et al. (2004). H-Cad: A new approach for home rehabilitation. *International Journal Of Rehabilitation Research* 27(Suppl 1), 110–111.
- Slatin, J., and Rush, S. (2003). *Maximum Accessibility*. Reading, MA: Addison-Wesley.
- Smith, G. V., Silver, K. H. C., Goldberg, A. P., and Macko, R. F. (1999). “Task-oriented” exercise improves hamstring strength and spastic reflexes in chronic stroke patients. *Stroke*, 30(10), 2112–2118.
- Sporka, J., Kurniawan, H., and Slavík, P. (2006). Acoustic control of mouse pointer. *Universal Access in the Information Society*, 4(3), 237–245. doi: 10.1007/s10209-005-0010-z
- Strode, S. W., Gustke, S., and Allen, A. (1999). Technical and clinical progress in telemedicine. *JAMA: The Journal of the American Medical Association*, 281(12), 1066–1068. doi: 10.1001/jama.281.12.1066
- Struijk, L. (2006). A tongue based control for disabled people. In K. Miesenberger, J. Klaus, W. Zagler and A. Karshmer (Eds.), *Computers Helping People with Special Needs* (Vol. 4061, pp. 913–918). Berlin/Heidelberg: Springer.
- Taub, E., Uswatte, G., van der Lee, J. H., Lankhorst, G. J., Bouter, L. M., and Wagenaar, R. C. (2000). Constraint-induced movement therapy and massed practice. *Stroke*, 31(4), 983–991.
- Torsney, K. (2003). Advantages and disadvantages of telerehabilitation for persons with neurological disabilities. *Neurorehabilitation*, 18(2), 183–185.
- Whitten, P. S., Mair, F. S., Haycox, A., May, C. R., Williams, T. L., and Hellmich, S. (2002). Systematic review of cost effectiveness studies of telemedicine interventions. *BMJ*, 324(7351), 1434–1437. doi: 10.1136/bmj.324.7351.1434
- Wootton, R. (2001). Telemedicine. *BMJ*, 323(7312), 557–560. doi: 10.1136/bmj.323.7312.557
- Zampolini, M., Baratta, S., Schifini, F., Spitali, C., Todeschini, E., Bernabeu, M., et al. (2007). *Upper Limb Telerehabilitation with Home Care and Activity Desk (HCAD) system*. Paper presented at Virtual Rehabilitation 2007, Venice, Italy.
- Zhao, H., Plaisant, C., Shneiderman, B., and Lazar, J. (2008). Data sonification for users with visual impairment: A case study with georeferenced data. *ACM Transactions on Computer-Human Interaction*, 15(1), 1–28. doi: 10.1145/1352782.1352786

17

Brain–Computer Interfaces: The New Landscape in Assistive Technology

E. Pasqualotto, S. Federici, M. Olivetti Belardinelli, and N. Birbaumer

CONTENTS

17.1	What Is a Brain–Computer Interface?	379
17.2	Measuring Brain Activity	381
17.2.1	EEG	381
17.2.2	MEG	381
17.2.3	fMRI	381
17.2.4	fNIRS	382
17.3	History of BCIs	382
17.4	Communication	384
17.4.1	Potential Users	384
17.4.2	Development	385
17.5	Motor Restoration	387
17.5.1	Potential Users	387
17.5.2	BCI in Movement Restoration	388
17.6	BCI and Behavioral Disorders	389
17.6.1	Epilepsy and ADHD	389
17.6.2	Neurofeedback in Epilepsy and ADHD	389
17.7	Assistive Technologies and BCI	390
17.8	Conclusions	391
	Summary of the Chapter	392
	References	393

17.1 What Is a Brain–Computer Interface?

A brain–computer interface (BCI) provides a direct connection between the brain and an external device, such as a computer or any other system capable of receiving a signal. In June 1999, the First International Meeting on Brain–Computer Interface Technology took place at the Rensselaerville Institute (Albany, NY). The aims of this first meeting, which 50 researchers from 22 different research groups attended, were to review the state of the art of BCI research and to define a shared set of procedures, methods, and definitions. During this meeting, it was established that “a brain–computer interface is a communication system that does not depend on the brain’s normal output pathways of peripheral nerves and muscles” (Wolpaw et al. 2000). In a BCI, neuromuscular activity is not necessary for the production of the activity that is needed to convey the message (Pasqualotto et al. 2011a).

to allow the person direct access to stimulation as well as the possibility to call for social attention and interaction. The fourth section discusses (1) the results obtained with the different forms of technology used and their applicability and possible impact in daily education/rehabilitation contexts, and (2) the possibility of using combinations of microswitches also for programs aimed at simultaneously targeting increases of adaptive responding and reduction of problem behaviors or inadequate postures.

References

- Algozzine, B., Browder, D., Karvonen, M., Test, D. W., and Wood, W. M. (2001). Effects of interventions to promote self-determination for individuals with disabilities. *Review of Educational Research, 71*, 219–277.
- Begnoche, D., and Pitetti, K. H. (2007). Effects of traditional treatment and partial body weight treadmill training on the motor skills of children with spastic cerebral palsy: A pilot study. *Pediatric Physical Therapy, 19*, 11–19.
- Browder, D. M., Wood, W. M., Test, D. W., Karvonen, M., and Algozzine, B. (2001). Reviewing resources on self-determination: A map for teachers. *Remedial and Special Education, 22*, 233–244.
- Cannella, H. I., O'Reilly, M. F., and Lancioni, G. E. (2005). Choice and preference assessment research with people with severe to profound developmental disabilities: A review of the literature. *Research in Developmental Disabilities, 26*, 1–15.
- Catania, A. C. (2007). *Learning* (4th Interim ed.). New York: Sloan Publishing.
- Crawford, M. R., and Schuster, J. W. (1993). Using microswitches to teach toy use. *Journal of Developmental and Physical Disabilities, 5*, 349–368.
- Dillon, C. M., and Carr, J. E. (2007). Assessing indices of happiness and unhappiness in individuals with developmental disabilities: A review. *Behavioral Interventions, 22*, 229–244.
- Glickman, L., Deitz, J., Anson, D., and Stewart, K. (1996). The effect of switch control site on computer skills of infants and toddlers. *American Journal of Occupational Therapy, 50*, 545–553.
- Green, C. W., and Reid, D. H. (1999). A behavioral approach to identifying sources of happiness and unhappiness among individuals with profound multiple disabilities. *Behavior Modification, 23*, 280–293.
- Hoch, H., McComas, J. J., Johnson, L., Faranda, N., and Guenther, S. L. (2002). The effects of magnitude and quality of reinforcement on choice responding during play activities. *Journal of Applied Behavior Analysis, 35*, 171–181.
- Holburn, S., Nguyen, D., and Vietze, P. M. (2004). Computer-assisted learning for adults with profound multiple disabilities. *Behavioral Interventions, 19*, 25–37.
- Judge, S., Floyd, K., and Wood-Fields, C. (2010). Creating a technology-rich learning environment for infants and toddlers with disabilities. *Infants and Young Children, 23*, 84–92.
- Karvonen, M., Test, D. W., Wood, W. M., Browder, D., and Algozzine, B. (2004). Putting self-determination into practice. *Exceptional Children, 71*, 23–41.
- Kazdin, A. E. (2001). *Behavior Modification in Applied Settings* (6th ed.). New York: Wadsworth.
- Lachapelle, Y., Wehmeyer, M. L., Haelewyck, M. C., Courbois, Y., Keith, K. D., Schalock, R., Verdugo, M. A., and Walsh, P. N. (2005). The relationship between quality of life and self-determination: An international study. *Journal of Intellectual Disability Research, 49*, 740–744.
- Lancioni, G. E., Bellini, D., Oliva, D., Singh, N. N., O'Reilly, M. F., and Sigafoos, J. (2010a). Camera-based microswitch technology for eyelid and mouth responses of persons with profound multiple disabilities: Two case studies. *Research in Developmental Disabilities, 31*, 1509–1514.
- Lancioni, G. E., and Lems, S. (2001). Using a microswitch for vocalization responses with persons with multiple disabilities. *Disability and Rehabilitation, 23*, 745–748.

- Lancioni, G. E., Olivetti Belardinelli, M., Stasolla, F., Singh, N. N., O'Reilly, M. F., Sigafoos, J., and Angelillo, M. T. (2008a). Promoting engagement, requests and choice by a man with post-coma pervasive motor impairment and minimally conscious state through a technology-based program. *Journal of Developmental and Physical Disabilities, 20*, 379–388.
- Lancioni, G. E., O'Reilly, M. F., and Basili, G. (2001a). An overview of technological resources used in rehabilitation research with people with severe/profound and multiple disabilities. *Disability and Rehabilitation, 23*, 501–508.
- Lancioni, G. E., O'Reilly, M. F., and Basili, G. (2001b). Use of microswitches and speech output systems with people with severe/profound intellectual or multiple disabilities: A literature review. *Research in Developmental Disabilities, 22*, 21–40.
- Lancioni, G. E., O'Reilly, M. F., Cuvo, A. J., Singh, N. N., Sigafoos, J., and Didden, R. (2007a). PECS and VOCA to enable students with developmental disabilities to make requests: An overview of the literature. *Research in Developmental Disabilities, 28*, 468–488.
- Lancioni, G. E., O'Reilly, M. F., Oliva, D., and Coppa, M. M. (2001c). A microswitch for vocalization responses to foster environmental control in children with multiple disabilities. *Journal of Intellectual Disability Research, 45*, 271–275.
- Lancioni, G. E., O'Reilly, M. F., Oliva, D., and Coppa, M. M. (2001d). Using multiple microswitches to promote different responses in children with multiple disabilities. *Research in Developmental Disabilities, 22*, 309–318.
- Lancioni, G. E., O'Reilly, M. F., Oliva, D., Singh, N. N., and Coppa, M. M. (2002a). Multiple microswitches for multiple responses with children with profound disabilities. *Cognitive Behaviour Therapy, 31*, 81–87.
- Lancioni, G. E., O'Reilly, M. F., Sigafoos, J., Singh, N. N., Oliva, D., and Basili, G. (2004a). Enabling a person with multiple disabilities and minimal motor behaviour to control environmental stimulation with chin movements. *Disability and Rehabilitation, 26*, 1291–1294.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Buonocunto, F., Sacco, V., Colonna, F., Navarro, J., Lanzilotti, C., and Megna, G. (2010b). Post-coma persons with minimal consciousness and motor disabilities learn to use assistive communication technology to seek environmental stimulation. *Journal of Developmental and Physical Disabilities, 22*, 119–129.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Buonocunto, F., Sacco, V., Colonna, F., Navarro, J., Lanzilotti, C., Olivetti Belardinelli, M., Bosco, A., Megna, G., and De Tommaso, M. (2009a). Evaluation of technology-assisted learning setups for undertaking assessment and providing intervention to persons with a diagnosis of vegetative state. *Developmental Neurorehabilitation, 12*, 411–420.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Buonocunto, F., Sacco, V., Colonna, F., Navarro, J., Oliva, D., Megna, G., and Bosco, A. (2009b). Technology-based intervention options for post-coma persons with minimally conscious state and pervasive motor disabilities. *Developmental Neurorehabilitation, 12*, 24–31.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Groeneweg, J., Bosco, A., Tota, A., Smaldone, A., Stasolla, F., Manfredi, F., Baccani, S., and Pidala, S. (2006a). A social validation assessment of micro-switch-based programs for persons with multiple disabilities employing teacher trainees and parents as raters. *Journal of Developmental and Physical Disabilities, 18*, 383–391.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Oliva, D., Baccani, S., Severini, L., and Groeneweg, J. (2006b). Micro-switch programmes for students with multiple disabilities and minimal motor behaviour: Assessing response acquisition and choice. *Pediatric Rehabilitation, 9*, 137–143.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Oliva, D., Coppa, M. M., and Montironi, G. (2005a). A new microswitch to enable a boy with minimal motor behavior to control environmental stimulation with eye blinks. *Behavioral Interventions, 20*, 147–153.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Oliva, D., Piazzolla, G., Pirani, P., and Groeneweg, J. (2002b). Evaluating the use of multiple microswitches and responses for children with multiple disabilities. *Journal of Intellectual Disability Research, 46*, 346–351.

- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Didden, R., Oliva, D., Campodonico, F., de Pace, C., Chiapparino, C., and Groeneweg, J. (2009c). Persons with multiple disabilities accessing stimulation and requesting social contact via microswitch and VOCA devices: New research evaluation and social validation. *Research in Developmental Disabilities, 30*, 1084–1094.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Didden, R., Oliva, D., and Montironi, G. (2007b). Persons with multiple disabilities and minimal motor behavior using small forehead movements and new microswitch technology to control environmental stimuli. *Perceptual and Motor Skills, 104*, 870–878.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Didden, R., Oliva, D., Montironi, G., and La Martire, M. L. (2007c). Small hand-closure movements used as a response through microswitch technology by persons with multiple disabilities and minimal motor behavior. *Perceptual and Motor Skills, 104*, 1027–1034.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Oliva, D., Antonucci, M., Tota, A., and Basili, G. (2008b). Microswitch-based programs for persons with multiple disabilities: An overview of some recent developments. *Perceptual and Motor Skills, 106*, 355–370.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Oliva, D., Baccani, S., Bosco, A., and Stasolla, F. (2004b). Technological aids to promote basic developmental achievements by children with multiple disabilities: Evaluation of two cases. *Cognitive Processing, 5*, 232–238.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Oliva, D., and Severini, L. (2008c). Enabling two persons with multiple disabilities to access environmental stimuli and ask for social contact through microswitches and a VOCA. *Research in Developmental Disabilities, 29*, 21–28.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Oliva, D., and Severini, L. (2008d). Three persons with multiple disabilities accessing environmental stimuli and asking for social contact through microswitch and VOCA technology. *Journal of Intellectual Disability Research, 52*, 327–336.
- Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Sigafoos, J., Tota, A., Antonucci, M., and Oliva, D. (2006c). Children with multiple disabilities and minimal motor behavior using chin movements to operate microswitches to obtain environmental stimulation. *Research in Developmental Disabilities, 27*, 290–298.
- Lancioni, G. E., Saponaro, F., Singh, N. N., O'Reilly, M. F., Sigafoos, J., and Oliva, D. (2010c). A microswitch to enable a woman with acquired brain injury and profound multiple disabilities to access environmental stimulation with lip movements. *Perceptual and Motor Skills, 110*, 488–492.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., La Martire, M. L., Stasolla, F., Smaldone, A., and Oliva, D. (2006d). Microswitch-based programs as therapeutic recreation interventions for students with profound multiple disabilities. *American Journal of Recreation Therapy, 5*, 15–20.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., and Oliva, D. (2004c). A microswitch program including words and choice opportunities for students with multiple disabilities. *Perceptual and Motor Skills, 98*, 214–222.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., and Oliva, D. (2005b). Microswitch programs for persons with multiple disabilities: An overview of the responses adopted for microswitch activation. *Cognitive Processing, 6*, 177–188.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Oliva, D., and Montironi, G. (2004d). A computer system serving as a microswitch for vocal utterances of persons with multiple disabilities: Two case evaluations. *Journal of Visual Impairment and Blindness, 98*, 116–120.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Oliva, D., Montironi, G., and Chierchie, S. (2004e). Assessing a new response-microswitch combination with a boy with minimal motor behavior. *Perceptual and Motor Skills, 98*, 459–462.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Oliva, D., Montironi, G., Piazza, F., Ciavattini, F., and Bettarelli, F. (2004f). Using computer systems as microswitches for vocal utterances of persons with multiple disabilities. *Research in Developmental Disabilities, 25*, 183–192.

- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Oliva, D., Smaldone, A., Tota, A., Martielli, G., Stasolla, F., Pontiggia, G., and Groeneweg, J. (2006e). Assessing the effects of stimulation versus microswitch-based programmes on indices of happiness of students with multiple disabilities. *Journal of Intellectual Disability Research*, 50, 739–747.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., and Sigafoos, J. (2009d). An overview of behavioral strategies for reducing hand-related stereotypes of persons with severe to profound intellectual and multiple disabilities. *Research in Developmental Disabilities*, 30, 20–43.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Buonocunto, F., Sacco, V., Colonna, F., Navarro, J., Megna, G., Chiapparino, C., and De Pace, C. (2009e). Two persons with severe post-coma motor impairment and minimally conscious state use assistive technology to access stimulus events and social contact. *Disability and Rehabilitation: Assistive Technology*, 4, 367–372.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Buonocunto, F., Sacco, V., Colonna, F., Navarro, J., Oliva, D., Signorino, M., and Megna, G. (2009f). Microswitch- and VOCA-assisted programs for two post-coma persons with minimally conscious state and pervasive motor disabilities. *Research in Developmental Disabilities*, 30, 1459–1467.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Didden, R., Oliva, D., Severini, L., Smaldone, A., Tota, A., and Lamartire, M. L. (2007d). Effects of microswitch-based programs on indices of happiness of students with multiple disabilities: A new research evaluation. *American Journal on Mental Retardation*, 112, 167–176.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Didden, R., Smaldone, A., and La Martire, M. L. (2010d). Helping a man with multiple disabilities to use single vs repeated performance of simple motor schemes as different responses. *Perceptual and Motor Skills*, 110, 105–113.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Oliva, D., Costantini, A., Gatto, S., Marinelli, V., and Putzolu, A. (2006f). An optic microswitch for an eyelid response to foster environmental control in children with minimal motor behaviour. *Pediatric Rehabilitation*, 9, 53–56.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Oliva, D., Gatti, M., Manfredi, F., Megna, G., La Martire, M. L., Tota, A., Smaldone, A., and Groeneweg, J. (2008e). A microswitch-cluster program to foster adaptive responses and head control in students with multiple disabilities: Replication and validation assessment. *Research in Developmental Disabilities*, 29, 373–384.
- Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Oliva, D., Severini, L., Smaldone, A., and Tamma, M. (2007e). Microswitch technology to promote adaptive responses and reduce mouthing in two children with multiple disabilities. *Journal of Visual Impairment and Blindness*, 101, 628–636.
- Leatherby, J. K., Gast, D. L., Wolery, M., and Collins, B. C. (1992). Assessment of reinforcer preference in multi-handicapped students. *Journal of Developmental and Physical Disabilities*, 4, 15–36.
- Leung, B., and Chau, T. (2010). A multiple camera tongue switch for a child with severe spastic quadriplegic cerebral palsy. *Disability and Rehabilitation: Assistive Technology*, 5, 58–68.
- Leyshon, R. T., and Shaw, L. E. (2008). Using the ICF as a conceptual framework to guide ergonomic intervention in occupational rehabilitation. *Work: Journal of Prevention, Assessment and Rehabilitation*, 31, 47–61.
- Matson, J. L., Minshawi, N. F., Gonzalez, M. L., and Mayville, S. B. (2006). The relationship of comorbid problem behaviors to social skills in persons with profound mental retardation. *Behavior Modification*, 30, 496–506.
- McDougall, J., Evans, J., and Baldwin, P. (2010). The importance of self-determination to perceived quality of life for youth and young adults with chronic conditions and disabilities. *Remedial and Special Education*, 31, 252–260.
- Mechling, L. C. (2006). Comparison of the effects of three approaches on the frequency of stimulus activation, via a single switch, by students with profound intellectual disabilities. *The Journal of Special Education*, 40, 94–102.
- Petry, K., Maes, B., and Vlaskamp, C. (2005). Domains of quality of life of people with profound multiple disabilities: The perspective of parents and direct support staff. *Journal of Applied Research in Intellectual Disabilities*, 18, 35–46.

- Petry, K., Maes, B., and Vlaskamp, C. (2009). Measuring the quality of life of people with profound multiple disabilities using the QOL-PMD: First results. *Research in Developmental Disabilities, 30*, 1394–1405.
- Richman, D. M. (2008). Early intervention and prevention of self-injurious behaviour exhibited by young children with developmental disabilities. *Journal of Intellectual Disability Research, 52*, 3–17
- Ringdahl, J. E., Vollmer, T. R., Marcus, B. E., and Roane, H. S. (1997). An analogue evaluation of environmental enrichment: The role of stimulus preference. *Journal of Applied Behavior Analysis, 30*, 203–216.
- Rispoli, M. J., Franco, J. H., van der Meer, L., Lang, R., and Camargo, S. P. H. (2010). The use of speech generating devices in communication interventions for individuals with developmental disabilities: A review of the literature. *Developmental Neurorehabilitation, 13*, 276–293.
- Ross, E., and Oliver, C. (2003). The assessment of mood in adults who have severe or profound mental retardation. *Clinical Psychology Review, 23*, 225–245.
- Saunders, M. D., Timler, G. R., Cullinan, T. B., Pilkey, S., Questad, K. A., and Saunders, R. R. (2003). Evidence of contingency awareness in people with profound multiple impairments: Response duration versus response rate indicators. *Research in Developmental Disabilities, 24*, 231–245.
- Schalock, R., Brown, I., Brown, R., Cummins, R. A., Felce, D., Matikka, L., Keith, K. D., and Parmenter, T. (2003). Conceptualization, measurement, and application of quality of life for persons with intellectual disabilities: Reports of an international panel of experts. *Mental Retardation, 40*, 457–470.
- Schlosser, R. W., and Sigafoos, J. (2006). Augmentative and alternative communication interventions for persons with developmental disabilities: Narrative review of comparative single-subject experimental studies. *Research in Developmental Disabilities, 27*, 1–29.
- Shih, C.-H., Chang, M.-L., and Shih, C.-T. (2010). A new limb movement detector enabling people with multiple disabilities to control environmental stimulation through limb swing with a gyration air mouse. *Research in Developmental Disabilities, 31*, 875–880.
- Sigafoos, J., Green, V. A., Payne, D., Son, S. H., O'Reilly, M. F., and Lancioni, G. E. (2009). A comparison of picture exchange and speech-generating devices: Acquisition, preference, and effects on social interaction. *Augmentative and Alternative Communication, 25*, 99–109.
- Stafford, A. M., Alberto, P. M., Fredrick, L. D., Heflin, L. J., and Heller, K. W. (2002). Preference variability and the instruction of choice making with students with severe intellectual disabilities. *Education and Training in Mental Retardation and Developmental Disabilities, 37*, 70–88.
- Sullivan, M. W., Laverick, D. H., and Lewis, M. (1995). Fostering environmental control in a young child with Rett syndrome: A case study. *Journal of Autism and Developmental Disorders, 25*, 215–221.
- Sullivan, M. W., and Lewis, M. (1993). Contingency, means-end skills and the use of technology in infant intervention. *Infants and Young Children, 5*, 58–77.
- Szymanski, L. S. (2000). Happiness as a treatment goal. *American Journal on Mental Retardation, 105*, 352–362.
- Valiquette, C., Sutton, A., and Ska, B. (2010). A graphic symbol tool for the evaluation of communication, satisfaction and priorities of individuals with intellectual disability who use a speech generating device. *Child Language Teaching and Therapy, 26*, 303–319.
- Wehmeyer, M. L., and Schwartz, M. (1998). The relationship between self-determination, quality of life, and life satisfaction for adults with mental retardation. *Education and Training in Mental Retardation and Developmental Disabilities, 33*, 3–12.
- Zekovic, B., and Renwick, R. (2003). Quality of life for children and adolescents with developmental disabilities: Review of conceptual and methodological issues relevant to public policy. *Disability and Society, 18*, 19–34.

19

Methods and Technologies for Leisure, Recreation, and an Accessible Sport

C. M. Capio, G. Mascolo, and C. H. P. Sit

CONTENTS

19.1 Introduction.....	421
19.1.1 Self-Efficacy Theory.....	421
19.1.2 Facilitating Psychological Recovery through Sport.....	422
19.2 Adapted Physical Activity: When Physical Activity Is for Everyone.....	422
19.2.1 Adapted Physical Activity.....	423
19.2.2 Types of APA Programs.....	423
19.3 Sport and Disability.....	425
19.3.1 Historical Perspective.....	426
19.3.2 Classification Systems within Paralympic Sports.....	427
19.3.3 Sports Participation among Persons With Disabilities.....	428
19.4 Sport and Disability Techniques and Technologies for a “Sport for All”.....	429
19.4.1 Power Wheelchair Sports.....	429
19.4.2 Prosthetic Technology.....	430
19.4.3 Technology for Developing Countries.....	431
19.5 Conclusions.....	432
Summary of the Chapter.....	432
References.....	432

19.1 Introduction

19.1.1 Self-Efficacy Theory

A well-established area of sport psychology has built research on the role of self-efficacy in successful sports participation. Initially proposed by Bandura (1997), self-efficacy refers to the belief that an individual has in his or her ability to execute a task to generate a specific outcome. This belief of having some amount of control over one's own functioning has been described to have a pervasive influence in an individual's task performance. Studies of the self-efficacy construct in sport have included physical proficiency and different aspects of game performance such as strategy selection, prediction of opponent's actions, and pressure management (Short and Ross-Stewart 2009).

Self-efficacy beliefs have been theorized to be products of an individual's cognitive processing of diverse sources of efficacy information (Feltz et al. 2008). The four principal sources of efficacy information as proposed by Bandura (1997) are (1) past performance accomplishments, (2) vicarious experiences, (3) verbal persuasion, and (4) psychological and emotional states. Among individuals with disabilities, efficacy information may be

essential strategy in wheelchair design in developing countries because it not only keeps the costs low, but it also ensures that the chair will be locally maintained (Pfaelzer and Krizack 2000). The corresponding local labor cost was also much lower relative to developed countries, and the combination with local materials resulted in a wheelchair design that cost less than 20% of similar equipment in the United States. It has been advocated that the cost of technology should not be a hindrance for individuals with disability to take part in sports and physical activity (Sport and Development 2011). Essentially, projects such as this one need to be pursued to enhance the participation of individuals with disabilities from less developed nations, leading toward the ideal of “sport for all.”

19.5 Conclusions

Sport represents one form of physical activity, and among individuals with disabilities, this has been facilitated by adaptation strategies. Disability sport continues to grow in terms of both participation and competition. Such positive change appears to be dynamic, as methods, strategies, and technologies continue to evolve from research findings.

Summary of the Chapter

This chapter initiated the discussion on methods and technologies that facilitate accessible sport through self-efficacy theories that provide the motivation for enabling sports participation for all. The proposition that adapted physical activity (APA) programs sets up the stage for making PA participation possible for everyone was developed. Diverse forms of APA have been documented to have beneficial effects among individuals with disabilities, and sports activities appear to be an important form of PA. The wide extent of sports participation among individuals with disabilities is evident in the Special Olympics and Paralympics.

Such prestigious status of sports for individuals with disabilities has generated a corresponding body of research that has started to move towards evidence-based practice. The inherent competitive nature of sports has also been evident, consequently resulting in the use of technology to address evolving demands of athletes with disabilities. While it appears that PA is indeed for everyone, and is achieved through sports as supported by technology, further research is desired to enhance different parameters of the current status.

References

- American Academy of Pediatrics. (2001). Health supervision for children with down syndrome. *Pediatrics*, 107(2), 442–449.
- Authier, E. L., Pearlman, J., Allegretti, A. L., Rice, I., and Cooper, R. A. (2007). A sports wheelchair for low-income countries. *Disability Rehabilitation*, 29(11–12), 963–967.

- Balzini, L., Vannucchi, L., Benvenuti, F., Benucci, M., Monni, M., Cappozzo, A., et al. (2003). Clinical characteristics of flexed posture in elderly women. *Journal of the American Geriatrics Society*, 51(10), 1419–1426.
- Bandini, L. G., Curtin, C., Hamad, C., Tybor, D. J., and Must, A. (2005). Prevalence of overweight in children with developmental disorders in the continuous national health and nutrition examination survey (NHANES) 1999–2002. *Journal of Pediatrics*, 146(6), 738–743.
- Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman.
- Barfield, J. P., Malone, L. A., Collins, J. M., and Ruble, S. B. (2005). Disability type influences heart rate response during power wheelchair sport. *Medicine and Science in Sports and Exercise*, 37(5), 718–723.
- Beckman, E. M., and Tweedy, S. M. (2009). Towards evidence-based classification in Paralympic athletics: Evaluating the validity of activity limitation tests for use in classification of Paralympic running events. *British Journal of Sports Medicine*, 43(13), 1067–1072.
- Benedetti, M. G., Berti, L., Presti, C., Frizziero, A., and Giannini, S. (2008). Effects of an adapted physical activity program in a group of elderly subjects with flexed posture: Clinical and instrumental assessment. *Journal of Neuroengineering and Rehabilitation*, 5, 32.
- Bjornson, K. F., Belza, B., Kartin, D., Logsdon, R., McLaughlin, J., and Thompson, E. A. (2008). The relationship of physical activity to health status and quality of life in cerebral palsy. *Pediatric Physical Therapy*, 20(3), 247–253.
- Bouchard, C., and Shephard, R. (1994). Physical activity, fitness and health: The model and key concepts. In C. Bouchard, R. Shephard and T. Stephens (Eds.), *Physical Activity, Fitness and Health. International Proceedings and Consensus Statement* (pp. 77–88). Champaign, IL: Human Kinetics.
- Brodtkorb, T. H., Henriksson, M., Johannesen-Munk, K., and Thidell, F. (2008). Cost-effectiveness of C-leg compared with non-microprocessor-controlled knees: A modeling approach. *Archives of Physical Medicine and Rehabilitation*, 89(1), 24–30.
- Brown, M. B., Millard-Stafford, M. L., and Allison, A. R. (2009). Running-specific prostheses permit energy cost similar to nonamputees. *Medicine and Science in Sports and Exercise*, 41(5), 1080–1087.
- Bull, F. C., Armstrong, T., Dixon, T., Ham, S., Neiman, A., and Pratt, M. (2004). Physical inactivity. In M. Ezzati, A. Lopez, A. Rodgers and C. J. L. Murray (Eds.), *Comparative Quantification of Health Risks: Global and Regional Burden of Disease Attributable to Selected Major Risk Factors* (Vol. 1, pp. 729–882). Geneva, Switzerland: WHO.
- Burkett, B. (2010). Technology in Paralympic sport: Performance enhancement or essential for performance? *British Journal of Sports Medicine*, 44(3), 215–220.
- Burkett, B., Smeathers, J., and Barker, T. (2003). Walking and running inter-limb asymmetry for Paralympic trans-femoral amputees, a biomechanical analysis. *Prosthetics and Orthotics International*, 27(1), 36–47.
- Camporesi, S. (2008). Oscar Pistorius, enhancement and post-humans. *Journal of Medical Ethics*, 34(9), 639.
- Capio, C. M., Sit, C. H., and Abernethy, B. (2010). Physical activity measurement using MTI (actigraph) among children with cerebral palsy. *Archives of Physical Medicine and Rehabilitation*, 91(8), 1283–1290.
- Carless, D., and Sparkes, A. C. (2008). The physical activity experiences of men with serious mental illness: Three short stories. *Psychology of Sport and Exercise*, 9(2), 191–210.
- Cavill, N., Kahlmeier, S., and Racioppi, F. (2006). Physical activity and health in Europe: Evidence for action. Geneva, Switzerland: WHO.
- Coutts, K. D., Rhodes, E. C., and McKenzie, D. C. (1983). Maximal exercise responses of tetraplegics and paraplegics. *Journal of Applied Physiology*, 55(2), 479–482.
- CPISRA. (2009). *About Boccia*. Retrieved from <http://www.cpisra.org/index.php?id=80>
- Daniel, F., Vale, R., Giani, T., Bacellar, S., and Dantas, E. (2010). Effects of a physical activity program on static balance and functional autonomy in elderly women. *Macedonian Journal of Medical Science*, 3(1), 21–26.

- Driver, S., and Ede, A. (2009). Impact of physical activity on mood after TBI. *Brain Injury*, 23(3), 203–212.
- Dunn, A., and Blair, S. (2002). Translating evidenced-based physical activity interventions into practice: The 2010 challenge. *American Journal of Preventive Medicine*, 22(4S), 8–9.
- Dykens, E. M., and Cohen, D. J. (1996). Effects of Special Olympics International on social competence in persons with mental retardation. *Journal of the American Academy of Child and Adolescent Psychiatry*, 35(2), 223–229.
- Dykens, E. M., Rosner, B. A., and Butterbaugh, G. (1998). Exercise and sports in children and adolescents with developmental disabilities—Positive physical and psychosocial effects. *Child and Adolescent Psychiatric Clinics of North America*, 7(4), 757–771, viii.
- Edwards, S. D. (2008). Should Oscar Pistorius be excluded from the 2008 Olympic games? *Sport Ethics and Philosophy*, 2(2), 112–125.
- Ekelund, U., Brage, S., and Wareham, N. J. (2004). Physical activity in young children. *Lancet*, 363(9415), 1163; author reply 1163–1164.
- Farrell, R. J., Crocker, P. R. E., McDonough, M. H., and Sedgwick, W. A. (2004). The driving force: Motivation in special Olympians. *Adapted Physical Activity Quarterly*, 21(2), 153–166.
- Faupin, A., Campillo, P., Weissland, T., Gorce, P., and Thevenon, A. (2004). The effects of rear-wheel camber on the mechanical parameters produced during the wheelchair sprinting of handbasketball athletes. *Journal of Rehabilitation Research and Development*, 41(3B), 421–428.
- Feltz, D. L., Short, S., and Sullivan, P. J. (2008). *Self-Efficacy in Sport*. Champaign, IL: Human Kinetics.
- Fernhall, B., and Unnithan, V. B. (2002). Physical activity, metabolic issues, and assessment. *Physical Medicine and Rehabilitation Clinics of North America*, 13(4), 925–947.
- Foley, J. T., Bryan, R. R., and McCubbin, J. A. (2008). Daily physical activity levels of elementary school-aged children with and without mental retardation. *Journal of Developmental and Physical Disabilities*, 20(4), 365–378.
- Fox, K. R. (2000). Self-esteem, self-perceptions and exercise. *International Journal of Sport Psychology*, 31(2), 228–240.
- Freudenberg, P., and Arlinghaus, R. (2010). Benefits and constraints of outdoor recreation for people with physical disabilities: Inferences from recreational fishing. *Leisure Science*, 32(1), 55–71.
- Fukuchi, K. (2007). *My Hope for an Inclusive Society*. Paper presented at the Sport in the United Nations Convention on the Rights of Persons with Disabilities.
- Giacobbi, P. R., Stancil, M., Hardin, B., and Bryant, L. (2008). Physical activity and quality of life experienced by highly active individuals with physical disabilities. *Adapted Physical Activity Quarterly*, 25(3), 189–207.
- Gold, J. R., and Gold, M. M. (2007). Access for all: The rise of the Paralympic Games. *Perspectives in Public Health*, 127(3), 133–141.
- Goosey, V. L., Campbell, I. G., and Fowler, N. E. (2000). Effect of push frequency on the economy of wheelchair racers. *Medicine and Science in Sports and Exercise*, 32(1), 174–181.
- Groff, D. G., Lundberg, N. R., and Zabriskie, R. B. (2009). Influence of adapted sport on quality of life: Perceptions of athletes with cerebral palsy. *Disability and Rehabilitation*, 31(4), 318–326.
- Guttman, L. (1976). *Textbook of Sport for the Disabled*. Aylesbury, UK: HM & M Publishers Ltd.
- Haisma, J. A., van der Woude, L. H., Stam, H. J., Bergen, M. P., Sluis, T. A., & Bussmann, J. B. (2006). Physical capacity in wheelchair-dependent persons with a spinal cord injury: A critical review of the literature. *Spinal Cord*, 44(11), 642–652.
- Higgs, C. (1983). An analysis of racing wheelchairs used at the 1980 Olympic games for the disabled. *Research Quarterly for Exercise and Sport*, 54(3), 229–233.
- Horvat, M., Croce, R., and Roswal, G. (1993). Magnitude and reliability of measurements of muscle strength across trials for individuals with mental retardation. *Perceptual and Motor Skills*, 77(2), 643–649.
- Huang, J. S., Sallis, J., and Patrick, K. (2009). The role of primary care in promoting children's physical activity. *British Journal of Sports Medicine*, 43(1), 19–21.
- Hutzler, Y., and Sherrill, C. (2007). Defining adapted physical activity: International perspectives. *Adaptive Physical Activity Quarterly*, 24(1), 1–20.

- IBC. (2007). Boccia. Retrieved from <http://www.bocciainternational.com/boccia.html>
- IBSA. (2011). Torball. Retrieved from <http://www.ibsa.es/eng/deportes/torball/presentacion.htm>
- IWASF. (2011). International Stoke Mandeville Wheelchair Sports Federation (ISMWSF) History. Retrieved from <http://www.iwasf.com/iwasf/index.cfm/about-iwas/history/ismwsf-history/>
- Jacob, T., and Hutzler, Y. (1998). Sports-medical assessment for athletes with a disability. *Disability and Rehabilitation*, 20(3), 116–119.
- Jones, C., and Wilson, C. (2009). Defining advantage and athletic performance: The case of Oscar Pistorius. *European Journal of Sport Science*, 9(2), 125–131.
- Kelly, N., and Lindley, B. (1994). Health volunteers overseas: Bringing rehabilitation to the world. *ARN News* 6–7.
- Kim, J., and Mulholland, S. J. (1999). Seating/wheelchair technology in the developing world: Need for a closer look. *Technology & Disability*, 11, 21–27.
- Klein, T., Gilman, E., and Zigler, E. (1993). Special Olympics—An evaluation by professionals and parents. *Mental Retardation*, 31(1), 15–23.
- Klenck, C., and Gebke, K. (2007). Practical management: Common medical problems in disabled athletes. *Clinical Journal of Sports Medicine*, 17(1), 55–60.
- Krizack, M. (2007, August 10). The importance of user choice for cost-effective wheelchair provision in low income countries. *Whirlwind Wheelchair International Newsletter*.
- Kudlacek, M., Jesina, O., and Flannagan, P. (2010). European inclusive physical education training. *Advanced Rehabilitation*, 3, 14–17.
- Kudlacek, M., Valkova, H., Sherrill, C., Myers, B., and French, R. (2002). An inclusion instrument based on planned behaviour: Theory for prospective Czech physical educators. *Adaptive Physical Activity Quarterly* 19, 280–299.
- Law, M., King, G., King, S., Kertoy, M., Hurley, P., Rosenbaum, P., et al. (2006). Patterns of participation in recreational and leisure activities among children with complex physical disabilities. *Developmental Medicine and Child Neurology*, 48(5), 337–342.
- Lippi, G., and Mattiuzzi, C. (2008). Pistorius ineligible for the Olympic Games: The right decision. *British Journal of Sports Medicine*, 42(3), 160–161.
- Loy, D. P., Dattilo, J., and Kleiber, D. A. (2003). Exploring the influence of leisure on adjustment: Development of the leisure and spinal cord injury adjustment model. *Leisure Science*, 25(2–3), 231–255.
- Mackey, A. H., Hewart, P., Walt, S. E., and Stott, N. S. (2009). The sensitivity and specificity of an activity monitor in detecting functional activities in young people with cerebral palsy. *Archives of Physical Medicine and Rehabilitation*, 90(8), 1396–1401.
- Manfredo, M. J., and Driver, B. L. (1996). Measuring leisure motivation: A meta-analysis of the Recreation Experience Preference Scales. *Journal Leisure Research*, 28(3), 188.
- Martens, R. (1996). Turning kids on to physical activity for a lifetime. *Quest*, 48, 303–310.
- McAvoy, L., Holman, T., Goldenberg, M., and Klenosky, D. (2006). Wilderness and persons with disabilities. *International Journal of Wilderness*, 12, 23–31, 35.
- McCann, C. (1984). Classification of the locomotor disabled for competitive sports: Theory and practice. *International Journal of Sports Medicine*, 5(Suppl), 167–170.
- McCann, C. (1996). Sports for the disabled: The evolution from rehabilitation to competitive sport. *British Journal of Sports Medicine*, 30(4), 279–280.
- Meegan, S., and MacPhail, A. (2006). Irish physical educators' attitude toward teaching students with special educational needs. *European Physical Education Review*, 12(1), 75–97.
- Metcalf, B., Voss, L., Jeffery, A., Perkins, J., and Wilkin, T. (2004). Physical activity cost of the school run: Impact on schoolchildren of being driven to school (EarlyBird 22). *British Medical Journal*, 329(7470), 832–833.
- Moritz, S. E., Feltz, D. L., Fahrback, K. R., and Mack, D. E. (2000). The relation of self-efficacy measures to sport performance: A meta-analytic review. *Research Quarterly for Exercise and Sport*, 71(3), 280–294.

- Murphy, N. A., and Carbone, P. S. (2008). Promoting the participation of children with disabilities in sports, recreation, and physical activities. *Pediatrics*, 121(5), 1057–1061.
- Murphy, N. A., Christian, B., Caplin, D. A., and Young, P. C. (2007). The health of caregivers for children with disabilities: Caregiver perspectives. *Child Care Health Development*, 33(2), 180–187.
- Nasuti, G., and Temple, V. A. (2010). The risks and benefits of snow sports for people with disabilities: A review of the literature. *International Journal of Rehabilitation Research*, 33(3), 193–198.
- Nolan, L., and Lees, A. (2007). The influence of lower limb amputation level on the approach in the amputee long jump. *Journal of Sports Science*, 25(4), 393–401.
- Parnes, P., and Hashemi, G. (2007). Sport as a means to foster inclusion, health and well-being of people with disabilities Report for the Sport for Development and Peace International Working Group (SDP IWG) Secretariat (pp. 124–157).
- Pasquina, P. F., Bryant, P. R., Huang, M. E., Roberts, T. L., Nelson, V. S., and Flood, K. M. (2006). Advances in amputee care. *Archives of Physical Medicine and Rehabilitation*, 87(3 Suppl 1), S34–S43; quiz S44–S35
- Patel, D. R., and Greydanus, D. E. (2002). The pediatric athlete with disabilities. *Pediatric Clinics of North America*, 49(4), 803–827.
- Pedersen, B. K., and Saltin, B. (2006). Evidence for prescribing exercise as therapy in chronic disease. *Scandinavian Journal of Medicine and Science of Sports*, 16, 3–63.
- Pensgaard, A. M., and Sorensen, M. (2002). Empowerment through the sport context: A model to guide research for individuals with disability. *Adaptive Physical Activity Quarterly*, 19(1), 48–67.
- Pfaelzer, P., and Krizack, M. (2000, June 1). Wheelchair riders in control: WWI's model of technology transfer. *Whirlwind Wheelchair International Newsletter*.
- Rabin, B. A., Brownson, R. C., Kerner, J. F., and Glasgow, R. E. (2006). Methodologic challenges in disseminating evidence-based interventions to promote physical activity. *American Journal of Preventive Medicine*, 31(4 Suppl), S24–S34.
- Richardson, C. R., Faulkner, G., McDevitt, J., Skrinar, G. S., Hutchinson, D. S., and Piette, J. D. (2005). Integrating physical activity into mental health services for persons with serious mental illness. *Psychiatric Services*, 56(3), 324–331.
- Richter, K. J., Sherrill, C., McCann, C., Mushett, C. A., and Kaschak, S. M. (2005). Recreation and sport for people with disabilities. In J. A. DeLisa, B. M. Gans and N. E. Walsh (Eds.), *Physical Medicine and Rehabilitation: Principles and Practice*. Philadelphia: Lippincott Williams & Wilkins.
- Sallis, J. F., and Patrick, K. (1994). Physical activity guidelines for adolescents: Consensus statement. *Pediatric Exercise Science*, 60, 302–314.
- Schell, L. A., Schell, L. A. B., and Duncan, M. C. (1999). A content analysis of CBS's coverage of the 1996 Paralympic games. *Adaptive Physical Activity Quarterly*, 16(1), 27–47.
- Sharav, T., and Bowman, T. (1992). Dietary practices, physical-activity, and body-mass index in a selected population of Down-syndrome children and their siblings. *Clinical Pediatrics*, 31(6), 341–344.
- Sherrill, C. (2004). *Adapted Physical Activity, Recreation, and Sport: Cross-Disciplinary and Lifespan* (6th ed.). New York: McGraw-Hill.
- Short, S., and Ross-Stewart, L. (2009). A review of self-efficacy based interventions. In S. D. Mellalieu and S. Hanton (Eds.), *Advances in Applied Sport Psychology: A Review*. London: Routledge.
- Sinaki, M., Brey, R. H., Hughes, C. A., Larson, D. R., and Kaufman, K. R. (2005). Significant reduction in risk of falls and back pain in osteoporotic-kyphotic women through a Spinal Proprioceptive Extension Exercise Dynamic (SPEED) program. *Mayo Clinic Proceedings*, 80(7), 849–855.
- Sit, C. H. P., Lau, C. H. L., and Vertinsky, P. (2009). Physical activity and self-perceptions among Hong Kong Chinese with an acquired physical disability. *Adaptive Physical Activity Quarterly*, 26(4), 321–335.
- Special Olympics. (2010). Healthy Athletes. Retrieved from http://www.specialolympics.org/healthy_athletes.aspx
- Special Olympics. (2011a). General Rules. Retrieved from http://www.specialolympics.org/general_rules.aspx

- Special Olympics. (2011b). Sports Offered. Retrieved from <http://www.athens2011.org/en/sports.asp>
- Speyer, E., Herbinet, A., Vuillemin, A., Briancon, S., and Chastagner, P. (2010). Effect of adapted physical activity sessions in the hospital on health-related quality of life for children with cancer: A cross-over randomized trial. *Pediatric Blood Cancer*, 55(6), 1160–1166.
- Sport and Development. (2011). Sport and disability technical considerations: Equipment and technology Retrieved from http://www.sportanddev.org/en/learnmore/sport_and_disability2/technical_considerations__sport__disability/equipment_and_technology/
- Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., et al. (2005). Evidence based physical activity for school-age youth. *Journal of Pediatrics*, 146(6), 732–737.
- Taylor, N. F., Dodd, K. J., and Larkin, H. (2004). Adults with cerebral palsy benefit from participating in a strength training programme at a community gymnasium. *Disability & Rehabilitation*, 26(19), 1128–1134.
- Thomas, N., and Smith, A. (2003). Preoccupied with able-bodiedness? An analysis of the British media coverage of the 2000 Paralympic Games. *Adaptive Physical Activity Quarterly*, 20(2), 166–181.
- Trudel, G., Kirby, R. L., Ackroyd-Stolarz, S. A., and Kirkland, S. (1997). Effects of rear-wheel camber on wheelchair stability. *Archives of Physical Medicine and Rehabilitation*, 78(1), 78–81.
- Tweedy, S. M. (2003). Biomechanical consequences of impairment: A taxonomically valid basis for classification in a unified disability athletics system. *Research Quarterly for Exercise and Sport*, 74(1), 9–16.
- Tweedy, S. M., and Vanlandewijck, Y. C. (2010). International Paralympic Committee position stand—Background and scientific principles of classification in Paralympic sport. *British Journal of Sports Medicine*, 45(4), 259–269.
- Vanderstraeten, G. G., and Oomen, A. G. M. (2010). Sports for disabled people: A general outlook. *International Journal of Rehabilitation Research*, 33(4), 283–284.
- van der Woude, L. H. V., de Groot, S., and Janssen, T. W. (2006). Manual wheelchairs: Research and innovation in rehabilitation, sports, daily life and health. *Medical Engineering and Physics*, 28(9), 905–915.
- Vanlandewijck, Y. (2006). Sport science in the Paralympic movement. *Journal of Rehabilitation Research and Development*, 43(7), xvii–xxiv.
- Vanlandewijck, Y., Theisen, D., and Daly, D. (2001). Wheelchair propulsion biomechanics—Implications for wheelchair sports. *Sports Medicine*, 31(5), 339–367.
- Vanlandewijck, Y., Verellen, J., and Tweedy, S. (2010). Towards evidence-based classification – the impact of impaired trunk strength on wheelchair propulsion. *Advances in Rehabilitation*, 3(1), 1–5.
- Veeger, H. E. J., van der Woude, L. H. V., and Rozendal, R. H. (1989). Wheelchair propulsion technique at different speeds. *Scandinavian Journal of Rehabilitative Medicine*, 21(4), 197–203.
- Wang, Y., and Lobstein, T. (2006). Worldwide trends in childhood overweight and obesity. *International Journal of Pediatric Obesity*, 1(1), 11–25.
- Warms, C. A., Belza, B. L., and Whitney, J. D. (2007). Correlates of physical activity in adults with mobility limitations. *Family and Community Health*, 30(2 Suppl), S5–16.
- Wheelchair Foundation. (2011). Retrieved from <http://www.wheelchairfoundation.org/about/faq>
- Wind, W. M., Schwend, R. M., and Larson, J. (2004). Sports for the physically challenged child. *Journal of the American Academy of Orthopedic Surgeons*, 12(2), 126–137.
- Winnick, J. P. (2005). An introduction to adapted physical education and sport. In J. P. Winnick (Ed.), *Adapted Physical Education and Sport* (4th ed., pp. 3–20). Champaign, IL: Human Kinetics.
- World Health Organization (WHO). (2010). *Global Recommendations on Physical Activity for Health*. Geneva, Switzerland: World Health Organization.
- Wrotniak, B. H., Epstein, L. H., Dorn, J. M., Jones, K. E., and Kondilis, V. A. (2006). The relationship between motor proficiency and physical activity in children. *Pediatrics*, 118(6), e1758–1765.

Index

A

Accessibility

definitions, 332–333, 340, 341, 343
usability and, 340–341

Accessibility, sustainability, and universal design (UD), 68

continuum model of, 69–70
environmental assessment process and, 71–72, 76–79
environment assessment in ATA process based on concepts of, 71–72
interaction between, 69–71
intersection model of, 69, 70
meaning of, 68–69

Accommodation (vision), 202, 203, 215–216

Action by Design Component (ADC) framework, 368

Adapted physical activity (APA), 422–423

Adapted physical activity (APA) programs, types of, 423–425

Adaptive behavior, defined, 20

Alzheimer's disease, vocational rehabilitation for, 121–125

American Speech-Language-Hearing Association (ASHA), 301–302

conceptual framework of ASHA practice documents, 302

Ametropias, 217–218

Amyotrophic lateral sclerosis (ALS), 385–386, 390, 392

Assistance Users/Caregiver Dyad Assistive Technology Process Model, outcome measurement with vignettes based on, 93–97

Assistec graduates, fields of expertise of, 196

Assistec program, 192–193, 196

curriculum, 193–194

impact, 196–197

Assistive technology (AT)

acceptance, rejection, or abandonment of an, 280–282, *see also* Assistive technology (AT) abandonment

definition and role of, 232–233

is increasingly complex and sophisticated, x
process involved in selecting and using, 233–236

Assistive technology (AT) abandonment, 5–6; *see also under* Assistive technology

Assistive technology assessment (ATA), global perspectives and emerging themes in, ix–xiv

Assistive technology assessment (ATA) model, 2–5

Assistive technology assessment (ATA) process, 58, 60–61, 221

assessing individual functioning and disability in, 20–23

outcome of, 34–35

Assistive technology assessment (ATA) process flow chart, 22, 189

Assistive Technology Device Predisposition Assessment (ATD-PA), 36–37, 56–61, 120, 123, 157

Assistive technology devices, databases of, 329–330

Assistive technology (AT) match, measuring the, 51–58

outcome measures, 51–52

Assistive Technology Outcomes Measurement System (ATOM), 41–42

Association of Intellectual and Developmental Disabilities (AAIDD), 38–39

AT, *see* Assistive technology

ATA, *see* Assistive technology assessment

Attention deficit hyperactivity disorder (ADHD), 389

neurofeedback in, 389–390

Augmentative and alternative

communication (AAC), 136, 252, 309–310, 321–323

Ausilioteca di Roma (Centre for Technological Aid of Rome), xii–xiii

B

Bathing chair, 257

Behavioral-cognitive therapy, *see* Cognitive-behavioral therapy

Behavioral disorders and brain-computer interfaces, 389–390

Binocular vision, 214

Biopsychosocial approach, 103, 114–116

- Biopsychosocial model, 3–5, 11–12, 21, 27
 ICF, 3–5, 21, 60, 116–117, 152, 188
 interaction system according to, 183
- BlinkAndPitch model, 368
- BlinkAndPitchSonification model, 368
- Body functions, 156
- Brain activity, measuring, 381–382
- Brain-computer interaction (BCI), 363
- Brain-computer interfaces (BCIs), 391–392
 AT and, 390–391
 behavioral disorders and, 389–390
 for communication
 development of, 385–387
 potential users of, 384–385
 comparison of technologies, 384
 history, 382–383
 for motor restoration, potential users of,
 387–389
 nature of, 379–380
- C**
- Canadian Occupational Performance Measure (COPM), 38, 51–52
- Caregiver Assistive Technology Outcome Measure (CATOM), 91–92, 95
 domains, 92
 scores over time, 95
- Caregivers of assistive users, 83–87, 97–98
 conceptual framework for understanding
 outcomes experienced by, 89, 90
 conceptual framework on the impact of AT
 on users and, 87–91
 future directions regarding, 97
 measurement tools addressing AT impacts
 on, 91–97
 model for AT outcomes on user/caregiver
 dyad, 88–90
- Care-O-Bot, 280
- Case studies, AT
 process involved in selecting and using,
 236–242
- Center for technical aid, xvi–xvii, 4–5, 22, 32,
 171, 221, 350
 ATA process in, 60–61, 188–190
 flow chart of, 159
 environmental assessment process and, 73
 psychologist in, 155–157
- Cerebral palsy (CP), case studies of, 140,
 144–145, 253–259, 264, 320–322
- Chair to help child sit and use upper
 limbs, 255
- Charity/donation models, 16, 17
- Children; *see also* Pediatric specialists
 AT resources applied to daily life of,
 250–251
- Client-oriented model, *see* Service delivery
 models
- Cognitive-behavioral therapy (CBT), 108–111
- Cognitive impairments, 276
 technological devices for people with,
 278–279
- Cognitive Orthosis for Assessing aCtivities in
 the Home (COACH) system, 279
- Cognitive prostheses, 278
- Cognitive rehabilitation, 115–116
- Cognitive screening, 276
- Cognitive support technology (CST), 116–119
- Cognitive Support Technology Device
 Predisposition Assessment (CST PA), 56
- Cognitive therapists, 110–113
- Cognitive therapy (CT), 107–111
 case study, 121–125
 with individuals having cognitive disability,
 114–115
- Communication, *see* Augmentative and
 alternative communication; Brain-
 computer interfaces; Voice output
 communication aids
- Community-based rehabilitation (CBR) models,
 16, 17
- Complete locked-in syndrome (CLIS), 384, 391, 392
- Comprehensive geriatric assessment (CGA),
 274–275, 292
- Computers, *see* Brain-computer interfaces;
 Human-computer interaction
- Cone and rod cell, 204
- Context, impact of, xi
- Convention on the Rights of Persons with
 Disabilities, 14
- Convergence (vision), 203, 204
- CoRT (Cognitive Research Trust) Thinking
 Techniques, 137
- D**
- Degenerative disabilities, treating, 102
- Depression, 276–277
- Design for All, 191; *see also* Universal design
- Developmental disabilities, treating, 101–102
- Disability(ies), 1–2
 classification, declaration, and international
 definitions of, 13–16, 26
 measurement of, 25–28

- objective vs. subjective dimensions of, 29–30
 - personal factors of, 153–154
 - persons with multiple, 399–400, *see also*
 - Microswitches
 - professionals' representation of, 165–168
 - treating acquired, 102–103
 - Donation models, *see* Charity/donation models
- E**
- eAccessibility, 190–191
 - Ease of operation, 342; *see also* Accessibility; Usability
 - Education, vocational field of, 193
 - Educational setting
 - environmental factors to promote AT in classrooms, 136–138
 - outcome studies of AT in, 136
 - Education Technology Device
 - Predisposition Assessment (ET PA), 57, 121
 - Effectiveness, defined, 333
 - Efficacy, defined, 333
 - Efficiency, defined, 333
 - eInclusion, 190–191
 - Elderly people, 162
 - eLearning system, 194–195
 - Electroencephalography (EEG), 381
 - Electronic travel aids (ETAs), 352
 - categories of, 352
 - Empowering USers Through Assistive Technology (EUSTAT), 42
 - Encephalopathy, hypoxic-ischemic, 139–143, 236–239
 - Entrepreneurial models, 16, 17
 - Environment, impact of, xi
 - Environmental assessment (EA) process, 67–68, 72–75
 - case evaluation, 76–79
 - step-by-step decision making, 75–76
 - Epilepsy, 389
 - neurofeedback in, 389–390
 - Ergonomics, 182
 - eSystems, 181, 338
 - intrasystemic relation between users and, 339, 340
 - Evaluation methods/strategies, 230; *see also specific topics*
 - Evidence-based practice (EBP), 304–307, 320–321
 - four-step model for, 304, 305
 - Eye, structure of, 203
 - Eye movements during reading text, 213
- F**
- Family, 169–170; *see also* Caregivers of assistive users
 - AT resources applied to daily life of child and, 250–251
 - Family Impact of Assistive Technology Scale (FIATS), 41, 92–93
 - scores over time, 93, 94
 - Frailty, defined, 272
 - Functional magnetic resonance imaging (fMRI), 381–382
 - Functional near-infrared spectroscopy (fNIRS), 382
 - Functioning
 - classification, declaration, and international definitions of, 13–16
 - how to measure, 31
 - guidelines for measurement and assessment, 31–32
 - measurement and assessment in ATA process, 32–33
 - measures of, 25–31
 - monitoring, in the context of ATA use, 34–35
 - objective vs. subjective dimensions of, 29–30
 - personal factors of, 153–154
 - suggested measurement tools for an ATA process, 35–39
 - outcome analysis tools, 39–42
- G**
- Geriatric assessment, 273–275
 - vs. assessment of young adults, 274
 - of a clinical case, 288–291
 - ICF codes and, 282–287
 - interaction dimensions of, 274
 - Geriatric Assessment in a Centre for Technical Aids, 291
 - Geriatricians, 270, 291–293
 - role in ATA process, 282–287
 - case study, 288–291
 - Geriatric rehabilitation, 275–277
 - assistive solutions in, 277–281
 - objectives, 275
 - Geriatrics, 269–270
 - Globalization and large-scale manufacturing model, 16–18
 - Global position system (GPS), 279

Goal Attainment Scale (GAS), 51, 52
Guido, 279

H

Health, defined, 20
Healthcare Technology Device Predisposition Assessment (HCT PA), 57, 121
“Hellodoc” project, 372–373
Human assistance, AT and, 84–85
Human-centered design (HCD), 339
Human-computer interaction (HCI), 181, 340–342
 hierarchical model for, 362
Hypermetropia, 237–239

I

I-Cat robot, 280
Inclusive Learning through Technology (ILT), 137
Individual empowerment model, 16, 17
Individual functioning, *see* Functioning
Individualized education plan (IEP), 132
Individual Prioritised Problem Assessment (IPPA), 41, 51, 52
Information visualization approach (IVA), 365–369
Institute for Matching Person and Technology, xv
Intellectual disability (ID), 15, 20
Intelligence, defined, 20
Interaction evaluation, integrated model of, 343–348
Interaction model (human-computer interaction), 363–365
Interdisciplinary approaches to assessment, need for, x–xi
Interdisciplinary team approach; *see also* Multidisciplinary team; Pediatric case evaluation in an interprofessional team; Teamwork
 assistive solutions and, 248–250
International Classification of Functioning, Disability, and Health (ICF), 1, 3, 13, 14, 25–26
 ATA process under the lens of ICF biopsychosocial model, 3–5, 21, 60, 116–117, 152, 188, *see also* Biopsychosocial model
 ICF Checklist, 35
 ICF codes and geriatric assessment, 282–287
 ICF Core Set, 35

Matching Person & Technology Model and, 58, 59
 and measuring the AT match, 51
 need for revision, 151–153
 overview, 151–152
International Classification of Impairments, Disabilities, and Handicaps (ICIDH), 152, 153
Internet, *see* Web accessibility
iSonic system, 353

L

Language activity monitoring (LAM), 312
Leadership Energy and Environmental Design (LEED), 74
Learning, AT and, 251–253
Learning disabilities, 313–320
Leonarda Vaccari Institute, xii–xiii
Locked-in syndrome (LIS), 384–387, 391, 392
Locomotion, device for independent, 256

M

Magnetoencephalography (MEG), 381
MANUS, 279–280
Matching Assistive Technology and Child (MATCH), 58
Matching Older Adults with Dementia and Technology (MOADT), 287–291
Matching Person & Technology (MPT) Model, xv, 7, 36, 39, 51–55, 119, 133, 139
 assessment process and forms, 56–57, 119–121, 292
 ATA process and, 61–62
 different versions of, 58
 ICF and, 58, 59
 process and measures, 55–58
Medical model, 2, 11, 27
Mental models, 182, 345–348, 354
“Mental prostheses,” 385–387
Mental retardation, *see* Intellectual disability
Microswitches
 combinations of, 405–407
 combinations of VOCAs and, 407–410
 experimental, for small (nontypical) responses, 402–405
Microswitch technology, studies using, 401–405
 outcomes of, 410–411
 practical perspectives and implications of, 411–413

- Motor disability, technological devices for elderly people with, 279–280
- Motor functions, evaluation of, 222–223
- Motor restoration, brain-computer interfaces for, 387–389
- Movement restoration, brain-computer interface in, 388–389
- MPT, *see* Matching Person & Technology (MPT) Model
- Multidisciplinary approaches to assessment, need for, x–xi
- Multidisciplinary team, 30, 170, 182; *see also* Interdisciplinary team approach; Teamwork
 assessment professionals on, 101–103
 meeting with psychologist, 159
- Multidisciplinary team evaluation, assistive solution, 160, 187–188
- Multidisciplinary team meetings, 159, 186–187
- N**
- National Health and Aging Trends Study (NHATS), 286
- Near-infrared spectroscopy (NIRS), 382
- Neurofeedback, 389–390
- Nu!Reha Desk, 362, 369–371
 clinical evaluation, 372–374
 flow chart of experimental design for clinical evaluation of, 374
 proposed approach of, 371–372
- O**
- Occupational therapists (OTs)
 interventions used by, 231–232
 perspective of, 229–230
- Older patients
 disability, 271–272
 disease, 270–271
 frailty, 272–273
- Optic chiasm, 206, 208
- Optic nerves and their pathway, 206, 208
- Optometrists, role in ATA process, 220–222
 vision and, 202–220
- Optotype symbol examples, 209
- P**
- PAM-AID (Personal Adaptive Mobility Aid), 279
- PanAndPitchBlinking model, 368
- PanAndPitch model, 368
- Paralympic Games, 425–426
 classification systems within Paralympic sports, 427–428
- Pediatric case evaluation in an interprofessional team, 253–264
- Pediatric specialists
 in assistive solutions, 248
 in the process of development and rehabilitation, 245–248
- Perceptive abilities, superior, 219–220
- Perceptive functions; *see also* Visual abilities in behavioral optometry
 evaluation of, 222–223
- Personal factors
 assistive solutions and, 154–155
 of functioning and disability, 153–154
 psychologist as specialist in, 155–157
- Physical activity (PA), 422–423; *see also* Adapted physical activity
- PICO, 306
- PitchAndVolume model, 368
- POEM, 306
- Power wheelchair sports, 429–430
- Profession groups, 165, 166
- Prosthetic technology, 430–431
- P300 Speller, 385
- Psychological practice, new approach
 in, 168
- Psychological professional practice guidelines
 in ATA process, 168–170
- Psychologist role in ATA process, 157–158
 when it is required, 158–160
- Psychologists
 in a center for technical aid, 155–157
 facilitating awareness of user/client's context and multidisciplinary team perspectives, 160–164
 and professional's representations of disabled users/clients and AT, 164–170
 role in ATA, 149–151, 170–171
 what they should do in promoting user/client request, 164
- Psychosocial Impact of Assistive Devices Scale (PIADS), 40–41
- Psychotechnologists, 180–181, 184–186
 and AT assignment process in center for technical aid, 188–190
 the context of their profession, 190–191
 need for education, 191–192
 role in ATA process, 181–183, 186–188

- Psychotechnology
 definitions of, 180
 first course in, xv
 Psychotechnology education, example of,
 190–197
- Q**
- Quadriplegia, congenital, 236–239
 Quebec User Evaluation of Satisfaction with
 Assistive Technology 2.0 (QUEST),
 39–40
- R**
- Rational emotive behavioral therapy (REBT),
 108–109, 111
 Rehab-CYCLE, 19
 Rehabilitation; *see also* Geriatric rehabilitation;
 User eXperience (UX) concept
 application in design system for
 rehabilitation
 cognitive, 115–116
 community-based, 16, 17
 pediatric, 245–248
 Rehabilitation counseling, vocational,
 121–125, 193
 Rehabilitation Problem-Solving Form (RPS-
 Form), 19
 Rehabilitation process
 assessing individual functioning within a,
 18–20
 Rehabilitation project, ATA process in the, 60–61
 Rehabilitation technology service delivery
 models, *see* Service delivery models
 Retina
 functional division, 204, 205
 histological characteristics, 204, 206
 projection of visual fields onto left and right,
 206, 207
 structure, 204, 205
 RoboCare, 280
- S**
- Sapienza University of Rome, xv
 Satisfaction, defined, 333
Scope of Practice in Speech-Language Pathology
 (ASHA), 302
 Search engines, *see* WhatsOnWeb search engine
 Self-efficacy theory, 421–422
 Service delivery
 defined, 5
 Service delivery models, 5–7, 16–18, 27
 Service delivery process of AT, stages in, 139
 Service delivery system in different
 countries, 5–7
 Slow cortical potentials (SCPs), 386
 Socially assistive robotics systems, 280–281
 Social model, 27; *see also* Service delivery
 models
 Sonification, 351–353, 367–368
 defined, 333
 Special educator, role in ATA, 131–133,
 145–146
 case studies, 139–145
 teaching alternatives using AT, 134–135
 Specific learning disabilities (SLDs),
 313–320
 Speech-language pathologists (SLPs),
 322–323
 AT assessments and, 307–308
 case evaluation in multidisciplinary
 team vs. as a professional
 consultant, 320
 asking meaningful EBP questions,
 320–321
 characterizing the client, 320
 collecting clinical and personal
 evidence, 321
 locating and reviewing research
 evidence, 321
 using the evidence for MPT process,
 321–322
 description of professional profile,
 301–303
 development and implementation of AT
 intervention plans, 313
 evaluation of the effectiveness and
 usefulness of AT, 311–313
 evidence-based practice and, 304–307
 matching persons with technology and,
 308–311
 overlapping domains of language and
 literacy assessed by, 308
 role in advocacy, 313
 specific learning disabilities and,
 313–320
 AT teams and, 303–304
 Sport, facilitating psychological recovery
 through, 422
 Sport and disability techniques and
 technologies for a “sport for all,”
 429–431
 technology for developing countries,
 431–432

- Sports
 disability and, 425–426
 historical perspective, 426–427
 included and Special Olympics and Paralympics, 425, 426
- Sports participation among persons with disabilities, 428–429
- STATEMENT project, 145
- Stroke, ischemic, 239–242
- Support Intensity Scale (SIS), 32, 38–39
- Survey of Technology Use (SOTU), 56, 157
- Sustainability, *see* Accessibility, sustainability, and universal design
- Systems, evaluation of, 343–348
- T**
- Talker
 with keyboard, 263
 that uses simple switches to scan letters for forming words, 259
- Teamwork, 246–247; *see also* Interdisciplinary team approach; Multidisciplinary team
- Technology Acceptance Model (TAM), 280
- Telemedicine, 369–374
 future evolutions, 374–375
- Thinking skills, 137
- Toilet seat, customized, 257
- Toy with adaptive switch, 256
- Traumatic brain injury (TBI)
 case of, 260–264
- U**
- United Nations (UN)
 International Seminar on the Measurement of Disability, 25
- Universal design (UD), 74, 75, 333; *see also* Accessibility, sustainability, and universal design; Design for All principles of, 77
 in public use infrastructure models, 17, 18
- Universal design for learning (UDL), 138–139
- Usability
 defined, 340, 342
 rights of access and, 340–341
- Usability standards, 341–342
- User-assistive technology, 181; *see also specific topics*
- User-centered design (UCD), 333, 339
- User eXperience (UX), 337–338, 354–355
 application of UX framework for designing sonified visual Web search engine, 353–354
 areas in which it goes beyond usability, 338
 in ATA process, 348–351
 defined, 337
 four phases of, 338, 339
- User eXperience (UX) concept application
 in design system for rehabilitation, 348–351
 sonification of the system, 351–353
- User eXperience (UX) evaluation
 evaluator's mental model for from the perspective of, 347, 348
- V**
- Vineland Adaptive Behaviour Scales (VABS), 35–36
- Visual abilities in behavioral optometry, 208
 accommodation, 202, 203, 215–216
 binocular vision, 214
 convergence, 214–215
 field of vision, 218–219
 fixation, 211–212
 refraction, 216–218
 saccadic movements, 213–214
 slow pursuit, 212–213
 superior perceptive abilities, 219–220
 visual acuity, 208–211
- Visual functions, evaluation of, 222–223
- Visual process from eye to brain, complexity of, 202–208
- Visual training, 225
- Visus font, 211
- Vocal synthesis, 318
- Vocational rehabilitation counseling, 121–125, 193
- Voice output communication aids (VOCAs), 400
 combinations of microswitches and, 407–410
- vOICE system, 352–353
- Volatile organic compound (VOC)-free manufacturing processes, 77–78
- VolumeSonification model, 368
- W**
- Web accessibility, 341; *see also* Information visualization approach
- Well-being, 29

- WhatsOnWeb search engine, 353–354, 361–363
 - sonification, 367–368
 - usability evaluation, 368–369
 - Wheelchair-mounted robotic arms (WMRAs), 279
 - Wheelchair with anatomical seat and backrest, 257, 258
 - WHODAS II, 37
 - Workplace Technology Device Predisposition Assessment (WT PA), 57, 121
 - World Health Organization Disability Assessment Schedule (WHODAS), 28
- Y**
- Y-shaped model (rehabilitation process), 18–19