

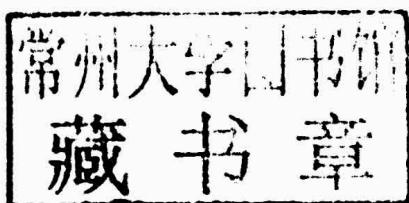
Cross-Cultural Design for IT Products and Services

Pei-Luen Patrick Rau • Tom Plocher • Yee-Yin Choong

 CRC Press
Taylor & Francis Group

Cross-Cultural Design for IT Products and Services

Pei-Luen Patrick Rau • Tom Plocher • Yee-Yin Choong



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

© 2013 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: 20121026

International Standard Book Number: 978-1-4398-3873-0 (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

Rau, Pei-Luen Patrick.
Cross-cultural design for IT products and services / Pei-Luen Patrick Rau, Tom Plocher, Yee-Yin Choong.
p. cm. -- (Human factors and ergonomics series)
Includes bibliographical references and index.
ISBN 978-1-4398-3873-0 (hardback)
1. Human-computer interaction. 2. User interfaces--Cross cultural studies. 3. Intercultural communication. 4. Communication in design. I. Plocher, Thomas A. II. Choong, Yee-Yin. III. Title.

QA76.9.H85R38 2012
004.01'9--dc23

2012009681

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

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

Cross-Cultural Design for IT Products and Services

Human Factors and Ergonomics

Series Editor

Gavriel Salvendy

Professor Emeritus

*School of Industrial Engineering
Purdue University*

Chair Professor & Head

*Dept. of Industrial Engineering
Tsinghua Univ., P.R. China*

PUBLISHED TITLES

Conceptual Foundations of Human Factors Measurement, *D. Meister*

Content Preparation Guidelines for the Web and Information Appliances:
Cross-Cultural Comparisons

H. Liao, Y. Guo, A. Savoy, and G. Salvendy

Cross-Cultural Design for IT Products and Services, *P. Rau, T. Plocher and Y. Choong*

Designing for Accessibility: A Business Guide to Countering Design Exclusion,
S. Keates

Handbook of Cognitive Task Design, *E. Hollnagel*

The Handbook of Data Mining, *N. Ye*

Handbook of Digital Human Modeling: Research for Applied Ergonomics
and Human Factors Engineering
V. G. Duffy

Handbook of Human Factors and Ergonomics in Health Care and Patient Safety,
Second Edition, *P. Carayon*

Handbook of Human Factors in Web Design, Second Edition, *R. Proctor and K. Vu*

Handbook of Occupational Safety and Health, *D. Koradecka*

Handbook of Standards and Guidelines in Ergonomics and Human Factors,
W. Karwowski

Handbook of Virtual Environments: Design, Implementation, and Applications,
K. Stanney

Handbook of Warnings, *M. Wogalter*

Human–Computer Interaction: Designing for Diverse Users and Domains,
A. Sears and J. A. Jacko

Human–Computer Interaction: Design Issues, Solutions, and Applications,
A. Sears and J. A. Jacko

Human–Computer Interaction: Development Process, *A. Sears and J. A. Jacko*

The Human–Computer Interaction Handbook: Fundamentals, Evolving
Technologies, and Emerging Applications, Second Edition, *A. Sears and J. A. Jacko*

Human Factors in System Design, Development, and Testing,
D. Meister and T. Enderwick

Introduction to Human Factors and Ergonomics for Engineers, *M. R. Lehto and J. R. Buck*

Macroergonomics: Theory, Methods and Applications, *H. Hendrick and B. Kleiner*

Practical Speech User Interface Design, *James R. Lewis*

Smart Clothing: Technology and Applications, *Gilsoo Cho*

Theories and Practice in Interaction Design, *S. Bagnara and G. Crampton-Smith*

Foreword

This book is published at a very opportune time when there are major activities around the globe including, but not limited to, products and services that are sold worldwide across different cultures, languages, and countries.

Industries establish facilities in other countries where they employ local personnel and personnel from the country of origin of the corporation. There are cases of business and diplomatic negotiations in cross-culture settings. For these situations, this book with its 14 chapters, 26 tables, 95 figures, and 276 references provides both the depth and breadth of knowledge to maximize the effectiveness of communication and affective utilization of products and services across different geographic locations. For this purpose, the book effectively illustrates the role of different languages and different cultures within a country and illustrates the effectiveness of cross-culture design by case studies. The chapters conclude with specific guidelines on design of cross-cultural products and services. As such, the book should be of value and great utility to all corporations operating in different languages, cultures, and countries and for researchers working in the cross-cultural area.

Gavriel Salvendy
October 2011

The Authors

Pei-Luen Patrick Rau (BA, Mechanical Engineering, National Taiwan University, 1992; MS, Manufacturing, School of Industrial Engineering, Purdue University, 1996; PhD, Human Factors, School of Industrial Engineering, Purdue University, 1998) is a professor in the Department of Industrial Engineering at Tsinghua University in Beijing. He founded and since 2002 has directed the Human–Computer Interaction (HCI) and Usability research center at Tsinghua University, and also directs the Institute of Human Factors and Ergonomics at Tsinghua University. The Institute of Human Factors and Ergonomics at Tsinghua University received the President’s Medal from the Economic Society in the United Kingdom (2008). He was named National Science Fund China’s Distinguished Young Scholar (2011). His human factors courses were awarded “Excellent Course” from Beijing (2009) and from Tsinghua University. He also received a number of awards from Tsinghua University, including Award for New Academics, Excellent Teaching Achievement, Outstanding Young Teacher award, Excellent Teaching for International Master Program, and Excellent Instruction for Student Research Training. His research themes include cross-cultural design and human-centered design, and he published book chapters and articles on these topics in HCI and related journals and conferences.

Thomas Plocher (MS, Psychology, Yale University, 1975; BA, Psychology, Hamline University, 1973) recently retired from Honeywell International, Inc., and currently works as an industry consultant and educator on human factors and global engineering teamwork. During his 35 years working as a senior human factors engineer at Honeywell, Tom was involved in both research and development. On the development side, Tom applied user-centered design methods to new product development across diverse businesses, including industrial process control, fire systems, video surveillance and security, and health monitoring. In 2005 he was recognized with a Honeywell Technical Achievement Award for his conceptualization and design of Honeywell’s FirstVision™ product. He was the first human factors engineer to receive that prestigious award from Honeywell. On the research side, Tom developed numerous innovative technology solutions to difficult human–computer interaction problems, particularly in the areas of hands-free interaction, small screen design, and graphical visualizations of built spaces. His 15 awarded U.S. patents and numerous patents pending resulted from this research. Tom worked with and mentored global engineering and research teams in China since 1998, fueling his interest in cross-cultural collaboration and cross-cultural design. For over 10 years, he has had a highly productive research collaboration with the Institute of Psychology, Chinese Academy of Sciences. He also served as industry advisor and participant in the Cultural Usability (CULTUSAB) research consortium, sponsored by the Danish Research Council. From 2006 to 2009, this multinational team of researchers from Denmark, India, China, and the United States investigated how culture affects

usability evaluation and recommended best practices for cross-cultural usability testing. He is the coauthor, with Patrick Rau and Yee-Yin Choong, of several handbook chapters on cross-cultural design of user interfaces.

Yee-Yin Choong (BA, Electronics Engineering, National Chiao-Tung University, Taiwan, 1987; MS, Electronics Engineering, National Chiao-Tung University, Taiwan, 1989; M.Eng, School of Industrial Engineering, Pennsylvania State University, 1991; PhD, Human Factors, School of Industrial Engineering, Purdue University, 1996) is a research scientist at the National Institute of Standards and Technology (NIST) since 2006. Prior to joining NIST, she was a senior Usability Engineer at General Electric for 10 years. During her graduate work at Purdue University, she pioneered the research linking cross-cultural psychology with human–computer interaction (HCI) by studying the impacts of information organization and presentation styles on computer performance of Chinese and Americans due to cultural differences. From her groundwork in cross-cultural HCI research, other researchers have published work that was inspired by her research. Her research has been focused on applying human factors and usability disciplines on any systems with a human-interaction component. The research expands from graphical user interface design, symbol and icons design, to biometrics technology, and cyber security. She has authored and coauthored numerous publications throughout her career.

Contents

Foreword	xvii
The Authors	xix

SECTION I Cross-Cultural Psychology

Chapter 1 A Global Market.....	3
1.1 Introduction	3
1.2 Cultural Differences.....	3
1.3 Organization of This Book	4
Chapter 2 Cross-Cultural Psychology.....	5
2.1 Framework.....	5
2.1.1 Values and Attitudes.....	5
2.1.2 Preferred Communication Style—Use of Context.....	11
2.2 Cognition and Human Information Processing.....	12
2.2.1 Cognitive Style	12
2.2.1.1 Organizing and Searching Information.....	13
2.2.1.2 Spatial Cognition	15
2.2.1.3 Time Cognition.....	15
2.2.1.4 Problem Solving and Decision Making.....	18
2.2.2 Language	19
References	20

SECTION II Cross-Cultural Design Guidelines

Chapter 3 Introduction to Cross-Cultural Design Guidelines	27
3.1 Introduction	27
References	28
Chapter 4 Language	31
4.1 Introduction to the Problem of Language.....	31
4.2 Design Guidelines	31
4.2.1 Use Simplified English.....	31
4.2.1.1 Why?	31
4.2.1.2 How?	31

4.2.1.3	Example	33
4.2.1.4	Tools.....	33
4.2.2	Use Technology Jargon Words Carefully.....	33
4.2.2.1	Why?.....	33
4.2.2.2	How?.....	34
4.2.2.3	Example	34
4.2.3	Do Not Use Abbreviations	34
4.2.3.1	Why?	34
4.2.3.2	How?	34
4.2.3.3	Example	35
4.2.4	Make Sure Words Are Translated to an Appropriate Context.....	35
4.2.4.1	Why?	35
4.2.4.2	How?	35
4.2.5	Provide Multiple Language Support	35
4.2.5.1	Why?	35
4.2.5.2	How?	36
4.2.6	Make Sure Content Matches Concepts and Values of Selected Language	36
4.2.6.1	Why?	36
4.2.6.2	How?	36
4.2.7	Adapt to Regional Preferences When Designing Speech Interactions	36
4.2.7.1	Why?	36
4.2.7.2	How?	36
4.2.7.3	Example	37
4.2.8	Allow Extra Space for Text	37
4.2.8.1	Why?	37
4.2.8.2	How?	37
4.2.8.3	Example	38
4.2.9	Do Not Embed Text in Icons	38
4.2.9.1	Why?	38
4.2.9.2	How?	38
4.2.10	Use an Appropriate Method of Sequence and Order in Lists.....	38
4.2.10.1	Why?	38
4.2.10.2	How?	39
4.2.10.3	Example	39
4.2.11	Avoid Combining User Interface (UI) Objects into Phrases	39
4.2.11.1	Why?	39
4.2.11.2	How?	41
4.2.11.3	Example	41
4.2.12	Avoid the Use of Case as a Distinguishing Feature of Characters	41
4.2.12.1	Why?	41

4.2.12.2 How?	42
4.2.13 Text Directionality.....	42
4.2.13.1 Why?.....	42
4.2.13.2 How?	42
4.2.13.3 Example	43
4.2.14 Use Correct Linguistic Boundaries, Ligatures, Text Wrappings, and Justifications, Punctuation, Diacritic Marks, and Symbols.....	43
4.2.14.1 Why?	43
4.2.14.2 How?	43
4.2.14.3 Examples.....	44
4.2.15 Consider Legibility Factors When Rendering Text Using Chinese Characters	44
4.2.15.1 Why?	44
4.2.15.2 How?	44
4.2.15.3 Example	45
4.2.16 Select an Efficient Text Input Method When Chinese Characters Must Be Entered	45
4.2.16.1 Why?	45
4.2.16.2 How?	46
4.2.16.3 Example	47
4.3 Case Study: Cross-Cultural Usability Issues in Bilingual Mobile Phones	47
4.3.1 Background	47
4.3.2 Objectives	49
4.3.3 Method	49
4.3.4 Differences between English and Devanagari Scripts.....	50
4.3.5 Results	51
4.3.5.1 Devanagari Keypad Usability.....	51
4.3.5.2 Use of Language on Mobile Phones	53
4.3.5.3 Bitmap Fonts and Rendering of Devanagari Characters	54
4.3.5.4 Reading Comprehension.....	56
4.4 Conclusion	57
4.5 Application	57
References	57
Chapter 5 Color Coding and Affect	61
5.1 Introduction to the Problem.....	61
5.1.1 Color Associations with Safety Conditions.....	61
5.1.1.1 Why?	61
5.1.1.2 How?	62
5.1.2 Use of Colors That Are Affectively Satisfying in the Target Culture.....	63

5.1.2.1	Why?	63
5.1.2.2	How?	63
5.1.2.3	Example	63
5.2	Case Study	63
5.2.1	Methodology	63
5.2.2	Demographics.....	64
5.2.2.1	Malaysia.....	64
5.2.2.2	Singapore	65
5.2.2.3	China.....	65
5.2.3	Color Association Questions	65
5.2.4	Results	65
5.3	Conclusion	67
5.4	Application	68
	References	68
Chapter 6	Icons and Images.....	71
6.1	Introduction to Icons and Images	71
6.1.1	Icons	71
6.1.2	Images	71
6.2	Guidelines.....	72
6.2.1	Make Sure Icons Are Highly Recognizable to the Target Users.....	72
6.2.1.2	Why?	72
6.2.1.3	How?	73
6.2.1.4	Example	73
6.2.2	When Designing Icons, Provide a Combination of Text and Picture	73
6.2.2.1	Why?	73
6.2.2.2	How?	74
6.2.3	Make Sure the Textual Components of Graphics Are Compatible with the Language(s) of the Target Users.....	74
6.2.3.1	Why?	74
6.2.3.2	How?	74
6.2.3.3	Example	75
6.2.4	Design Graphics to Support Natural Reading and Scanning Direction.....	75
6.2.4.1	Why?	75
6.2.4.2	How?	75
6.2.4.3	Example	75
6.2.5	Avoid Using Graphics with Culture-Specific Metaphors and Associations.....	75
6.2.5.1	Why?	75
6.2.5.2	How?	76
6.2.5.3	Example	76

6.2.6	Make Use of Appropriate Symbols, Images, Graphics, and Colors That Are Highly Recognized in the Target Culture to Excite and Please the User	76
6.2.6.1	Why?.....	76
6.2.6.2	How?.....	77
6.2.6.3	Example	77
6.2.7	Ensure That Graphics Reflect, or at Least Do Not Contradict, the Dominant Social Values of the Target Locale for Social Distance, Point of View, Degree of Involvement, and Power	78
6.2.7.1	Why?.....	78
6.2.7.2	How?	78
6.3	Case Studies.....	83
6.3.1	Case Study: Cross-Cultural Studies on Icons	83
6.3.1.1	Objective	83
6.3.1.2	Method.....	83
6.3.1.3	Results.....	84
6.3.1.4	Conclusion	84
6.3.1.5	Application.....	85
6.3.2	Case Study: Design and Evaluation of Symbols for Biometric Technologies	85
6.3.2.1	Background.....	85
6.3.2.2	Objective.....	87
6.3.2.3	Method.....	87
6.3.2.4	Procedure.....	88
6.3.2.5	Results.....	88
6.4	Conclusion	92
6.5	Application	93
	References	93
Chapter 7	Presentation Formats and Layout.....	97
7.1	Introduction to the Problem.....	97
7.1.1	Presentation Formats.....	97
7.1.2	Layout.....	97
7.2	Design Guidelines	100
7.2.1	Provide Natural Layout Orientation for Information to Be Scanned	100
7.2.1.1	Why?.....	100
7.2.1.2	How?	100
7.2.1.3	Example	100
7.2.2	For Menu Design, Provide Orientation Compatible with the Language Being Presented	101
7.2.2.1	Why?.....	101
7.2.2.2	How?	101

7.2.2.3	Example	101
7.2.3	Text Direction, Labeling, and Scrolling.....	101
7.2.3.1	Why?.....	101
7.2.3.2	How?	102
7.3	Case Study: Visual Search Strategies and Eye Movements When Searching Chinese Character Screens ...	102
7.3.1	Background	102
7.3.2	Methodology	103
7.3.2.1	Experimental Design	103
7.3.2.2	Participants	103
7.3.2.3	Experiment Paradigm.....	103
7.3.3	Results	105
7.3.3.1	Errors	105
7.3.3.2	Search Time	105
7.3.3.3	Search Patterns	106
7.3.4	Discussion.....	106
7.3.5	Application	108
	References	109
Chapter 8	Information Organization and Representation, Navigation, and Hyperlinks	111
8.1	Introduction to the Problem.....	111
8.1.1	Information Organization.....	111
8.1.2	Navigation	112
8.2	Design Guidelines	113
8.2.1	Information Should Be Organized According to the Target User's Style of Thinking	113
8.2.1.1	Why?.....	113
8.2.1.2	How?	113
8.2.2	Provide Searching Mechanisms and Procedural Supports That Are Compatible with the User's Time Orientation	114
8.2.2.1	Why?.....	114
8.2.2.2	How?	114
8.2.3	Provide Both a Search Engine and a Web Directory to Support Different Needs of Users	115
8.2.3.1	Why?.....	115
8.2.4	Provide Possible Outcomes and Results of Operations as Much as Possible for Asian Users or Users in High-Uncertainty-Avoidance Cultures	115
8.2.4.1	Why?.....	115
8.2.5	Provide Extra Navigational Aids for Japanese, Arabic, and Mediterranean Users or Users in High-Context Communication Style.....	116

8.2.5.1 Why?	116
8.2.5.2 How?	116
8.3 Case Study 1: Culturally Adapted Mobile Phone Interface Design	117
8.3.1 Background	117
8.3.2 Objective.....	117
8.3.3 Method	117
8.3.3.1 Prototype Test	118
8.3.3.2 Cognitive-Style Test.....	118
8.3.4 Results	118
8.3.4.1 Categorization Style.....	118
8.3.4.2 Initial Menu Choice	119
8.3.4.3 Preferred Menus	119
8.3.4.4 Correlation between Categorization Style and Preferred Menu	120
8.3.4.5 Impact of Prior Experience.....	120
8.3.5 Discussion.....	120
8.3.6 Conclusion	120
8.3.7 Application	120
8.4 Case Study 2: Cultural Effects of Knowledge Representation and Information Structure in a User Interface for Online Shopping.....	121
8.4.1 Background	121
8.4.2 Objectives.....	121
8.4.3 Method	122
8.4.3.1 Participants	122
8.4.3.2 Design of the Experiments	122
8.4.4 Results	125
8.4.4.1 Knowledge Representation (Abstract vs. Concrete)	125
8.4.4.2 Information Structure (Functional vs. Thematic)	126
8.5 Conclusions.....	127
8.6 Application	127
References	128
Chapter 9 Physical Ergonomics and Anthropometry	131
9.1 Introduction to the Problem.....	131
9.1.1 Anthropometry	131
9.1.2 Movement and Reach Zone.....	131
9.2 Guidelines for Application of Anthropometry to Cross-Cultural Designs	132
9.2.1 Select Appropriate Database	133
9.2.1.1 Why?	133
9.2.1.2 How?	133

9.2.2	Carefully Choose the User Population.....	136
9.2.2.1	Why?.....	136
9.2.2.2	How?.....	137
9.3	Case Study 1: Rapid Preliminary Helmet Shell Design Based on Three-Dimensional Anthropometric Head Data.....	137
9.3.1	Background	137
9.3.2	Objective.....	137
9.3.3	Method	138
9.3.4	Results	138
9.3.5	Conclusions	138
9.4	Case Study 2: Anthropometric Measurement and Chinese Medical Acupuncture	139
9.4.1	Background	139
9.4.2	Objective.....	142
9.4.3	Method	142
9.4.4	Results	142
9.5	Conclusions.....	143
	References	143

SECTION III Methodology

Chapter 10	Weaving Culture into the Product Development Process	147
10.1	Introduction	147
10.2	Phase 1: Identify Customer (User) Requirements	147
10.2.1	Determine Where the Product Will Be Engineered and Where It Will Be Sold.....	149
10.2.2	Describe Users, User Goals, and Environments	149
10.2.3	Identify Attitudes about the Technology	149
10.2.4	Identify Any Regional Certification Requirements.....	149
10.2.5	Prepare Cross-Cultural Design Plan and Budget....	150
10.2.6	Documentation: User Experience Report.....	150
10.3	Phase 2: Concept Definition	150
10.3.1	Establish Cross-Cultural Design Philosophy	150
10.3.1.1	Internationalization-Localization Strategy	151
10.3.1.2	Determining Key Usability Factors and Values.....	151
10.3.2	Concept Previsualization Studies.....	152
10.3.3	User Reviews of Concepts in Target Cultures.....	152
10.3.4	Documentation: User Interface Concept Document	153

10.4	Phase 3: Design and Specify Product.....	153
10.4.1	Design, Develop, and Iterate User Interface (UI) Prototypes According to Guidelines	153
10.4.2	Design for Technology Acceptance.....	153
10.4.3	Cross-Cultural Heuristic Evaluation	154
10.4.4	Usability Testing in Target Regions	154
10.4.5	Documentation: Human Factors Detailed Design Document	154
10.4.6	Documentation: Human Factors Evaluation Report	154
10.5	Phase 4: Develop Hardware or Software.....	155
10.6	Phase 5: Product Validation.....	155
10.7	Phase 6: Product Launch and Deployment.....	156
10.7.1	Implement Technology Acceptance/Deployment Plan.....	156
10.7.2	Collect User Feedback.....	156
10.7.3	Add Project to Cultural Database	156
	References	156
Chapter 11	User Needs Research: Understanding the Lay of the Land	159
11.1	Introduction	159
11.2	Reducing Ethnocentricity in Cross-Cultural Research	160
11.3	Countries Are Not Necessarily Proxies for Cultures	160
11.4	Measurements Are Not Necessarily Equivalent.....	161
11.5	Concepts Are Not Necessarily Equivalent	161
11.6	Case Studies.....	162
11.6.1	Case Study: Using Photointerviews to Understand Independent Living Needs of Elderly Chinese	162
11.6.1.1	Methodology	162
11.6.1.2	Findings	166
11.6.2	Case Study: Health-Care User Needs and Concepts in Rural India.....	169
11.6.2.1	Introduction	169
11.6.2.2	Methodology	170
11.6.2.3	Findings	174
11.6.2.4	Implications and Epilogue	175
	References	178
Chapter 12	Gaining User Acceptance in Specific Cultures.....	181
12.1	Introduction	181
12.2	Case Study 1: Using Explorative Survey to Understand Socioeconomic Influences on Rural Chinese Users' Acceptance of Mobile Entertainment.....	182
12.2.1	Introduction	182