Lecture Notes in Computer Science **11584**

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board Members

David Hutchison
Lancaster University, Lancaster, UK
Takeo Kanade
Carnegie Mellon University, Pittsburgh, PA, USA
Josef Kittler
University of Surrey, Guildford, UK
Jon M. Kleinberg
Cornell University, Ithaca, NY, USA
Friedemann Mattern
ETH Zurich, Zurich, Switzerland
John C. Mitchell
Stanford University, Stanford, CA, USA
Moni Naor
Weizmann Institute of Science, Rehovot, Israel
C. Pandu Rangan
Indian Institute of Technology Madras, Chennai, India
Bernhard Steffen
TU Dortmund University, Dortmund, Germany
Demetri Terzopoulos
University of California, Los Angeles, CA, USA
Doug Tygar
University of California, Berkeley, CA, USA

More information about this series at http://www.springer.com/series/7409

Aaron Marcus · Wentao Wang (Eds.)

Design, User Experience, and Usability

User Experience in Advanced Technological Environments

8th International Conference, DUXU 2019
Held as Part of the 21st HCI International Conference, HCII 2019
Orlando, FL, USA, July 26–31, 2019
Proceedings, Part II

Springer

Editors
Aaron Marcus
Aaron Marcus and Associates
Berkeley, CA, USA

Wentao Wang
Zuoyebang, K12 education
Beijing, China

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-23540-6 ISBN 978-3-030-23541-3 (eBook)
https://doi.org/10.1007/978-3-030-23541-3

LNCS Sublibrary: SL3 – Information Systems and Applications, incl. Internet/Web, and HCI

© Springer Nature Switzerland AG 2019
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, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

The 21st International Conference on Human-Computer Interaction, HCI International 2019, was held in Orlando, FL, USA, during July 26–31, 2019. The event incorporated the 18 thematic areas and affiliated conferences listed on the following page.

A total of 5,029 individuals from academia, research institutes, industry, and governmental agencies from 73 countries submitted contributions, and 1,274 papers and 209 posters were included in the pre-conference proceedings. These contributions address the latest research and development efforts and highlight the human aspects of design and use of computing systems. The contributions thoroughly cover the entire field of human-computer interaction, addressing major advances in knowledge and effective use of computers in a variety of application areas. The volumes constituting the full set of the pre-conference proceedings are listed in the following pages.

This year the HCI International (HCII) conference introduced the new option of "late-breaking work." This applies both for papers and posters and the corresponding volume(s) of the proceedings will be published just after the conference. Full papers will be included in the *HCII 2019 Late-Breaking Work Papers Proceedings* volume of the proceedings to be published in the Springer LNCS series, while poster extended abstracts will be included as short papers in the HCII 2019 *Late-Breaking Work Poster Extended Abstracts* volume to be published in the Springer CCIS series.

I would like to thank the program board chairs and the members of the program boards of all thematic areas and affiliated conferences for their contribution to the highest scientific quality and the overall success of the HCI International 2019 conference.

This conference would not have been possible without the continuous and unwavering support and advice of the founder, Conference General Chair Emeritus and Conference Scientific Advisor Prof. Gavriel Salvendy. For his outstanding efforts, I would like to express my appreciation to the communications chair and editor of *HCI International News,* Dr. Abbas Moallem.

July 2019 Constantine Stephanidis

HCI International 2019 Thematic Areas and Affiliated Conferences

Thematic areas:

- HCI 2019: Human-Computer Interaction
- HIMI 2019: Human Interface and the Management of Information

Affiliated conferences:

- EPCE 2019: 16th International Conference on Engineering Psychology and Cognitive Ergonomics
- UAHCI 2019: 13th International Conference on Universal Access in Human-Computer Interaction
- VAMR 2019: 11th International Conference on Virtual, Augmented and Mixed Reality
- CCD 2019: 11th International Conference on Cross-Cultural Design
- SCSM 2019: 11th International Conference on Social Computing and Social Media
- AC 2019: 13th International Conference on Augmented Cognition
- DHM 2019: 10th International Conference on Digital Human Modeling and Applications in Health, Safety, Ergonomics and Risk Management
- DUXU 2019: 8th International Conference on Design, User Experience, and Usability
- DAPI 2019: 7th International Conference on Distributed, Ambient and Pervasive Interactions
- HCIBGO 2019: 6th International Conference on HCI in Business, Government and Organizations
- LCT 2019: 6th International Conference on Learning and Collaboration Technologies
- ITAP 2019: 5th International Conference on Human Aspects of IT for the Aged Population
- HCI-CPT 2019: First International Conference on HCI for Cybersecurity, Privacy and Trust
- HCI-Games 2019: First International Conference on HCI in Games
- MobiTAS 2019: First International Conference on HCI in Mobility, Transport, and Automotive Systems
- AIS 2019: First International Conference on Adaptive Instructional Systems

Pre-conference Proceedings Volumes Full List

1. LNCS 11566, Human-Computer Interaction: Perspectives on Design (Part I), edited by Masaaki Kurosu
2. LNCS 11567, Human-Computer Interaction: Recognition and Interaction Technologies (Part II), edited by Masaaki Kurosu
3. LNCS 11568, Human-Computer Interaction: Design Practice in Contemporary Societies (Part III), edited by Masaaki Kurosu
4. LNCS 11569, Human Interface and the Management of Information: Visual Information and Knowledge Management (Part I), edited by Sakae Yamamoto and Hirohiko Mori
5. LNCS 11570, Human Interface and the Management of Information: Information in Intelligent Systems (Part II), edited by Sakae Yamamoto and Hirohiko Mori
6. LNAI 11571, Engineering Psychology and Cognitive Ergonomics, edited by Don Harris
7. LNCS 11572, Universal Access in Human-Computer Interaction: Theory, Methods and Tools (Part I), edited by Margherita Antona and Constantine Stephanidis
8. LNCS 11573, Universal Access in Human-Computer Interaction: Multimodality and Assistive Environments (Part II), edited by Margherita Antona and Constantine Stephanidis
9. LNCS 11574, Virtual, Augmented and Mixed Reality: Multimodal Interaction (Part I), edited by Jessie Y. C. Chen and Gino Fragomeni
10. LNCS 11575, Virtual, Augmented and Mixed Reality: Applications and Case Studies (Part II), edited by Jessie Y. C. Chen and Gino Fragomeni
11. LNCS 11576, Cross-Cultural Design: Methods, Tools and User Experience (Part I), edited by P. L. Patrick Rau
12. LNCS 11577, Cross-Cultural Design: Culture and Society (Part II), edited by P. L. Patrick Rau
13. LNCS 11578, Social Computing and Social Media: Design, Human Behavior and Analytics (Part I), edited by Gabriele Meiselwitz
14. LNCS 11579, Social Computing and Social Media: Communication and Social Communities (Part II), edited by Gabriele Meiselwitz
15. LNAI 11580, Augmented Cognition, edited by Dylan D. Schmorrow and Cali M. Fidopiastis
16. LNCS 11581, Digital Human Modeling and Applications in Health, Safety, Ergonomics and Risk Management: Human Body and Motion (Part I), edited by Vincent G. Duffy

17. LNCS 11582, Digital Human Modeling and Applications in Health, Safety, Ergonomics and Risk Management: Healthcare Applications (Part II), edited by Vincent G. Duffy
18. LNCS 11583, Design, User Experience, and Usability: Design Philosophy and Theory (Part I), edited by Aaron Marcus and Wentao Wang
19. LNCS 11584, Design, User Experience, and Usability: User Experience in Advanced Technological Environments (Part II), edited by Aaron Marcus and Wentao Wang
20. LNCS 11585, Design, User Experience, and Usability: Application Domains (Part III), edited by Aaron Marcus and Wentao Wang
21. LNCS 11586, Design, User Experience, and Usability: Practice and Case Studies (Part IV), edited by Aaron Marcus and Wentao Wang
22. LNCS 11587, Distributed, Ambient and Pervasive Interactions, edited by Norbert Streitz and Shin'ichi Konomi
23. LNCS 11588, HCI in Business, Government and Organizations: eCommerce and Consumer Behavior (Part I), edited by Fiona Fui-Hoon Nah and Keng Siau
24. LNCS 11589, HCI in Business, Government and Organizations: Information Systems and Analytics (Part II), edited by Fiona Fui-Hoon Nah and Keng Siau
25. LNCS 11590, Learning and Collaboration Technologies: Designing Learning Experiences (Part I), edited by Panayiotis Zaphiris and Andri Ioannou
26. LNCS 11591, Learning and Collaboration Technologies: Ubiquitous and Virtual Environments for Learning and Collaboration (Part II), edited by Panayiotis Zaphiris and Andri Ioannou
27. LNCS 11592, Human Aspects of IT for the Aged Population: Design for the Elderly and Technology Acceptance (Part I), edited by Jia Zhou and Gavriel Salvendy
28. LNCS 11593, Human Aspects of IT for the Aged Population: Social Media, Games and Assistive Environments (Part II), edited by Jia Zhou and Gavriel Salvendy
29. LNCS 11594, HCI for Cybersecurity, Privacy and Trust, edited by Abbas Moallem
30. LNCS 11595, HCI in Games, edited by Xiaowen Fang
31. LNCS 11596, HCI in Mobility, Transport, and Automotive Systems, edited by Heidi Krömker
32. LNCS 11597, Adaptive Instructional Systems, edited by Robert Sottilare and Jessica Schwarz
33. CCIS 1032, HCI International 2019 - Posters (Part I), edited by Constantine Stephanidis

34. CCIS 1033, HCI International 2019 - Posters (Part II), edited by Constantine Stephanidis
35. CCIS 1034, HCI International 2019 - Posters (Part III), edited by Constantine Stephanidis

http://2019.hci.international/proceedings

8th International Conference on Design, User Experience, and Usability (DUXU 2019)

Program Board Chair(s): **Aaron Marcus, *USA*, and Wentao Wang, *P.R. China***

- Sisira Adikari, Australia
- Claire Ancient, UK
- Jan Brejcha, Czech Republic
- Silvia De los Rios, Spain
- Marc Fabri, UK
- Josh Halstead, USA
- Wei Liu, P.R. China
- Yang Meng, P.R. China
- Judith Moldenhauer, USA
- Jingyan Qin, P.R. China
- Francisco Rebelo, Portugal
- Christine Riedmann-Streitz, Germany
- Elizabeth Rosenzweig, USA
- Patricia Search, USA
- Marcelo Soares, P.R. China
- Carla G. Spinillo, Brazil

The full list with the Program Board Chairs and the members of the Program Boards of all thematic areas and affiliated conferences is available online at:

http://www.hci.international/board-members-2019.php

HCI International 2020

The 22nd International Conference on Human-Computer Interaction, HCI International 2020, will be held jointly with the affiliated conferences in Copenhagen, Denmark, at the Bella Center Copenhagen, July 19–24, 2020. It will cover a broad spectrum of themes related to HCI, including theoretical issues, methods, tools, processes, and case studies in HCI design, as well as novel interaction techniques, interfaces, and applications. The proceedings will be published by Springer. More information will be available on the conference website: http://2020.hci.international/.

General Chair
Prof. Constantine Stephanidis
University of Crete and ICS-FORTH
Heraklion, Crete, Greece
E-mail: general_chair@hcii2020.org

http://2020.hci.international/

Contents – Part II

Visual DUXU

Interacting with Intelligent Digital Twins 3
Alexie Dingli and Foaad Haddod

Making Packaging Waste Sorting More Intuitive in Fast Food Restaurant . . . 16
Yu-Chen Hsieh, Yi-Jui Chen, and Wang-Chin Tsai

The Research on Quantificational Method of Chromatic-Light Emotion in Automotive Interior Lighting 32
Jiaying Lu and Jiong Fu

An Evaluation Method of the Influence of Icon Shape Complexity on Visual Search Based on Eye Tracking 44
Zijing Luo, Chengqi Xue, Yafeng Niu, Xinyue Wang, Bingzheng Shi, Lingcun Qiu, and Yi Xie

Three-Dimensional Representation in Visual Communication of Science 56
Marco Neves and Pedro Gonçalves

Mobile Web Design: The Effect of Education on the Influence of Classical and Expressive Aesthetics on Perceived Credibility 66
Kiemute Oyibo, Ifeoma Adaji, and Julita Vassileva

Water Cartography 80
João Paulo Ramos Piron and Luisa Paraguai

Search-Efficacy of Modern Icons Varying in Appeal and Visual Complexity 94
Mick Smythwood, Siné McDougall, and Mirsad Hadzikadic

Examining the Influence of Visual Stimuli and Personal Characteristics on Users' Willingness-to-Wait Time and Waiting Patterns 105
Jingyi Zhou and Pengyi Zhang

DUXU for Novel Interaction Techniques and Devices

User-Centered Gestures for Mobile Phones: Exploring a Method to Evaluate User Gestures for UX Designers 121
Ariane Beauchesne, Sylvain Sénécal, Marc Fredette, Shang Lin Chen, Bertrand Demolin, Marie-Laure Di Fabio, and Pierre-Majorique Léger

Affective Haptics Research and Interaction Design 134
Yang Jiao, Yingqing Xu, and Xiaobo Lu

Exploration of Ideal Interaction Scheme on Smart TV: Based on User Experience Research of Far-Field Speech and Mid-air Gesture Interaction 144
Xuan Li, Daisong Guan, Jingya Zhang, Xingtong Liu, Siqi Li, and Hui Tong

How the Cognitive Styles Affect the Immersive Experience: A Study of Video-Watching Experience in VR 163
Wei Li, Xiaobo Lu, YiShen Zhang, and Huiya Zhao

Device Transition: Understanding Usability Issues in Shifting a Device During a Task 178
Ngoc Thi Nguyen and Hyowon Lee

Head and Shoulders Gestures: Exploring User-Defined Gestures with Upper Body 192
Jean Vanderdonckt, Nathan Magrofuoco, Suzanne Kieffer, Jorge Pérez, Ysabelle Rase, Paolo Roselli, and Santiago Villarreal

The Vision of Human-Computer Interactive Game Platform for the Future of Brain Development and Interaction 214
Tingwei Zhao

Research on Multiple Tactile Induction of Human-Computer Interaction 228
Yang-shuo Zheng and Shi-chao He

DUXU and Robots

Study on the Morphological Sensitivity of Children's Companion Robot 241
Xiang-yu Liu, Mei-yu Zhou, Chao Li, Xian-xian Ma, and Zheng-yu Wang

Research on Active Interaction Design for Smart Speakers Agent of Home Service Robot 253
Jingyan Qin, Zhibo Chen, Wenhao Zhang, Daisong Guan, Zhun Wu, and Min Zhao

Research on Robot Interaction Design Based on Embodied and Disembodied Interaction Grammars 264
Jingyan Qin, Xinghui Lu, Yanlin An, Zeyu Hao, Daisong Guan, Moli Zhou, and Shiyan Li

Investigating the Relationship Between Connection, Agency and Autonomy for Controlling a Robot Arm for Remote Social Physical Interaction 277
Ryuya Sato, Don Kimber, and Yanxia Zhang

ARena: Improving the Construction Process of Line-Follower Robot Arenas Through Projection Mapping 291
Pedro J. L. Silva, Diogo B. B. Henriques, Gustavo C. R. Lima, Júlia D. T. de Souza, João M. X. N. Teixeira, and Veronica Teichrieb

Stepped Warm-Up–The Progressive Interaction Approach for Human-Robot Interaction in Public 309
Min Zhao, Dan Li, Zhun Wu, Shiyan Li, Xiaonan Zhang, Lu Ye, Guangfu Zhou, and Daisong Guan

DUXU for AI and AI for DUXU

Computational Evolutionary Art: Artificial Life and Effective Complexity . . . 331
Tiago Barros Pontes e Silva

Design and Development of a Standard Interface Component to Highlight Automated AI Recommendations in the Conta Azul Software. 347
João Antonio de Menezes Neto, Bruno Carlos Cruz, Harry Porto Schroeter, and Ludmila Rocha Ribeiro Feitosa

Usability in the Development of a Project Management Software Reinforced with Machine Learning 361
Jorge Espinoza, Pamela Loarte, Freddy Paz, and Luis Flores

Modeling People-AI Interaction: A Case Discussion with Using an Interaction Design Language 379
Juliana Jansen Ferreira, Ana Fucs, and Vinícius Segura

Towards Explainable AI Using Similarity: An Analogues Visualization System 389
Vinícius Segura, Bruna Brandão, Ana Fucs, and Emilio Vital Brazil

Artificial Intelligence Augments Design Creativity: A Typeface Family Design Experiment 400
Zhen Zeng, Xiaohua Sun, and Xiang Liao

Dialogue, Narrative, Storytelling

Multimedia Exhibition Design: Exploring Intersections Among Storytelling, Usability and User Experience on an Interactive Large Wall Screen. 415
Danielle Behrens, Erika Espinoza, Darby Siscoe, and Jennifer Palilonis

Interactive Storytelling in V.R.: Coming Soon?. 428
Andy Deck

Do Smart Speakers Respond to Their Errors Properly? A Study on Human-Computer Dialogue Strategy 440
Xiang Ge, Dan Li, Daisong Guan, Shihui Xu, Yanyan Sun, and Moli Zhou

Storytelling Research of Virtual Image Based on User Experience. 456
Jing Li and Ling Zou

Narrative Controllability in Visual Reality Interactive Film. 471
Jinning Wang and Feng Ye

Study on Visual Guidance on Scene Art Design of Immersive Video 484
Songheng Wang and Zhimin Wang

The Application of Visual Image and Interactive Storytelling to Stage Performance. 502
Zhen Wu and Ximin Zhou

Exploration of the Interactive Narrative Modes and Application Form of AR Animations 517
Shen Yongliang and Niu Bosi

Author Index 529