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Human-Computer Interaction – INTERACT 2021


18th IFIP TC 13 International Conference
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Proceedings, Part II

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Welcome

It is our great pleasure to welcome you to the 18th IFIP TC13 International Conference on Human-Computer Interaction, INTERACT 2021, one of the most important conferences in the area of Human-Computer Interaction at a world-wide level. INTERACT 2021 was held in Bari (Italy) from August 30 – September 3, 2021, in cooperation with ACM and under the patronage of the University of Bari Aldo Moro. This is the second time that INTERACT was held in Italy, after the edition in Rome in September 2005. The Villa Romanazzi Carducci Hotel, which hosted INTERACT 2021, provided the right context for welcoming the participants, thanks to its liberty-period villa immersed in a beautiful park. Due to the COVID-19 pandemic, INTERACT 2021 was held in hybrid mode to allow attendees who could not travel to participate in the conference.

INTERACT is held every two years and is well appreciated by the international community, attracting experts with a broad range of backgrounds, coming from all over the world and sharing a common interest in HCI, to make technology effective and useful for all people in their daily life. The theme of INTERACT 2021, “Sense, Feel, Design,” highlighted the new interaction design challenges. Technology is today more and more widespread, pervasive and blended in the world we live in. On one side, devices that sense humans’ activities have the potential to provide an enriched interaction. On the other side, the user experience can be further enhanced by exploiting multisensorial technologies. The traditional human senses of vision and hearing and senses of touch, smell, taste, and emotions can be taken into account when designing for future interactions. The hot topic of this edition was Human-Centered Artificial Intelligence, which implies considering who AI systems are built for and evaluating how well these systems support people’s goals and activities. There was also considerable attention paid to the usable security theme. Not surprisingly, the COVID-19 pandemic and social distancing have also turned the attention of HCI researchers towards the difficulties in performing user-centered design activities and the modified social aspects of interaction.

With this, we welcome you all to INTERACT 2021. Several people worked hard to make this conference as pleasurable as possible, and we hope you will truly enjoy it.

Paolo Buono
Catherine Plaisant

Preface

The 18th IFIP TC13 International Conference on Human-Computer Interaction, INTERACT 2021 (Bari, August 30 – September 3, 2021) attracted a relevant collection of submissions on different topics.

Excellent research is the heart of a good conference. Like its predecessors, INTERACT 2021 aimed to foster high-quality research. As a multidisciplinary field, HCI requires interaction and discussion among diverse people with different interests and backgrounds. The beginners and the experienced theoreticians and practitioners, and people from various disciplines and different countries gathered, both in-person and virtually, to learn from each other and contribute to each other's growth.

We were especially honoured to welcome our invited speakers: Marianna Obrist (University College London), Ben Shneiderman (University of Maryland), Luca Viganò (King's College London), Geraldine Fitzpatrick (TU Wien) and Philippe Palanque (University Toulouse 3 "Paul Sabatier").

Marianna Obrist's talk focused on the multisensory world people live in and discussed the role touch, taste and smell can play in the future of computing. Ben Shneiderman envisioned a new synthesis of emerging disciplines in which AI-based intelligent algorithms are combined with human-centered design thinking. Luca Viganò used a cybersecurity show and tell approach to illustrate how to use films and other artworks to explain cybersecurity notions. Geraldine Fitzpatrick focused on skills required to use technologies as enablers for good technical design work. Philippe Palanque discussed the cases of system faults due to human errors and presented multiple examples of faults affecting socio-technical systems.

A total of 680 submissions, distributed in 2 peer-reviewed tracks, 4 curated tracks, and 3 juried tracks, were received. Of these, the following contributions were accepted:

- 105 Full Papers (peer-reviewed)
- 72 Short Papers (peer-reviewed)
- 36 Posters (juried)
- 5 Interactive Demos (curated)
- 9 Industrial Experiences (curated)
- 3 Panels (curated)
- 1 Course (curated)
- 11 Workshops (juried)
- 13 Doctoral Consortium (juried)

The acceptance rate for contributions received in the peer-reviewed tracks was 29% for full papers and 30% for short papers. In the spirit of inclusiveness of INTERACT, and IFIP in general, a substantial number of promising but borderline full papers, which had not received a direct acceptance decision, were screened for shepherding.

Interestingly, many of these papers eventually turned out to be excellent quality papers and were included in the final set of full papers. In addition to full papers and short papers, the present proceedings feature's contributions accepted in the shape of posters, interactive demonstrations, industrial experiences, panels, courses, and descriptions of accepted workshops.

Subcommittees managed the reviewing process of the full papers. Each subcommittee had a chair and a set of associated chairs who were in charge of coordinating the reviewing process with the help of expert reviewers. Two new sub-committees were introduced in this edition: "Human-AI Interaction" and "HCI in the Pandemic". Hereafter we list the sub-committees of INTERACT 2021:

- Accessibility and assistive technologies
- Design for business and safety-critical interactive systems
- Design of interactive entertainment systems
- HCI education and curriculum
- HCI in the pandemic
- Human-AI interaction
- Information visualization
- Interactive systems technologies and engineering
- Methodologies for HCI
- Social and ubiquitous interaction
- Understanding users and human behaviour

The final decision on acceptance or rejection of full papers was taken in a Programme Committee meeting held virtually, due to the COVID-19 pandemic, in March 2021. The technical program chairs, the full papers chairs, the subcommittee chairs, and the associate chairs participated in this meeting. The meeting discussed a consistent set of criteria to deal with inevitable differences among many reviewers. The corresponding track chairs and reviewers made the final decisions on other tracks, often after electronic meetings and discussions.

We would like to express our strong gratitude to all the people whose passionate and strenuous work ensured the quality of the INTERACT 2021 program: the 12 sub-committees chairs, 88 associated chairs, 34 track chairs, and 543 reviewers; the Keynote & Invited Talks Chair Maria Francesca Costabile; the Posters Chairs Maristella Matera, Kent Norman, Anna Spagnolli; the Interactive Demos Chairs Barbara Rita Barricelli and Nuno Jardim Nunes; the Workshops Chairs Marta Kristín Larusdóttir and Davide Spano; the Courses Chairs Nikolaos Avouris and Carmen Santoro; the Panels Chairs Effie Lai-Chong Law and Massimo Zancanaro; the Doctoral Consortium Chairs Daniela Fogli, David Lamas and John Stasko; the Industrial Experiences Chair Danilo Caivano; the Online Experience Chairs Fabrizio Balducci and Miguel Ceriani; the Advisors Fernando Loizides and Marco Winckler; the Student Volunteers Chairs Vita Santa Barletta and Grazia Ragone; the Publicity Chairs Ganesh D. Bhutkar and Veronica Rossano; the Local Organisation Chair Simona Sarti.

We would like to thank all the authors, who chose INTERACT 2021 as the venue to publish their research and enthusiastically shared their results with the INTERACT community. Last, but not least, we are also grateful to the sponsors for their financial support.

Carmelo Ardito
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IFIP TC13 – <http://ifip-tc13.org/>

Established in 1989, the Technical Committee on Human–Computer Interaction (IFIP TC 13) of the International Federation for Information Processing (IFIP) is an international committee of 34 member national societies and 10 Working Groups, representing specialists of the various disciplines contributing to the field of human–computer interaction. This includes (among others) human factors, ergonomics, cognitive science, and multiple areas of computer science and design.

IFIP TC 13 aims to develop the science, technology and societal aspects of human–computer interaction (HCI) by

- encouraging empirical, applied and theoretical research
- promoting the use of knowledge and methods from both human sciences and computer sciences in design, development, evaluation and exploitation of computing systems
- promoting the production of new knowledge in the area of interactive computing systems engineering
- promoting better understanding of the relation between formal design methods and system usability, user experience, accessibility and acceptability
- developing guidelines, models and methods by which designers may provide better human-oriented computing systems
- and, cooperating with other groups, inside and outside IFIP, to promote user-orientation and humanization in system design.

Thus, TC 13 seeks to improve interactions between people and computing systems, to encourage the growth of HCI research and its practice in industry and to disseminate these benefits worldwide.

The main orientation is to place the users at the center of the development process. Areas of study include:

- the problems people face when interacting with computing devices;
- the impact of technology deployment on people in individual and organizational contexts;
- the determinants of utility, usability, acceptability, accessibility, privacy, and user experience ...;
- the appropriate allocation of tasks between computing systems and users especially in the case of automation;
- engineering user interfaces, interactions and interactive computing systems;
- modelling the user, their tasks and the interactive system to aid better system design; and harmonizing the computing system to user characteristics and needs.

While the scope is thus set wide, with a tendency toward general principles rather than particular systems, it is recognized that progress will only be achieved through

both general studies to advance theoretical understandings and specific studies on practical issues (e.g., interface design standards, software system resilience, documentation, training material, appropriateness of alternative interaction technologies, guidelines, integrating computing systems to match user needs and organizational practices, etc.).

In 2015, TC13 approved the creation of a Steering Committee (SC) for the INTERACT conference series. The SC is now in place, chaired by Anirudha Joshi and is responsible for:

- promoting and maintaining the INTERACT conference as the premiere venue for researchers and practitioners interested in the topics of the conference (this requires a refinement of the topics above);
- ensuring the highest quality for the contents of the event;
- setting up the bidding process to handle the future INTERACT conferences (decision is made at TC 13 level);
- providing advice to the current and future chairs and organizers of the INTERACT conference;
- providing data, tools, and documents about previous conferences to the future conference organizers;
- selecting the reviewing system to be used throughout the conference (as this affects the entire set of reviewers, authors and committee members);
- resolving general issues involved with the INTERACT conference;
- capitalizing on history (good and bad practices).

In 1999, TC 13 initiated a special IFIP Award, the Brian Shackel Award, for the most outstanding contribution in the form of a refereed paper submitted to and delivered at each INTERACT. The award draws attention to the need for a comprehensive human-centered approach in the design and use of information technology in which the human and social implications have been taken into account. In 2007, IFIP TC 13 launched an Accessibility Award to recognize an outstanding contribution in HCI with international impact dedicated to the field of accessibility for disabled users. In 2013, IFIP TC 13 launched the Interaction Design for International Development (IDID) Award that recognizes the most outstanding contribution to the application of interactive systems for social and economic development of people in developing countries. Since the process to decide the award takes place after papers are sent to the publisher for publication, the awards are not identified in the proceedings. Since 2019 a special agreement has been made with the *International Journal of Behaviour & Information Technology* (published by Taylor & Francis) with Panos Markopoulos as editor in chief. In this agreement, authors of BIT whose papers are within the field of HCI are offered the opportunity to present their work at the INTERACT conference. Reciprocally, a selection of papers submitted and accepted for presentation at INTERACT are offered the opportunity to extend their contribution to be published in BIT.

IFIP TC 13 also recognizes pioneers in the area of HCI. An IFIP TC 13 pioneer is one who, through active participation in IFIP Technical Committees or related IFIP groups, has made outstanding contributions to the educational, theoretical, technical, commercial, or professional aspects of analysis, design, construction, evaluation, and

use of interactive systems. IFIP TC 13 pioneers are appointed annually and awards are handed over at the INTERACT conference.

IFIP TC 13 stimulates working events and activities through its Working Groups (WGs). Working Groups consist of HCI experts from multiple countries, who seek to expand knowledge and find solutions to HCI issues and concerns within a specific domain. The list of Working Groups and their domains is given below.

WG13.1 (Education in HCI and HCI Curricula) aims to improve HCI education at all levels of higher education, coordinate and unite efforts to develop HCI curricula and promote HCI teaching.

WG13.2 (Methodology for User-Centred System Design) aims to foster research, dissemination of information and good practice in the methodical application of HCI to software engineering.

WG13.3 (HCI, Disability and Aging) aims to make HCI designers aware of the needs of people with disabilities and encourage development of information systems and tools permitting adaptation of interfaces to specific users.

WG13.4 (also WG2.7) (User Interface Engineering) investigates the nature, concepts and construction of user interfaces for software systems, using a framework for reasoning about interactive systems and an engineering model for developing UIs.

WG 13.5 (Resilience, Reliability, Safety and Human Error in System Development) seeks a framework for studying human factors relating to systems failure, develops leading edge techniques in hazard analysis and safety engineering of computer-based systems, and guides international accreditation activities for safety-critical systems.

WG13.6 (Human-Work Interaction Design) aims at establishing relationships between extensive empirical work-domain studies and HCI design. It will promote the use of knowledge, concepts, methods and techniques that enable user studies to procure a better apprehension of the complex interplay between individual, social and organizational contexts and thereby a better understanding of how and why people work in the ways that they do.

WG13.7 (Human-Computer Interaction and Visualization) aims to establish a study and research program that will combine both scientific work and practical applications in the fields of human-computer interaction and visualization. It will integrate several additional aspects of further research areas, such as scientific visualization, data mining, information design, computer graphics, cognition sciences, perception theory, or psychology, into this approach.

WG13.8 (Interaction Design and International Development) is currently working to reformulate their aims and scope.

WG13.9 (Interaction Design and Children) aims to support practitioners, regulators and researchers to develop the study of interaction design and children across international contexts.

WG13.10 (Human-Centred Technology for Sustainability) aims to promote research, design, development, evaluation, and deployment of human-centered technology to encourage sustainable use of resources in various domains.

New Working Groups are formed as areas of significance in HCI arise. Further information is available at the IFIP TC13 website: <http://ifip-tc13.org/>.

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