

Immersed in Media

Matthew Lombard • Frank Biocca
Jonathan Freeman • Wijnand IJsselsteijn
Rachel J. Schaevitz
Editors

Immersed in Media

Telepresence Theory,
Measurement & Technology

 Springer

Editors

Matthew Lombard
School of Media & Communication
Temple University
Philadelphia, USA

Jonathan Freeman
Department of Psychology
Goldsmiths, University of London
London, UK

Rachel J. Schaevitz
School of Media & Communication
Temple University
Philadelphia, USA

Frank Biocca
Newhouse School of Public
Communications
Syracuse University
New York, USA

Wijnand IJsselsteijn
School of Innovation Sciences
Eindhoven University of Technology
Eindhoven, The Netherlands

ISBN 978-3-319-10189-7

ISBN 978-3-319-10190-3 (eBook)

DOI 10.1007/978-3-319-10190-3

Library of Congress Control Number: 2015941729

Springer Cham Heidelberg New York Dordrecht London

© Springer International Publishing Switzerland 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Contents

1	Lighting a Path While Immersed in Presence: A Wayward Introduction	1
	Frank Biocca	
Part I Telepresence Concepts and Theories		
2	Defining Presence	13
	Matthew Lombard and Matthew T. Jones	
3	Presence: Form, Content and Consciousness	35
	John A. Waterworth, Eva Lindh Waterworth, Giuseppe Riva, and Fabrizia Mantovani	
4	Affect, Availability and Presence	59
	Phil Turner	
5	Intention, Action, Self and Other: An Evolutionary Model of Presence	73
	Giuseppe Riva, Fabrizia Mantovani, Eva Lindh Waterworth, and John A. Waterworth	
6	An Action-Based Approach to Presence: Foundations and Methods	101
	Luciano Gamberini and Anna Spagnolli	
7	Spatial Presence Theory: State of the Art and Challenges Ahead	115
	Tilo Hartmann, Werner Wirth, Peter Vorderer, Christoph Klimmt, Holger Schramm, and Saskia Böcking	

Part II Telepresence Research and Design

- 8 Ways to Measure Spatial Presence: Review and Future Directions**..... 139
 Jari Laarni, Niklas Ravaja, Timo Saari, Saskia Böcking,
 Tilo Hartmann, and Holger Schramm
- 9 An Integrative Approach to Presence and Self-Motion Perception Research**..... 187
 Bernhard E. Riecke and Jörg Schulte-Pelkum
- 10 Patterns of Place: An Integrated Approach for the Design and Evaluation of Real and Virtual Environments**..... 237
 Michael Smyth, David Benyon, Rod McCall,
 Shaleph O’Neill, and Fiona Carroll

Part III Telepresence Applications

- 11 Collaboration in Immersive and Non-immersive Virtual Environments** 263
 Anthony Steed and Ralph Schroeder
- 12 Presence-Inducing Media for Mental Health Applications**..... 283
 Giuseppe Riva, Cristina Botella, Rosa Baños,
 Fabrizia Mantovani, Azucena García-Palacios, Soledad Quero,
 Silvia Serino, Stefano Triberti, Claudia Repetto, Antonios Dakanalis,
 Daniela Villani, and Andrea Gaggioli

List of Contributors

Rosa Baños is full Professor of Psychopathology and Head of Labpsitec at the University of Valencia (Spain). For more information, please visit <http://www.labpsitec.es>

David Benyon is Professor of Human Computer Systems at Edinburgh Napier University (Scotland) and Director of the Centre for Interaction Design. His research is based on HCI, User Experience (UX), and Interaction Design. He has published widely on these topics including the textbook *Designing Interactive Systems* (Pearson, 3rd edition, 2013) and with Manuel Imaz on the application of conceptual blending to HCI in *Designing with Blends* (MIT Press, 2006).

Frank Biocca is the Newhouse Endowed Chaired Professor at the Newhouse School of Public Communications at Syracuse University. He is also World Class University Professor at Sungkyunkwan University, South Korea. He is the founder and Director of Media Interface and Network Design (M.I.N.D.) Labs. Dr. Biocca was a Professor and Researcher at the University of California, Berkeley; Stanford University; University of North Carolina; Helsinki School of Economics; and Michigan State University. Dr. Biocca's research and commentary on media, cognition, and communication have been featured in the BBC World Service, CNN, *The New York Times*, ABC Nightline, *The Washington Post*, Discovery Channel, *USA Today*, NBC, C-SPAN, Voice of America, and over 60 broadcast and print organizations spanning more than 15 countries. His current research is funded by National Institutes of Health, US Department of State, European Union, AT&T Foundation, and by the National Research Foundation of Korea. Prior to getting a Ph.D., he was a Silicon Valley executive who participated in the introduction of the first portable computer. More detailed information is available on the website of the M.I.N.D. Lab (<http://www.mindlab.org>).

Saskia Böcking received her Ph.D. in Communication Science in 2007. Throughout the last years, she held various positions as market research manager in international market research companies. Currently, she is working as market insight manager in a Swiss energy enterprise.

Cristina Botella is full Professor of Clinical Psychology at Universitat Jaume I of Castellon (Spain) and Director of Labpsitec (Laboratorio de Psicología y Tecnología). For more information, please visit <http://www.labpsitec.es>

Fiona Carroll is a Lecturer at the University of Glamorgan and an active Researcher in the field of HCI. Over the past 6 years, she has worked on several projects such as the Benogo project (2003–2005), Citizenship project (2005–2006), TRIO project (2006–2008), and the Swansea Learning Partnership Project (2006–2008), exploring different ways of enhancing the user experience through user requirements research, user interface design, and user evaluation. Fiona has published widely and has presented her work at conferences worldwide.

Gian Luca Cesa is psychotherapist at the Centro Obesità e Nutrizione Clinica (CONC), Ospedale Privato Accreditato Villa Igea, Forlì (FC), Italy.

Antonios Dakanalis is Assistant Professor in the Department of Brain and Behavioral Sciences, Università di Pavia, Pavia, Italy. His research interests include clinical applications of virtual reality, obesity and eating disorders, and cognitive-behavioral therapy.

Jonathan Freeman is Managing Director for i2 media research ltd. and Professor of Psychology at Goldsmiths University of London, UK.

Andrea Gaggioli is Research Professor of New Media Psychology at Università Cattolica del Sacro Cuore, Milan, Italy, and Senior Researcher of the Applied Technology for Neuro-Psychology Laboratory–ATN-P Lab., Istituto Auxologico Italiano, Milan, Italy.

Luciano Gamberini is Associate Professor at the University of Padova, Department of General Psychology. In this university, he is also Rector's delegate for relations with enterprises and Director of the Human Inspired Technology Research Centre (HIT) and the Human Technology Laboratories (HTLab). He holds a degree in General Psychology and a Ph.D. in Experimental Psychology. Since 2000, he has taught several courses in the areas of social and cognitive ergonomics and mediated communication at the Universities of Padua and Trento. He is a member of scientific boards and chair of international conferences and journals, including The International Workshop on Presence, Persuasive Technology, Cybertherapy, CHI, CHIItaly ACM SIG, *PsychNology Journal*, *Cyberpsychology and Behavior*, *CyberTherapy and Rehabilitation*, and the Emerging Communication Series by IOS press. He is author of more than 100 peer-reviewed scientific papers and conference presentations in the area of human-computer interaction. More detailed information is available at <http://htlab.psy.unipd.it>

Azucena Garcia-Palacios is Senior Lecturer of Psychopathology at the Universitat Jaume I of Castellon (Spain) and Head of Research of Labpsitec. For more information, please visit <http://www.labpsitec.es>

Alessandra Gorini is Research Professor at the Università degli Studi di Milano, Milan, Italy. Her research interests include cognitive processes and decision making, clinical applications of virtual reality, and cognitive rehabilitation.

Tilo Hartmann is an Associate Professor in the Department of Communication Science at the VU University Amsterdam. He holds a Ph.D. in Communication Science from the Hannover University of Music, Drama and Media. In his research, he applies media-psychological approaches and methodology to study people's experience of mediated illusions (e.g., parasocial interaction, presence, virtual violence), media choice, and health communication behavior. Tilo Hartmann is editor of the book *Media Choice: A Theoretical and Empirical Overview* and editorial board member of the *Journal of Communication*, *Human Communication Research*, and *Media Psychology*.

Wijnand IJsselsteijn is Associate Professor within the Human-Technology Interaction Group at the Eindhoven University of Technology (the Netherlands). Since 1996, he has worked on the scientific investigation of how humans interact with advanced media technologies, such as stereoscopic television, virtual environments, or mobile communication services. He is specifically interested in how to conceptualize and measure the human experience in relation to media. For more information, please visit <http://www.ijsselsteijn.nl/index.html>

Matthew T. Jones is Chairperson of Communication at County College of Morris, Randolph, New Jersey. In addition to teaching a wide variety of courses in the field of Mass Media and Communication, Matthew Jones has authored several publications and numerous presentations. Most recently, Dr. Jones has published a textbook titled *Telling Your Story: A Narrative Approach to Public Speaking*. His current research centers on narrative structure, folktales, literary adaptation, and film. More information on the publications, presentations, films, and other professional activities of Matthew T. Jones can be found at his website (<http://www.mattsmediaresearch.com/>).

Christoph Klimmt is Professor of Communication Science at Hannover University of Music, Drama and Media. He is an associate editor of the *Journal of Media Psychology* and member of the International Communication Association (ICA) as well as of the German Communication Association (DGPK). His research interests include media entertainment, video games, processing and effects of media, new media technologies, and empirical methods.

Jari Laarni is Principal Scientist at the Systems Engineering Unit of VTT Research Centre of Finland. He received a Ph.D. in Psychology from the University of Helsinki in 1997. He is specialized in the areas of visual perception, cognitive psychology, media psychology, usability evaluation, and user experience analysis, and he has researched on the issues involved in visual attention and search, user interface evaluation, sense of presence in media environments, and operator work analysis. He has participated in several national and international research projects on these topics.

Matthew Lombard (Stanford, 1994) is Associate Professor in the Department of Media Studies and Production and Director of the Media and Communication doctoral program in the School of Media and Communication at Temple University in Philadelphia, Pennsylvania, USA. His research centers on individuals' psychological and physiological processing of media presentations and experiences, with particular focus on the concept of (tele)presence. He cofounded and is President of the International Society for Presence Research (<http://ispr.info>) and is editor of ISPR Presence News.

He is also Director of the Media Interface and Network Design (M.I.N.D.) Lab at Temple University (<http://mindlab.org>). His work has appeared in academic journals including *Behaviour & Information Technology*, *CyberPsychology and Behavior*, *Human Technology*, *Journal of Communication*, *Human Communication Research*, *Journal of Computer-Mediated Communication*, and *Presence: Teleoperators and Virtual Environments*. For more detailed information, please visit <http://matthewlombard.com>

Fabrizia Mantovani is Research Professor of General Psychology at the University of Milan-Bicocca. She has a Ph.D. in Psychology of Communication and Linguistic Processes (2003). Since 2000, she has been involved as team manager in research projects on information and communication technologies funded by the European Commission. Her research interests include virtual reality applications for therapy and training, affective computing and e-learning, serious games, and computer-mediated communication.

Rod McCall was the Deputy Head of the Collaborative Augmented and Virtual Environments (CVAE) Department at Fraunhofer FIT in Sankt Augustin, Germany (<http://www.fit.fraunhofer.de>), before taking up a Senior Researcher position at the University of Luxembourg. Previously he was an ERCIM Alain Besoussan Research Fellow at Fraunhofer FIT and CRP-Gabriel Lippman Luxembourg. He has been involved in researching presence, place, and usability in virtual, mixed, and augmented environments since 1997 and, more recently, location-aware games. He has authored around 45 publications in books, journals, conferences, and workshops.

Enrico Molinari is full Professor of Clinical Psychology at the Faculty of Clinical Psychology, Catholic University, Milan, Italy, and Head of the Clinical Psychology Service at St. Joseph Hospital, Italian Auxologic Institute, Milan. His scientific activity in the field of cardiac psychology includes the participation in Italian and European research projects involving the use of telematic technologies.

Shaleph O'Neill is Senior Lecturer at the University of Dundee and has worked on a number of interaction design projects that explore user sense making (usability) processes and creative activities. His expertise lies in the areas of semiotics and user interface design. He is author of *Interactive Media: The Semiotics of Embodied Interaction* (published by Springer, 2008) and has recently secured funding through the "First Grant Scheme" to look into ways of improving creative technologies for creative practitioners (Making Sense of Creative Interactions, EPSRC F053029/1). His research focus is to better understand the relationship between user experience

and the meanings embedded in multiple and distributed media interfaces of various sorts from traditional to interactive media.

Soledad Quero is Senior Lecturer of Clinical Psychology at the Universitat Jaume I of Castellon (Spain) and Senior Researcher of Labpsitec. For more information, please visit <http://www.labpsitec.es>

Niklas Ravaja is Professor of Social Psychology of Information and Communication Technology at the University of Helsinki, Finland. His previous appointment was Director of Research at the Center for Knowledge and Innovation Research (CKIR) in the Helsinki School of Economics in Finland. He received his Ph.D. (Psychology) from the University of Helsinki in 1996 and has been a Docent of Applied Psychology since 1999. His areas of research interest and expertise include the psychophysiology of attention, emotion, and temperament; psychophysiological responses to media messages, video games, and human-computer interaction; sense of presence; and time-series analysis. He has authored over 90 scientific papers (46 peer-reviewed journal articles). He is the coordinator and principal investigator of the EU-funded, international, interdisciplinary NEST project “The fun of gaming: Measuring the human experience of media enjoyment” (FUGA). Previously he has worked as a Postdoctoral Researcher of the Academy of Finland. In 2006, he was named Researcher of the Year at the Helsinki School of Economics.

Claudia Repetto is Researcher at the Interactive Communication and Ergonomics of New Technologies–ICE-NET, Università Cattolica del Sacro Cuore, Milan, Italy. Her research interests include clinical applications of virtual reality, cognitive rehabilitation, and cognitive-behavioral therapy.

Bernhard E. Riecke is Assistant Professor at the School of Interactive Arts and Technology at Simon Fraser University (Surrey/Vancouver). For more information, please visit <http://www.siat.sfu.ca/faculty/Bernhard-Riecke/>

Giuseppe Riva is Associate Professor of Communication Psychology and Director of the Interactive Communication and Ergonomics of New Technologies Lab (ICE-NET Lab) at the Catholic University of Milan, Italy. He also serves as Head Researcher at the Applied Technology for Neuro-Psychology Laboratory (ATN-P Lab.), Istituto Auxologico Italiano, Milan, Italy.

Timo Saari is Professor of Human-Centered Design and Technology at Tampere University of Technology, Finland. His previous appointments include Associate Professor at Temple University (USA), Affiliate Principal Scientist at the Center for Knowledge and Innovation Research (CKIR) in the Helsinki School of Economics, Affiliate Senior Research Scientist in the Helsinki Institute for Information Technology (HIIT) in the Digital Content Communities Research Group, and Associate Director of M.I.N.D. Lab in Michigan State University (USA) and Finland. He received his doctorate degree in Journalism and Mass Communication Research from the University of Tampere, Finland, in 2001. His research interests and expertise include the psychology of media processing (emotion/mood, cognition, and well-being), customized media and games, and mobile and ubiquitous

computing technologies. Dr. Saari has authored and coauthored over 70 peer-reviewed journal articles, book chapters, and conference proceedings. He has created and coordinated several large-scale international research projects. Dr. Saari has held various Visiting Professor and Researcher positions in Stanford University, University of California at Berkeley, Michigan State University, and University of Cologne, Germany. In 1995–2002, he worked in various executive positions at Alma Media Corporation, a Finnish media company.

Rachel J. Schaevitz earned her doctorate in Media and Communication at Temple University, USA. She teaches film and television production, and her research focuses on the use of image-based instructional videos to convey information to culturally and linguistically diverse audiences.

Holger Schramm is Professor of Communication at the Institute of Human-Computer-Media of the University of Würzburg in Germany. He was Head of the division “Media Audiences and Effects” of the German Communication Association and is specialized in the areas of media processes and effects (parasocial interactions, mood and emotion, entertainment, presence), music and media, sports communication, and advertising/brand communication. Dr. Schramm has edited or coedited 13 books (two handbooks) and has authored or coauthored about 40 peer-reviewed journal articles and 60 book chapters. His publications on presence include theoretical, empirical, and methodological perspectives on conditions, processes, and effects of spatial presence.

Ralph Schroeder is Professor and M.Sc. Program Director at the Oxford Internet Institute, Oxford University. Ralph Schroeder has interests in virtual environments, social aspects of e-Science, and sociology of science and technology and has written extensively about virtual reality technology. His current research is mainly related to e-Science. For more information, please visit <http://www.oii.ox.ac.uk/people/?id=26>

Jorg Schulte-Pelkum is Research Scientist at the Max Planck Institute for Biological Cybernetics. He has a background in experimental psychology, and his primary research interest is self-motion perception. For more information, please visit <http://www.kyb.mpg.de/~jssp>

Silvia Serino candidate, is Researcher at the Applied Technology for Neuro-Psychology Laboratory, Istituto Auxologico Italiano, Verbania, Italy. Her research interests include clinical applications of virtual reality and metaverse, cognitive rehabilitation, stress management, and interreality.

Michael Smyth is a Reader in the Centre for Interaction Design, Edinburgh Napier University, UK. He has worked in the fields of human-computer interaction and interaction design since 1987 and, during that period, has published over 50 academic papers in refereed journals, books, and conferences. In addition, he has had interactive installations exhibited at both UK and international conferences and arts and design festivals. He is coeditor of the book entitled *Digital Blur: Creative Practice at the Boundaries of Architecture, Design and Art*.

Anna Spagnoli is Assistant Professor at the University of Padova; scientific coordinator of the Human Technology Laboratories, Department of General Psychology (HTLab); and a member of the Human Inspired Technology Research Centre. She holds a degree in Social Psychology and a Ph.D. in Social and Personality Psychology. Her teaching activity regards social ergonomics and qualitative methods. Her research interests are in the fields of mediated interaction and social presence, and her expertise lies in qualitative research methods applied to HCI. She co-funded and is editor in chief of *PsychNology Journal* to support the open-access dissemination of scientific research in the area of ICT.

Anthony Steed is Professor of Virtual Environments and Computer Graphics in the Department of Computer Science, University College London. His research area is real-time interactive virtual environments, with particular interest in mixed-reality systems, large-scale models, and collaboration between immersive facilities. Details of his work can be found at <http://www.cs.ucl.ac.uk/staff/a.steed/>

Stefano Triberti candidate, is Researcher at the Interactive Communication and Ergonomics of NEw Technologies–ICE-NET, Università Cattolica del Sacro Cuore, Milan, Italy. His research interests include applications of virtual reality, ergonomics, and human-computer interaction.

Phil Turner is a Reader in the School of Computing at Edinburgh Napier University. His interest in presence research has been directed at making use of Heidegger's ontological perspective to the discipline and, more recently, with the role of make-believe in being-there.

Daniela Villani is Research Professor of General Psychology at the Università Cattolica del Sacro Cuore, Milan, Italy. She is also Senior Researcher of the Interactive Communication and Ergonomics of NEw Technologies (ICE- NET) Lab, in the same university. Her research work focuses on the concepts of “positive psychology” and “stress management” embedding the bits of the digital realm with the atoms of our physical world. Specifically, the main contribution of her research work is related to the impact of positive technologies, considering also the involvement of emotions in enhancing our quality of life.

Peter Vorderer Professor of Communication Science, received his Ph.D. from the Technical University of Berlin in 1992. He had been a Visiting Professor of Psychology at the University of Toronto (1993); a tenured Professor of Communication at the Hannover University of Music, Drama and Media (1994–2007); and a tenured Professor of Communication at the Annenberg School for Communication with a joint appointment in Psychology at the College of the University of Southern California in Los Angeles (2002–2007). He has been editor of the scholarly journal *Media Psychology*, published extensively, and received several research grants on topics like “Exposure to Communication Content,” “Media Effects,” “(Interactive) Entertainment,” and “Video Games.”

Eva Lindh Waterworth is manager of the Q-Life research group and a full Professor in the Department of Informatics at Umeå University. Her research focuses on the relationship between quality of life and information technology, with a particular interest in creating technology that meets the needs of special groups such as the elderly, the young, and the physically and mentally disadvantaged. Eva has a Ph.D. in Informatics (2001), with a doctoral thesis entitled “Perceptually-Seductive Technology: designing computer support for everyday creativity.” She has managed and contributed to several completed and ongoing international projects.

John A. Waterworth has been a full Professor of Informatics at Umeå University since 2001, during which time he was also research manager of the Interactive Institute studio in Umeå. He has a Ph.D. in Experimental Psychology from the University of Hertfordshire in the UK, for research on the perception of time. John has carried out human-computer interaction research for a long time: for 8 years at BT Labs in the UK, then 6 years at a research institute in Singapore, and for the last 20 years in Northern Sweden. His research interests center on the effects of using information and communication technologies on human lived experience and quality of life.

Werner Wirth Professor of Communication Science, studies communication science, psychology, statistics, sociology, and informatics. He has been Lecturer and research assistant at the Universities of Munich, Leipzig, and Hannover. In 2002–2003, he was Professor of Online Communication and Multimedia at the University of Munich. Since 2003, he has been full Professor of Communication and Empirical Media Research at the University of Zurich, Institute of Mass Communication and Media Research, and Head of the section “Media Psychology and Effects.” His main research areas are media audiences and effects, entertainment and emotion research, political and commercial persuasion, online and mobile communication, and theories and methods of communication research.