

# **2016 IEEE International Symposium on Mixed and Augmented Reality (ISMAR-Adjunct 2016)**

**Merida, Yucatan, Mexico  
19-23 September 2016**



**IEEE Catalog Number: CFP16D63-POD  
ISBN: 978-1-5090-3741-4**

**Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP16D63-POD
ISBN (Print-On-Demand):	978-1-5090-3741-4
ISBN (Online):	978-1-5090-3740-7

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# 2016 IEEE International Symposium on Mixed and Augmented Reality Adjunct Proceedings

## ISMAR-Adjunct 2016

### Table of Contents

Message from the ISMAR 2016 General Chair and Deputy General Chairs .....	xiv
Message from the ISMAR 2016 Science and Technology Poster Chairs .....	xv
Message from the Workshop and Tutorial Chairs.....	xvii
Message from the Demonstration Chairs .....	xviii
ISMAR 2016 Conference Committee Members .....	xix
ISMAR 2016 Science and Technology Program Committee Members.....	xx
ISMAR 2016 Steering Committee Members .....	xxi
Reviewers.....	xxii
Keynotes.....	xxiii
Sponsors and Supporters .....	xxv
Tutorial 1: Augmented Reality - Principles and Practice Tutorial .....	xxviii
Tutorial 2: DAQRI ARToolKit Tutorial .....	xxix
Tutorial 3: Microsoft Hololens Tutorial.....	xxx

### Science & Technology Posters

Mobile Guide to Augmented Reality for Campus of the Autonomous University of Nayarit .....	1
<i>Adalberto Iriarte-Solis, Palmira González-Villegas, Ricardo Fuentes-Covarrubias, and Gerardo Fuentes-Covarrubias</i>	
A Perspective on Non-Isometric Shape-from-Template .....	5
<i>Adrien Bartoli and Erol Özgür</i>	
EyeAR: Empiric Evaluation of a Refocusable Augmented Reality System .....	11
<i>Aitor Rovira, Takafumi Taketomi, Rompapas Damien Constantine, Hirokazu Kato, Christian Sandor, and Sei Ikeda</i>	
Measuring Observer Response to Object-Scene Disparity in Composites.....	13
<i>Alan Dolhasz, Ian Williams, and Maite Frutos-Pascual</i>	
Improving Localization under Varying Illumination .....	19
<i>Alexander Plopski, Tomohiro Mashita, Akira Kudo, Tobias Höllerer, Kiyoshi Kiyokawa, and Haruo Takemura</i>	

DualCAD: Integrating Augmented Reality with a Desktop GUI and Smartphone Interaction.....	21
<i>Alexandre Millette and Michael J. McGuffin</i>	
Real Time Noise Reduction to Identify Motion Parameters in AR Maintenance Scenario .....	27
<i>Alia Rukubayihunga, Jean-Yves Didier, and Samir Otmane</i>	
Challenges for Asynchronous Collaboration in Augmented Reality.....	31
<i>Andrew Irlitti, Ross T. Smith, Stewart Von Itzstein, Mark Billingham, and Bruce H. Thomas</i>	
Mobile Augmented Reality: Placing Labels Based on Gaze Position.....	36
<i>Ann McNamara and Chethna Kabeerdoss</i>	
Augmenting Surface Reconstructions.....	38
<i>Anna Katharina Hebborn, Nils Höhner, and Stefan Müller</i>	
Streaming and Exploration of Dynamically Changing Dense 3D Reconstructions in Immersive Virtual Reality.....	43
<i>Annette Mossel and Manuel Kroeter</i>	
A Systematic Review of Usability Studies in Augmented Reality between 2005 and 2014.....	49
<i>Arindam Dey, Mark Billingham, Robert W. Lindeman, and J. Edward Swan II</i>	
Full-Scale Visualization of a Person on a Movable Transparent Screen.....	51
<i>Atsuya Oikawa, Itaru Kitahara, Yoshinari Kameda, and Yuichi Ohta</i>	
Participatory Design of STEM Education AR Experiences for Heterogeneous Student Groups: Exploring Dimensions of Tangibility, Simulation, and Interaction .....	53
<i>Ben Thompson, Laura Leavy, Amelia Lambeth, David Byrd, Joelle Alcaidinho, Iulian Radu, and Maribeth Gandy</i>	
An Augmented Reality Guide for Assisting Forklift Operation.....	59
<i>Bhuvaneswari Sarupuri, Gun A. Lee, and Mark Billingham</i>	
Mimicking an Object Using Multiple Projectors .....	61
<i>Bilal Ahmed, Jong Hun Lee, Yong Yi Lee, and Kwan H. Lee</i>	
EgoSAR: Towards a Personalized Spatial Augmented Reality Experience in Multi-user Environments.....	64
<i>Brett Ridel, Loïs Mignard-Debise, Xavier Granier, and Patrick Reuter</i>	
Robust 3D Object Tracking Using an Elaborate Motion Model .....	70
<i>Byung-Kuk Seo and Harald Wuest</i>	
Pre-attentive Features in Natural Augmented Reality Visualizations .....	72
<i>Carla Barreiros, Eduardo Veas, and Viktoria Pammer-Schindler</i>	
Visual Guidance for Encountered Type Haptic Display: A Feasibility Study .....	74
<i>Chang-Gyu Lee, Gregory Lynn Dunn, Ian Oakley, and Jeha Ryu</i>	
Mobile Augmented Reality Based on Invisible Marker .....	78
<i>Changmin Lim, Chanran Kim, Jong-II Park, and Hanhoon Park</i>	

TeachAR: An Interactive Augmented Reality Tool for Teaching Basic English to Non-Native Children .....	82
<i>Che Samihah Che Dalim, Arindam Dey, Thammathip Piumsomboon, Mark Billingham, and Shahrizal Sunar</i>	
Visualisation of the Electronic Horizon in Head-Up-Displays .....	87
<i>Christian A. Wiesner, Mike Ruf, Demet Sirim, and Gudrun Klinker</i>	
Enhancing 3D Mapping via Real-Time Superpixel-based Segmentation .....	90
<i>Claudia Cruz Martínez, José Martínez Carranza, Walterio Mayol-Cuevas, and Miguel O. Arias Estrada</i>	
A Hand-Held, Self-Contained Simulated Transparent Display.....	96
<i>Daniel Andersen, Voicu Popescu, Chengyuan Lin, Maria Eugenia Cabrera, Aditya Shanghavi, and Juan Wachs</i>	
A Haptic Serious Augmented Reality Game for Motor Assessment of Parkinson's Disease Patients .....	102
<i>Erik van der Meulen, Marina A. Cidota, Stephan G. Lukosch, Paulina J.M. Bank, Aadjan J.C. van der Helm, and Valentijn T. Visch</i>	
Motion Parallax Representation for Indirect Augmented Reality .....	105
<i>Fumio Okura, Yuya Nishizaki, Tomokazu Sato, Norihiko Kawai, and Naokazu Yokoya</i>	
Indoor Localisation and Navigation on Augmented Reality Devices .....	107
<i>Gaurav Gupta, Nishant Kejriwal, Prasun Pallav, Ehtesham Hassan, Swagat Kumar, and Ramya Hebbalaguppe</i>	
Technical Concept and Technology Choices for Implementing a Tangible Version of the Sokoban Game .....	113
<i>Granit Luzhnica, Christoffer Öjeling, Eduardo Veas, and Viktoria Pammer</i>	
Enhancing Immersive Cinematic Experience with Augmented Virtuality .....	115
<i>Gun A. Lee, Joshua Chen, Mark Billingham, and Robert Lindeman</i>	
Diminishing Real Objects and Adding Virtual Objects Using a RGB-D Camera .....	117
<i>Hajime Sasanuma, Yoshitsugu Manabe, and Noriko Yata</i>	
Frustration Free Pose Computation For Spatial AR Devices in Industrial Scenario .....	121
<i>Hemal Naik, Mahmoud Bahaa, Federico Tombari, Peter Keitler, and Nassir Navab</i>	
Low-Cost Depth Camera Pose Tracking for Mobile Platforms .....	123
<i>Insung Ihm, Youngwook Kim, Jaehyun Lee, Jiman Jeong, and Ingu Park</i>	
iRay: Mobile AR Using Structure Sensor .....	127
<i>Ioannis A. Kakadiaris, Mohammad M. Islam, Tian Xie, Christophoros Nikou, and Alan B. Lumsden</i>	
3D Character Customization for Non-Professional Users in Handheld Augmented Reality .....	129
<i>Iris Seidinger and Jens Grubert</i>	
I Want to Change My Floor: Dominant Plane Recognition from a Single Image to Augment the Scene.....	135
<i>J. A. de Jesús Osuna-Coutiño, Claudia Cruz-Martínez, Jose Martinez-Carranza, Miguel Arias-Estrada, and Walterio Mayol-Cuevas</i>	

The RealityMashers: Augmented Reality Wide Field-of-View Optical See-Through Head Mounted Displays .....	141
<i>Jaron Lanier, Victor Mateevitsi, Kishore Rathinavel, Lior Shapira, Joseph Menke, Patrick Therien, Joshua Hudman, Gheric Speiginer, Andrea Stevenson Won, Andrzej Banburski, Xavier Benavides, Judith Amores, Javier Porras Lurashi, and Wayne Chang</i>	
Distributed Optimization for Shadow Removal in Spatial Augmented Reality .....	147
<i>Jun Tsukamoto, Daisuke Iwai, and Kenji Kashima</i>	
IoT Platform-based iAR: a Prototype for Plant O&M Applications .....	149
<i>Jungmin Lee, Kyungho Lee, Byeongwook Nam, and Yuepeng Wu</i>	
Chromaticity Based Local Linear Regression for Color Distortion Estimation of Optical See-Through Displays .....	151
<i>Kang-Kyu Lee, Jae-Woo Kim, Je-Ho Ryu, and Jong-Ok Kim</i>	
Modeling Physical Structure as Additional Constraints for Stereoscopic Optical See-Through Head-Mounted Display Calibration .....	154
<i>Long Qian, Alexander Winkler, Bernhard Fuerst, Peter Kazanzides, and Nassir Navab</i>	
Reduction of Interaction Space in Single Point Active Alignment Method for Optical See-Through Head-Mounted Display Calibration .....	156
<i>Long Qian, Alexander Winkler, Bernhard Fuerst, Peter Kazanzides, and Nassir Navab</i>	
A Transitional AR Furniture Arrangement System with Automatic View Recommendation .....	158
<i>Mami Mori, Jason Orlosky, Kiyoshi Kiyokawa, and Haruo Takemura</i>	
<i>Riverwalk: Incorporating Historical Photographs in Public Outdoor Augmented Reality Experiences</i> .....	160
<i>Marco Cavallo, Geoffrey Alan Rhodes, and Angus Graeme Forbes</i>	
Designing AR Systems to Explore Point-of-View, Bias, and Trans-cultural Conflict .....	166
<i>Maribeth Gandy, Laura Levy, Scott Robertson, Jeremy Johnson, Jeff Wilson, Tony Lemieux, Susan Tamasi, Darlene Mashman, Michele Sumler, and Laureen L. Hill</i>	
Using Visual Effects to Facilitate Depth Perception for Spatial Tasks in Virtual and Augmented Reality .....	172
<i>Marina A. Cidota, Rory M.S. Clifford, Stephan G. Lukosch, and Mark Billinghurst</i>	
Acceptability of an A2R Application: Analysis of Correlations between Factors in a TAM .....	178
<i>Maritzol Tenemaza, Jaime Ramírez, and Angélica de Antonio</i>	
A LED-Based IR/RGB End-to-End Latency Measurement Device .....	184
<i>Markus Billeter, Gerhard Röthlin, Jan Wezel, Daisuke Iwai, and Anselm Grundhöfer</i>	
Real-Time High Resolution 3D Data on the HoloLens .....	189
<i>Mathieu Garon, Pierre-Olivier Boulet, Jean-Philippe Doironz, Luc Beaulieu, and Jean-François Lalonde</i>	
Evaluating Positional Head-Tracking in Immersive VR for 3D Designers .....	192
<i>Max Krichenbauer, Goshiro Yamamoto, Takafumi Taketomi, Christian Sandor, Hirokazu Kato, and Steven Feiner</i>	

Augmented Cues Facilitate Learning Transfer from Virtual to Real Environments .....	194
<i>Natalia Cooper, Ferdinando Milella, Iain Cant, Carlo Pinto, Mark White, and Georg Meyer</i>	
Simultaneous Pose Estimation and Augmentation of Elastic Surfaces from a Moving Monocular Camera .....	199
<i>Nazim Haouchine, Marie-Odile Berger, and Stephane Cotin</i>	
HORUS EYE: See the Invisible Bird and Snake Vision for Augmented Reality Information Visualization .....	203
<i>Neven A. M. ElSayed, Ross T. Smith, and Bruce H. Thomas</i>	
An Artistic and Curatorial Installation in Virtual Reality: The Development of an Artistic Low-Cost Interface at University .....	209
<i>Pablo Gobira and Antônio Mozelli</i>	
A Tangible Volume for Portable 3D Interaction .....	215
<i>Paul Issartel, Lonni Besançon, Tobias Isenberg, and Mehdi Ammi</i>	
An AR Inspection Framework: Feasibility Study with Multiple AR Devices .....	221
<i>Perla Ramakrishna, Ehtesham Hassan, Ramya Hebbalaguppe, Monika Sharma, Gaurav Gupta, Lovekesh Vig, Geetika Sharma, and Gautam Shroff</i>	
PoLAR: A Portable Library for Augmented Reality .....	227
<i>Pierre-Jean Petitprez, Erwan Kerrien, and Pierre-Frederic Villard</i>	
Evaluation of Motion Tracking and Depth Sensing Accuracy of the Tango Tablet .....	231
<i>Rafael Roberto, João Paulo Lima, Thúlio Araújo, and Veronica Teichrieb</i>	
An Evaluation of Information Connection in Augmented Reality for 3D Scenes with Occlusion .....	235
<i>Ralf Dauenhauer and Tobias Müller</i>	
On Combining a Semi-Calibrated Stereo Camera and Massive Parallelism for Fast Plane Extraction .....	238
<i>Roberto de Lima, Jose Martinez-Carranza, Alicia Morales-Reyes, and Walterio Mayol-Cuevas</i>	
Reflectance and Illumination Estimation for Realistic Augmentations of Real Scenes .....	244
<i>Salma Jiddi, Philippe Robert, and Eric Marchand</i>	
Use of Random Dot Pattern for Achieving X-Ray Vision with Stereoscopic Augmented Reality Displays .....	250
<i>Sanaz Ghasemi, Mai Otsuki, and Paul Milgram</i>	
A Low Cost Optical See-Through HMD - Do-It-Yourself .....	252
<i>Saul Delabrida, Antonio A. F. Loureiro, Thiago D'Angelo, Ricardo A. Rabelo Oliveira, Bruce Thomas, Edson Carvalho, and Mark Billinghurst</i>	
Randomly Distributed Small Chip Makers .....	258
<i>Sei Ikeda, Anh Nguyen Trung, Takumi Komae, Fumihisa Shibata, and Asako Kimura</i>	
Integrating Building Information Modeling with Augmented Reality for Interdisciplinary Learning .....	260
<i>Shahin Vassigh, Albert Elias, Francisco R. Ortega, Debra Davis, Giovanna Gallardo, Hadi Alhaffar, Lukas Borges, Jonathan Bernal, and Naphtali D. Rishe</i>	

GestAR: Real Time Gesture Interaction for AR with Egocentric View.....	262
<i>Srinidhi Hegde, Ramakrishna Perla, Ramya Hebbalaguppe, and Ehtesham Hassan</i>	
Motion-Aware Iterative Closest Point Estimation for Fast Visual Odometry.....	268
<i>Ting-Yu Lin, Chun-Wei Chen, Jonas Wang, and Ming-Der Shieh</i>	
Effective Registration for Multiple Users AR System.....	270
<i>Wen-Jie Chen, Chun-Wei Chen, Jonas Wang, and Ming-Der Shieh</i>	
Learning Object and State Models for AR Task Guidance.....	272
<i>William Hoff and Hao Zhang</i>	
Empower VR Art and AR Book with Spatial Interaction.....	274
<i>Yang Xiang Zhang, ZiQiang Zhu, and Zhu Yun</i>	
On Stage Interactive Spatial AR for Drama Performance.....	280
<i>YanXiang Zhang and ZiQiang Zhu</i>	
Augmenting Three-dimensional Effects in Digital Exhibition of a Cultural Artifact using 3D Pseudo Hologram.....	284
<i>Yong Yi Lee, Bilal Ahmed, Jong Hun Lee, Hyounggap An, and Kwan H. Lee</i>	
AR Tabletop Interface using a Head-Mounted Projector.....	288
<i>Yusuke Kemmoku and Takashi Komuro</i>	

## 2nd International Workshop on Diminished Reality as Challenging Issue in Mixed and Augmented Reality (IWDR2016)

Workshop Summary.....	xxxii
<i>Hideo Saito, Fumihisa Shibata, Hideyuki Tamura, and Shohei Mori</i>	
Detour Light Field Rendering for Diminished Reality Using Unstructured Multiple Views.....	292
<i>Shohei Mori, Momoko Maezawa, Naoto Ienaga, and Hideo Saito</i>	
First Deployment of Diminished Reality for Anatomy Education.....	294
<i>Naoto Ienaga, Felix Bork, Siim Meerits, Shohei Mori, Pascal Fallavollita, Nassir Navab, and Hideo Saito</i>	
Diminished Reality for Acceleration - Motion Sickness Reduction with Vection for Autonomous Driving.....	297
<i>Taishi Sawabe, Masayuki Kanbara, and Norihiro Hagita</i>	

## Perceptual Issues in Augmented Reality Workshop

Workshop Summary.....	xxxii
<i>Guillaume Moreau and Yue Liu</i>	

Exploring Immersive AR Instructions for Procedural Tasks: The Role of Depth, Motion, and Volumetric Representations .....	300
<i>Stefano Baldassi, Grace T. Cheng, Jonathan Chan, Moqian Tian, Tim Christie, and Matthew T. Short</i>	
Human Attention and fatigue for AR Head-Up Displays.....	306
<i>Haruhiko Okumura and Kazumitsu Shinohara</i>	
Perceptual Issues of a Passive Haptics Feedback Based MR System .....	310
<i>Zhizhuo Yang, Dongdong Weng, Zhengliang Zhang, Yufeng Li, and Yue Liu</i>	

## Media, Arts, Social Sciences, Humanities & Design (MASH'D) Workshop

Workshop Summary.....	xxxiii
<i>Jorge Ramirez, Julian Stadon, and Thomas Sanchez</i>	
AR-Based Learning and AR Guides as Strategy in Two-Phase Learning Enhancement: A Case Study.....	318
<i>Yu-Ru Huang, Jia Zhang, Tzu-Chien Liu, Yao-Ting Sung, Kuo-En Chang, and Min-Jung Yang</i>	
Camouflage as an Adaptive Control System: Applications for Multimedia and Interactive Composition.....	322
<i>Pablo Padilla Longoria, Jaime Alonso, and Lobato Cardoso</i>	
Organic Data Feeding: Synthesizing Digital World Phenomena Using Natural Data as a Source .....	327
<i>neurohacker @ The Human BIOS Project</i>	

## Standards for Mixed and Augmented Reality Workshop

Workshop Summary.....	xxxiv
<i>Gerard J. Kim</i>	

## Workshop on Collaborative Mixed Reality Environments (CoMiRE)

Workshop Summary.....	xxxv
<i>Stephan Lukosch, Leila Alem, Mark Billingham, Steven Feiner, Kiyoshi Kiyokawa, and Michael Prilla</i>	

## Interaction Design Principles of Augmented Reality Focusing on the Ageing Population Workshop

Workshop Summary.....	xxxvii
<i>Chris Roast, Elizabeth Uruchurtu, and Sha Liang</i>	

# Workshop on Human Behavior Analysis and Visualization for Collective Visual Sensing

Workshop Summary.....	xxxviii
<i>Hideo Saito, Yuta Itoh, and Maki Sugimoto</i>	

## Demonstrations

Mixed Reality Extended TV .....	332
<i>Caroline Baillard, Vincent Alleaume, Matthieu Fradet, Pierrick Jouet, Anthony Laurent, Tao Luo, Philippe Robert, and Fabien Servant</i>	
EyeAR: Refocusable Augmented Reality Content through Eye Measurements .....	334
<i>Damien Constantine Rompapas, Aitor Rovira, Sei Ikeda, Alexander Plopski, Takafumi Taketomi, Christian Sandor, and Hirokazu Kato</i>	
Blurry (Sticky) Finger: Proprioceptive Pointing and Selection of Distant Objects for Optical See-Through Based Augmented Reality .....	336
<i>Ja Eun Yu and Gerard J. Kim</i>	
Scalable Mobile Image Recognition for Real-Time Video Annotation.....	338
<i>Philipp Fleck, Clemens Arth, and Dieter Schmalstieg</i>	
Robust Keyframe-Based Monocular SLAM for Augmented Reality .....	340
<i>Haomin Liu, Guofeng Zhang, and Hujun Bao</i>	
A Remote Collaboration System with Empathy Glasses .....	342
<i>Youngho Lee, Katsutoshi Masai, Kai Kunze, Maki Sugimoto, and Mark Billinghurst</i>	
TeachAR: An Interactive Augmented Reality Tool for Teaching Basic English to Non-native Children .....	344
<i>Che Samihah Che Dalim, Thammathip Piumsomboon, Arindam Dey, Mark Billinghurst, and Shahrizal Sunar</i>	
From CAD to 3D Tracking - Enhancing & Scaling Model-Based Tracking for Industrial Appliances .....	346
<i>Harald Wuest, Timo Engekle, Folker Wientapper, Florian Schmitt, and Jens Keil</i>	
AR4AR Based on ARVIDA Reference Architecture: Application Demonstration .....	348
<i>Frieder Pankratz and Gudrun Klinker</i>	
Collaborative Content Creation with the OpenUIX Framework .....	350
<i>Mikel Salazar and Carlos Laorden</i>	
The Object of Absence .....	351
<i>Amauta García, David Camargo, Xchel Gallegos, Rubén Maldonado, Estrella Luna, Daniel Godínez, Adrián Monroy, Jaime Lobato, and Erika Athié</i>	
Participatory Mixed Reality Space: Collective Memories .....	353
<i>Yun Tae Nam and Je-ho Oh</i>	

InspectAR: An Augmented Reality Inspection Framework for Industry .....	355
<i>Ramakrishna Perla, Gaurav Gupta, Ramya Hebbalaguppe, and Ehtesham Hassan</i>	
deBallution - Interactive Artwork by Throwing Pseudo Balls Based on Cultural Heritages .....	357
<i>Je-ho Oh, So-young Kim, Yun Tae Nam, and Chung-kon Shi</i>	
Author Index .....	359