

Lecture Notes in Artificial Intelligence 7502

Subseries of Lecture Notes in Computer Science

LNAI Series Editors

Randy Goebel

University of Alberta, Edmonton, Canada

Yuzuru Tanaka

Hokkaido University, Sapporo, Japan

Wolfgang Wahlster

DFKI and Saarland University, Saarbrücken, Germany

LNAI Founding Series Editor

Joerg Siekmann

DFKI and Saarland University, Saarbrücken, Germany

Yukiko Nakano Michael Neff Ana Paiva
Marilyn Walker (Eds.)

Intelligent Virtual Agents

12th International Conference, IVA 2012
Santa Cruz, CA, USA, September, 12-14, 2012
Proceedings

Series Editors

Randy Goebel, University of Alberta, Edmonton, Canada
Jörg Siekmann, University of Saarland, Saarbrücken, Germany
Wolfgang Wahlster, DFKI and University of Saarland, Saarbrücken, Germany

Volume Editors

Yukiko Nakano
Michael Neff
Ana Paiva
Marilyn Walker

University of California
Baskin School of Engineering
1156 N. High SOE-3
Santa Cruz, CA 95064, USA

E-mails:
y.nakano@st.seikei.ac.jp
neff@cs.ucdavis.edu
paiva.a@gmail.com
maw@soe.ucsc.edu

ISSN 0302-9743
ISBN 978-3-642-33196-1
DOI 10.1007/978-3-642-33197-8
Springer Heidelberg Dordrecht London New York

e-ISSN 1611-3349
e-ISBN 978-3-642-33197-8

Library of Congress Control Number: 2012945668

CR Subject Classification (1998): I.2.11, I.2, H.4-5, D.2, I.4-5, H.3, I.6

LNCS Sublibrary: SL 7 – Artificial Intelligence

© Springer-Verlag Berlin Heidelberg 2012

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, 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.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

Welcome to the proceedings of the 12th International Conference on Intelligent Virtual Agents. IVA is an interdisciplinary annual conference and the main forum for presenting research on modeling, developing, and evaluating intelligent virtual agents with a focus on communicative abilities and social behavior.

This conference represents a field of specialization within computer science, artificial intelligence, and human-machine interaction that aims at creating interactive characters that exhibit human-like qualities and communicate with humans or with each other in a natural way. Intelligent virtual agents should be capable of real-time perception, cognition, and action that allows them to participate in dynamic social environments. Creating these computational models involves the integration of knowledge, methodologies, and theories from a wide range of fields such as sociology, psychology, computer science, artificial intelligence, linguistics, cognitive science, and computer graphics.

IVA was started in 1998 as a workshop on Intelligent Virtual Environments at the European Conference on Artificial Intelligence in Brighton, UK, which was followed by a similar event in 1999 in Salford, Manchester. Then, dedicated stand-alone IVA conferences took place in Madrid, Spain, in 2001, Irsee, Germany, in 2003, and Kos, Greece, in 2005. Since 2006, IVA has become a full-fledged annual international event, which was first held in Marina del Rey, California, then Paris, France, in 2007, Tokyo, Japan, in 2008, Amsterdam, The Netherlands, in 2009, Philadelphia, Pennsylvania, in 2010, and Reykjavik, Iceland in 2011.

This year's conference was held in Santa Cruz, California, USA, September 12–14, 2012. It combined a wide range of expertise, from different scientific and artistic disciplines, and highlighted the value of both theoretical and practical work as necessary components to bring intelligent virtual agents to life.

The special topic of IVA 2012 was games and story telling. This topic touches on many aspects of intelligent virtual agent theory and applications. Narrative and story telling is a fundamental aspect of human experience. Telling a coherent compelling narrative involves integration of multimodal presentation functionalities such as speech, gesture, and facial expressions; coherent use of discourse context and appropriate contextual verbal and nonverbal gestures, the ability to portray personality and emotions, and an ability to monitor the audience and their reaction to the story. The talks by the three invited speakers addressed different aspects of essential requirements for IVAs. The talk by Noah Wardrip-Fruin from UCSC discussed different types of characters needed for gaming and narrative applications of IVAs. The talk by Jeremy Bailenson from Stanford discussed expressive gestures and how agents orient to one another by modifying their gestural expression in dialogic contexts. Rolf Pfeifer from Zurich discussed how embodiment affects intelligent agents' perceptions and behavior. One of the

sessions at IVA 2012 was dedicated to paper presentations focusing on agents in gaming and story-telling environments.

IVA 2012 received 84 submissions. Out of the 74 long-paper submissions, only 17 were accepted for the long-papers track. Furthermore, there were 31 short papers presented in the single-track paper session, and 18 poster papers were on display.

IVA continues to develop and improve the anonymous reviewing process. This year continued the author rebuttal phase begun with IVA 2011, which led to more informed discussion of the papers. The Senior Program Committee was enlarged this year and given a more active role in reviewer recruitment.

Since 2005, IVA has also hosted the Gathering of Animated Lifelike Agents (GALA), a festival to showcase state-of-the-art agents created by student, academic, or industrial research groups. This year, the GALA event was combined with a demo event where participants were also able to demonstrate their latest results.

This year's IVA also included two workshops. One on "Multimodal Analyses Enabling Artificial Agents in Human-Machine Interaction" and one focusing on "Real-Time Conversations with Virtual Agents."

There were many people that contributed their time and talent in order to make IVA possible. First, we would like to thank the members of the Senior Program Committee that took on the great responsibility of making sure that the reviewing for papers in their sections was done on time, in a smooth and professional way, with thoughtful and respectful discussion of submitted work. Also, the Program Committee members dedicated significant time and genuine effort to provide thoughtful paper reviews. The contributions of the SPC and PC were essential to assembling a quality program. We also want to thank our keynote speakers, Jeremy Bailenson from Stanford University, Noah Wardrip-Fruin from the University of California, Santa Cruz, and Rolf Pfeifer from the University of Zurich, for crossing domains and sharing their insights with us. The Center for Games and Playable Media at UCSC helped develop our web presence and conference organization. We would also like to thank Jennifer Bloom at UCSC Conference Services for supporting the conference administration.

Of course, IVA 2012 would not have been possible without all the authors, whose contributions extend beyond the creation of intelligent virtual agents to the creation and support of a vibrant research community, fostering our even deeper passion for this challenging field of research.

September 2012

Marilyn Walker
Michael Neff
Ana Paiva
Yukiko Nakano

Organization

Conference Co-chairs

Marilyn Walker	University of California - Santa Cruz, USA
Michael Neff	University of California - Davis, USA
Ana Paiva	INESC-ID and Instituto Superior Tecnico, Lisbon, Portugal
Yukiko I. Nakano	Seikei University, Japan

GALA/Poster and Demo Chair

Arnav Jhala	University of California - Santa Cruz, USA
-------------	--

Workshop Chair

Jean-Claude Martin	LIMSI-CNRS, France
--------------------	--------------------

Senior Program Committee

Elisabeth André	Augsburg University, Germany
Ruth Aylett	Heriot-Watt University, UK
Norm Badler	University of Pennsylvania, USA
Tim Bickmore	Northeastern University, USA
Christina Conati	University of British Columbia, Canada
Dirk Heylen	University of Twente, The Netherlands
Michael Kipp	University of Applied Sciences Augsburg, Germany
Stefan Kopp	Bielefeld University, Germany
James Lester	North Carolina State, USA
Stacy Marsella	University of Southern California, USA
Jean-Claude Martin	LIMSI-CNRS, France
Catherine Pelachaud	CNRS, TELECOM ParisTech, France
Mark Riedl	Georgia Institute of Technology, USA
Hannes Vilhjalmsson	Reykjavík University, Iceland
Michael Young	North Carolina State, USA

Program Committee

Jan Allbeck	Jihie Kim	Matthias Rehm
Ivon Arroyo	Tomoko Koda	Dennis Reidsma
Ryan Baker	Brigitte Krenn	Charles Rich
Christian Becker-Asano	Michael Kriegel	Laurel Riek
Kirsten Bergmann	Arjan Kuijper	Albert Rilliard
Kristy Boyer	Chad Lane	David Roberts
Hendrik Buschmeier	Jina Lee	Mercedes Rodrigo
Angelo Cafaro	Brian Magerko	Jon Rowe
Marc Cavazza	Louis-Philippe Morency	Zsofia Ruttkay
Morteza Dehghani	Kasia Muldner	Nicolas Sabouret
Sidney D'Mello	Asad Nazir	Daniel Schulman
Jens Edlund	Radoslaw Niewiadomski	Magy Seif El-Nasr
Arjan Egges	Santiago Ontanon	Mei Si
Birgit Endrass	Jeff Orkin	Candy Sidner
Friederike Eyssel	Sabine Payr	Nicolas Szilas
Patrick Gebhard	Christopher Peters	Mariiet Theune
Marco Gillies	Paolo Petta	Jim Thomas
Jonathan Gratch	Laura Pfeifer	David Traum
Alexis Heloir	Thies Pfeiffer	Ning Wang
Rania Hodhod	Ronald Poppe	Langxuan Yin
Ian Horswill	Rui Prada	Jichen Zhu
Yvonne Jung	David Pynadath	Amy Ogan
Sinhwa Kang	Stefan Rank	Astrid von der Putten

Reviewers

Alok Baikadi	Eunyoung Ha	Chris Mitchell
Ginevra Castellano	Hazael Jones	Stefan Scherer
Cathy Ennis	Jennifer Klatt	Sybren A. Stüvel
Mohamed Gawish	Seung Lee	Weizi Li
Joseph Grafsgaard	Wookhee Min	

Sponsoring Institutions

Center for Games and Playable Media, UCSC

Table of Contents

IVAs for Learning Environments

Fully Automated Generation of Question-Answer Pairs for Scripted Virtual Instruction	1
<i>Pascal Kuyten, Timothy Bickmore, Svetlana Stoyanchev, Paul Piwek, Helmut Prendinger, and Mitsuru Ishizuka</i>	
The Virtual Apprentice	15
<i>Weizi Li and Jan M. Allbeck</i>	
The City of Uruk: Teaching Ancient History in a Virtual World	28
<i>Anton Bogdanovych, Kiran Ijaz, and Simeon Simoff</i>	
An Analysis of the Dialogic Complexities in Designing a Question/Answering Based Conversational Agent for Preschoolers	36
<i>Anuj Tewari, Ingrid Liu, Carrie Cai, and John Canny</i>	
Building Autonomous Social Partners for Autistic Children	46
<i>Sara Bernardini, Kaska Porayska-Pomsta, Tim J. Smith, and Katerina Avramides</i>	

Emotion and Personality

The Effect of Virtual Agents' Emotion Displays and Appraisals on People's Decision Making in Negotiation	53
<i>Celso M. de Melo, Peter Carnevale, and Jonathan Gratch</i>	
First Impressions: Users' Judgments of Virtual Agents' Personality and Interpersonal Attitude in First Encounters	67
<i>Angelo Cafaro, Hannes Högni Vilhjálmsson, Timothy Bickmore, Dirk Heylen, Kamilla Rún Jóhannsdóttir, and Gunnar Steinn Valgarðsson</i>	
A Study of Emotional Contagion with Virtual Characters	81
<i>Jason Tsai, Emma Bowring, Stacy Marsella, Wendy Wood, and Milind Tambe</i>	
Longitudinal Affective Computing: Virtual Agents That Respond to User Mood	89
<i>Lazlo Ring, Timothy Bickmore, and Daniel Schulman</i>	

Generating Norm-Related Emotions in Virtual Agents	97
<i>Nuno Ferreira, Samuel Mascarenhas, Ana Paiva, Frank Dignum, John Mc Breen, Nick Degens, and Gert Jan Hofstede</i>	

Virtual Agents in Conflict	105
<i>Henrique Campos, Joana Campos, Carlos Martinho, and Ana Paiva</i>	

Evaluation and Empirical Studies (1)

How Do You Like Me in This: User Embodiment Preferences for Companion Agents	112
<i>Elena Márquez Segura, Michael Kriegel, Ruth Aylett, Amol Deshmukh, and Henriette Cramer</i>	

A Second Chance to Make a First Impression? How Appearance and Nonverbal Behavior Affect Perceived Warmth and Competence of Virtual Agents over Time	126
<i>Kirsten Bergmann, Friederike Eyssel, and Stefan Kopp</i>	

Spatial Misregistration of Virtual Human Audio: Implications of the Precedence Effect	139
<i>David M. Krum, Evan A. Suma, and Mark Bolas</i>	

Virtual Human Personality Masks: A Human Computation Approach to Modeling Verbal Personalities in Virtual Humans	146
<i>Vaishnavi Krishnan, Adriana Foster, Regis Kopper, and Benjamin Lok</i>	

The Effect of Visual Gender on Abuse in Conversation with ECAs	153
<i>Annika Silvervarg, Kristin Raukola, Magnus Haake, and Agneta Gulz</i>	

Multimodal Perception and Expression

Modeling Speaker Behavior: A Comparison of Two Approaches	161
<i>Jina Lee and Stacy Marsella</i>	

An Incremental Multimodal Realizer for Behavior Co-Articulation and Coordination	175
<i>Herwin van Welbergen, Dennis Reidsma, and Stefan Kopp</i>	

Thalamus: Closing the Mind-Body Loop in Interactive Embodied Characters	189
<i>Tiago Ribeiro, Marco Vala, and Ana Paiva</i>	

Lip-Reading: Furhat Audio Visual Intelligibility of a Back Projected Animated Face	196
<i>Samer Al Moubayed, Gabriel Skantze, and Jonas Beskow</i>	

Subjective Optimization	204
<i>Chung-Cheng Chiu and Stacy Marsella</i>	
Understanding the Nonverbal Behavior of Socially Anxious People during Intimate Self-disclosure	212
<i>Sin-Hwa Kang, Albert (Skip) Rizzo, and Jonathan Gratch</i>	

Narrative and Interactive Applications

Virtual Reality Negotiation Training Increases Negotiation Knowledge and Skill	218
<i>Joost Broekens, Maaïke Harbers, Willem-Paul Brinkman, Catholijn M. Jonker, Karel Van den Bosch, and John-Jules Meyer</i>	
Towards Multimodal Expression of Laughter	231
<i>Radosław Niewiadomski and Catherine Pelachaud</i>	
Ada and Grace: Direct Interaction with Museum Visitors	245
<i>David Traum, Priti Aggarwal, Ron Artstein, Susan Foutz, Jillian Gerten, Athanasios Katsamanis, Anton Leuski, Dan Noren, and William Swartout</i>	
Spatial Cues in Hamlet	252
<i>Christine Talbot and G. Michael Youngblood</i>	
Interactive Stories and Motivation to Read in the Raft Dyslexia Fluency Tutor	260
<i>Arthur Ward, Margaret McKeown, Carol Utay, Olga Medvedeva, and Rebecca Crowley</i>	
Integrating Backchannel Prediction Models into Embodied Conversational Agents	268
<i>Iwan de Kok and Dirk Heylen</i>	

Social Interaction

Incremental Dialogue Understanding and Feedback for Multiparty, Multimodal Conversation	275
<i>David Traum, David DeVault, Jina Lee, Zhiyang Wang, and Stacy Marsella</i>	
Designing Relational Agents as Long Term Social Companions for Older Adults	289
<i>Laura Pfeifer Vardoulakis, Lazlo Ring, Barbara Barry, Candace L. Sidner, and Timothy Bickmore</i>	
A Cognitive Model for Social Role Compliant Behavior of Virtual Agents	303
<i>Jeroen de Man, Annerieke Heuvelink, and Karel van den Bosch</i>	

A Cognitive Social Agent Architecture for Cooperation in Social Simulations	311
<i>Jackeline Spinola and Ricardo Imbert</i>	
A Model for Social Regulation of User-Agent Relationships	319
<i>Sandra Gama, Gabriel Barata, Daniel Gonçalves, Rui Prada, and Ana Paiva</i>	

Authoring and Tools

Using Collaborative Discourse Theory to Partially Automate Dialogue Tree Authoring	327
<i>Charles Rich and Candace L. Sidner</i>	
Authoring Rules for Bodily Interaction: From Example Clips to Continuous Motions	341
<i>Klaus Förger, Tapio Takala, and Roberto Pugliese</i>	
Expressive Body Animation Pipeline for Virtual Agent	355
<i>Jing Huang and Catherine Pelachaud</i>	
The Turning, Stretching and Boxing Technique: A Step in the Right Direction	363
<i>Mark Dunne, Brian Mac Namee, and John Kelleher</i>	
From Their Environment to Their Behavior: A Procedural Approach to Model Groups of Virtual Agents	370
<i>Rafael Hocevar, Fernando Marson, Vinícius Cassol, Henry Braun, Rafael Bidarra, and Soraia R. Musse</i>	

Evaluation and Empirical Studies (2)

Social Evaluation of Artificial Agents by Language Varieties	377
<i>Brigitte Krenn, Stephanie Schreitter, Friedrich Neubarth, and Gregor Sieber</i>	
Empirical Validation of an Accommodation Theory-Based Model of User-Agent Relationship	390
<i>Timothy Bickmore and Daniel Schulman</i>	
Cultural Study on Speech Duration and Perception of Virtual Agent's Nodding	404
<i>Tomoko Koda, Haruka Kishi, Takanori Hamamoto, and Yota Suzuki</i>	

Cultural Behaviors of Virtual Agents in an Augmented Reality Environment	412
<i>Mohammad Obaid, Ionut Damian, Felix Kistler, Birgit Endrass, Johannes Wagner, and Elisabeth André</i>	
Frown More, Talk More: Effects of Facial Expressions in Establishing Conversational Rapport with Virtual Agents	419
<i>Joshua Wong Wei-Ern and Kevin McGee</i>	

Conceptual Frameworks

Characters with Personality!	426
<i>Karel Van den Bosch, Arjen Brandenburgh, Tijmen Joppe Muller, and Annerieke Heuvelink</i>	
A Formal Architecture of Shared Mental Models for Computational Improvisational Agents	440
<i>Rania Hodhod, Andrey Piplica, and Brian Magerko</i>	
A Reasoning Module to Select ECA's Communicative Intention	447
<i>Jeremy Riviere, Carole Adam, and Sylvie Pesty</i>	
Perception Markup Language: Towards a Standardized Representation of Perceived Nonverbal Behaviors	455
<i>Stefan Scherer, Stacy Marsella, Giota Stratou, Yuyu Xu, Fabrizio Morbini, Alesia Egan, Albert (Skip) Rizzo, and Louis-Philippe Morency</i>	
Flexible Conversation Management Using a BDI Agent Approach	464
<i>Wilson Wong, Lawrence Cavedon, John Thangarajah, and Lin Padgham</i>	

Poster Abstracts

Synthesising and Evaluating Cross-Modal Emotional Ambiguity in Virtual Agents	471
<i>Matthew P. Aylett and Blaise Potard</i>	
Immersive Interfaces for Building Parameterized Motion Databases	474
<i>Yazhou Huang, Carlo Camporesi, and Marcelo Kallmann</i>	
Creating Personalized and Distributed Virtual Learning Spaces through the Use of i-Collaboration 3.0	477
<i>Eduardo A. Oliveira, Patricia Tedesco, and Thun Pin T.F. Chiu</i>	
Eliciting Gestural Feedback in Chinese and Swedish Informal Interactions	480
<i>Jia Lu</i>	

Locus of Control in Conversational Agent Design: Effects on Older Users' Interactivity and Social Presence	483
<i>Veena Chattaraman, Wi-Suk Kwon, Juan Gilbert, and Shelby Darnell</i>	
Online Behavior Evaluation with the Switching Wizard of Oz	486
<i>Ronald Poppe, Mark ter Maat, and Dirk Heylen</i>	
Modeling the Multi-modal Behaviors of a Virtual Instructor in Tutoring Ballroom Dance	489
<i>Hung-Hsuan Huang, Yuki Seki, Masaki Uejo, Joo-Ho Lee, and Kyoji Kawagoe</i>	
Hospital Buddy: A Persistent Emotional Support Companion Agent for Hospital Patients	492
<i>Timothy Bickmore, Laila Bukhari, Laura Pfeifer Vardoulakis, Michael Paasche-Orlow, and Christopher Shanahan</i>	
Towards Assessing the Communication Responsiveness of People with Dementia	496
<i>Yuko Nonaka, Yoichi Sakai, Kiyoshi Yasuda, and Yukiko Nakano</i>	
A Conversational Agent for Social Support: Validation of Supportive Dialogue Sequences	499
<i>Janneke M. van der Zwaan, Virginia Dignum, and Catholijn M. Jonker</i>	
Rich Computational Model of Conflict for Virtual Characters	502
<i>Reid Swanson and Arnav Jhala</i>	
A Model for Embodied Cognition in Autonomous Agents	505
<i>Marco Vala, Tiago Ribeiro, and Ana Paiva</i>	
Evaluation of an Affective Model: COR-E	508
<i>Sabrina Campano, Etienne de Sevin, Vincent Corruble, and Nicolas Sabouret</i>	
Evaluation of the Uncanny Valley in CG Characters	511
<i>Vanderson Dill, Laura Mattos Flach, Rafael Hocevar, Christian Lykawka, Soraia R. Musse, and Márcio Sarroglia Pinho</i>	
Full-Body Gesture Interaction with Improvisational Narrative Agents . . .	514
<i>Andrey Piplica, Christopher DeLeon, and Brian Magerko</i>	
Understanding How Well You Understood – Context-Sensitive Interpretation of Multimodal User Feedback	517
<i>Hendrik Buschmeier and Stefan Kopp</i>	

Toward a Computational Model for the Automatic Generation of Character Personality in Interactive Narrative	520
<i>Julio César Bahamón and R. Michael Young</i>	
Efficient Cultural Models of Verbal Behavior for Communicative Agents	523
<i>Alicia Sagae, Jerry R. Hobbs, Suzanne Wertheim, Michael H. Agar, Emily Ho, and W. Lewis Johnson</i>	
Author Index	527