

FINAL REPORT



ITU Kaleidoscope Secretariat

17 December 2021

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1. ITU Kaleidoscope 2021 overview

This year the [ITU Kaleidoscope conference](#) (K-2021) on *Connecting physical and virtual worlds* was exceptionally held online from 6 to 10 December 2021, due to the pandemic.

Nearly 130 delegates from 32 countries participated at the conference. The inhouse tool/platform, MyMeetings, was used and the **webcast** will be available shortly on the [event's webpage](#).

The conference was technically co-sponsored by the Institute of Electrical and Electronics Engineers ([IEEE](#)) and the IEEE Communications Society ([IEEE ComSoc](#)).

A 12-month, substantial preparatory process was required for this Kaleidoscope edition. This process involved the efforts and collaboration of five [TSB staff](#), a [Steering Committee](#) of eight members (SC), and a [Technical Programme Committee](#) (TPC) of 57 members, all internationally recognized ICT experts from academia, research institutes and the private sector.

The ITU Secretariat would like to thank the Kaleidoscope 2021 dedicated Steering Committee members: [Christoph Dosch](#) (ITU-R Study Group 6 Vice-Chairman; ARD, Germany), [Eva Ibarrola](#) (University of the Basque Country, Spain), [Kai Jakobs](#) (RWTH Aachen University, Germany), [Gyu Myoung Lee](#) (Liverpool John Moores University, United Kingdom), [Tiziana Margaria](#) (University of Limerick, Ireland), [Mitsuji Matsumoto](#) (Professor Emeritus Waseda University, Japan), [Roberto Minerva](#) (Télécom SudParis, France) and [Mostafa Hashem Sherif](#) (Consultant, USA); the whole Technical Programme Committee and in particular its Chairman, Mostafa Hashem Sherif, for ensuring transparency through the double-blind peer-review process; and all the partnering organizations which supported the promotion of the conference: [Waseda University](#), the [Institute of Image Electronics Engineers of Japan](#) (IIEEJ), the [Institute of Electronics, Information and Communication Engineers of Japan](#) (IEICE) of Japan, the [Chair of Communication and Distributed Systems at RWTH Aachen University](#), the [European Academy for Standardization](#) (EURAS), the [University of the Basque Country](#), [Liverpool John Moores University](#), [Korea Advanced Institute of Science and Technology](#) (KAIST), the [University of Limerick](#), [Confim Smart Manufacturing](#), and [Virtual Switzerland](#).

[Alessia Magliarditi](#), ITU Kaleidoscope Coordinator, chaired the meeting of the Award Committee that selected the winners of the awards for the best papers. The Award Committee was composed of five conference attendees and SC members: Christoph Dosch, Eva Ibarrola, Kai Jakobs, Mitsuji Matsumoto, Mostafa Hashem Sherif and Duncan Sparrell. At the Ceremony, Mostafa Hashem Sherif (TPC Chair) announced the winners of the best paper awards, the recipients of the young author recognition certificate and the best video demonstration (please see the [Conference programme](#) for details).

At the [Closing Session](#), Alessia informed the Kaleidoscope 2021 authors of keynote papers and summaries, and of all presented papers about the opportunities for publication of their research

work. All papers accepted and presented at the conference are published in the [Conference proceedings](#) and have been submitted for publication in the [IEEE Xplore Digital Library](#). Outstanding papers may also be published in the [IEEE Communications Standards Magazine](#). In addition, extended versions of selected papers are considered for publication in the [Journal of Standardisation](#) (JoS) or the [Journal of ICT Standardization](#). Alessia also thanked all the people that contributed to the success of the conference, including her team, the ITU Kaleidoscope Secretariat, Emer Windsor, Erica Campilongo and Simiso Dlodlo as well as Martin Adolph (technical adviser), Gent Bajrami, Kouraich Gharsallaoui and Ilia Londo (IT support), Pascal Borde (promotional collaterals), Matt Dalais (Communication) and the Registration team from the ITU Telecommunication Standardization Bureau.

2. Conference programme

As Master of Ceremony, Alessia officially opened the 13th edition of the Kaleidoscope series and gave the floor to Emer Windsor, Kaleidoscope Executive Assistant, who provided the audience with practical guidelines and showed the main features of the ITU-T platform MyMeetings.

The **Opening Ceremony** included welcome remarks from [Chaesub Lee](#), Director, Telecommunication Standardization Bureau (TSB), ITU and [Mario Maniewicz](#), Director, Radiocommunication Bureau (BR), ITU.

[Reinhard Scholl](#), Deputy to the Director of TSB, welcomed the Kaleidoscope 2021 participants on behalf of the Director, and provided some highlights about the conference programme. He also affirmed that the ITU Academia membership and the [ITU Journal on Future and Evolving Technologies](#) (ITU J-FET) form two more key avenues, in addition to the Kaleidoscope series, for the academics to engage in ITU's work. ITU J-FET, launched in September 2020, provides comprehensive coverage of communications and networking paradigms, it is free of charge for both readers and authors, and welcomes papers all year, on all [topics](#). By the end of this year, the Journal will have published 8 issues (3 regular issues and 5 special issues). In addition, 10 new calls for papers for upcoming special issues have already been announced.

The Director of the ITU Radiocommunication Bureau highlighted the well-established collaboration between TSB and BR through Kaleidoscope. In fact, again this year, several selected papers (in particular, papers presented in Session 1 “Enabling future wireless communication systems”, including the first best paper from ZTE Corporation, China, and Session 6 “Machine learning for next generation wireless network”), and keynotes (especially the first keynote session on 6G technologies and spectrum management in the 6G era) focused on topics of interest to the ITU Radiocommunication Sector.

Keynote sessions

After the opening addresses, [Geng Wu](#), Intel Fellow, Intel Corporation, USA, gave a keynote speech on *6G Technologies for mobile connected intelligence* [[Presentation](#)]. His keynote summary is available on pg. xv of the [Conference proceedings](#). This was followed by the keynote speech of [Marja Matinmikko-Blue](#), Director of Sustainability and Regulation, 6G Flagship, University of Oulu, Finland, on *Sustainability and spectrum management in the 6G era* [[Presentation](#)]. Her full keynote paper is available on pg. xxi of the [Conference proceedings](#). This keynote session was moderated by [Martin Adolph](#), Telecommunication Standardization Bureau, ITU.

The third keynote speech was delivered by [Takeshi Yamada](#), NTT Communication Science Laboratories, Japan on *Exploring the essence of communication to reach the heart* [[Presentation](#)]. This session was moderated by [Mitsuji Matsumoto](#), Waseda University Emeritus Professor, Japan. His full keynote paper is available on pg. xxxi of the [Conference proceedings](#).

On Day 5, the last keynote speech was delivered by [Rob Kitchin](#), Social Sciences Institute (MUSSI), Geography, Maynooth University, Ireland, on *The adoption gap: Ethics, citizenship, institutional factors and standards for smart cities* and was moderated by [Kai Jakobs](#), RWTH Aachen University, Germany. His keynote summary is available on pg. xvii of the [Conference proceedings](#).

Invited papers and talk

In addition to the four keynote speakers, the programme included two invited papers that shared research on a serverless approach for IoT, and an ITU standardization perspective on quantum key distribution networks for trust in 5G and beyond.

The first one, *Deviceless: A serverless approach for the Internet of Things* [[Presentation](#)], was presented by [Zakaria Benomar](#), and co-authored with Francesco Longo, Giovanni Merlino and Antonio Puliafito from the University of Messina, Italy and the National Interuniversity Consortium for Informatics (CINI), Italy. [Mostafa Hashem Sherif](#), Kaleidoscope Technical Programme Committee Chair, chaired this session. This invited paper is available on pg. xxxix of the [Conference proceedings](#). The second invited paper on *Quantum key distribution networks for trusted 5G and beyond: An ITU-T standardization perspective* [[Presentation](#)], was presented by [Taesang Choi](#), Electronic and Telecommunications Research Institute (ETRI), Korea, and co-authored with Hyungsoo Kim, KT, Korea; Jeongyun Kim, ETRI, Korea; Chun Seok Yoon, KT, Korea, and Gyu Myoung Lee, Liverpool John Moores University, UK and Korea Advanced Institute of Science and Technology (KAIST), Korea. Reinhard Scholl, Deputy Director of the TSB, chaired this session.

The invited speaker from ITU Kaleidoscope 2021 partner Virtual Switzerland, [George Papagiannakis](#), University of Crete, FORTH, ORamaVR, Greece, presented a proposal to accelerate the adoption of virtual reality in medical training [[Presentation](#)]. This session was chaired by [Laetitia Bochud](#), Director, Virtual Switzerland.

Paper sessions and winners

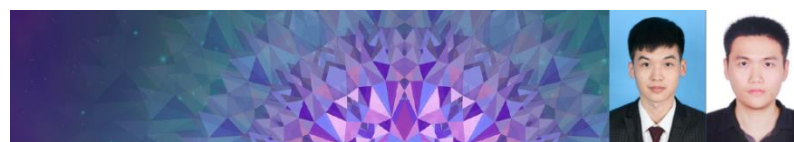
39 research papers from 19 countries (covering all continents of the world!) were submitted for review, 18 of which were accepted for publication and presentation at the conference from 10 countries.

The academic papers submitted to this year's conference shared insight into ongoing projects and research relevant to the development of persistent virtual realities and customized computer-generated environments, as well as new possibilities and associated challenges appearing on the horizon. Particularly, this conference encouraged submissions on technical standards for networks and services required to enable this transformation, including considerations on social and ethical implications.

Papers accepted for presentation at the conference are related to various ITU activities, in particular ITU-T [SG12 - Performance, QoS and QoE](#), [SG13 - Future networks \(& cloud\)](#), [SG16 - Multimedia](#), [SG17 - Security](#), and [SG20 - IoT, smart cities & communities](#); [AI for Good](#) and [ITU AI/ML in 5G Challenge](#); and [ITU-R Study Groups](#). They explored the prospects for future wireless networks and quantum networks; networking innovations for IoT and industrial applications; new possibilities introduced by advances in augmented reality and machine learning; and the security dimensions of a world increasingly mirrored in cyberspace.

An overview of Kaleidoscope papers and a mapping of papers and ITU activities (i.e. Study Groups, Focus Groups, etc.) have been prepared for the coming meeting of the ITU Telecommunication Standardization Advisory Group (TSAG), and also for the next ITU Radiocommunication Advisory Group (RAG) and the ITU Telecommunication Development Advisory Group (TDAG). Temporary documents providing information on selected papers will be also submitted to the various ITU Study Groups for consideration in their activities.

The authors of the award-winning papers shared the prize fund of CHF 6 000.-.



Best Paper Award

The International Telecommunication Union
together with the Steering Committee of the Kaleidoscope Academic Conference
"Connecting physical and virtual worlds" are honoured to award the paper entitled:

TOWARDS A ROBUST NEW RADIO COMPATIBLE WITH XR

Yuzhou Hu & Jiajun Xu

ZTE Corporation & State Key Laboratory of Mobile Network and Mobile Multimedia Technology, China

Co-Authors: Xiaoying Ma, Mengzhu Chen, Hong Tang, Jun Xu

with the first prize at Kaleidoscope 2021
6-10 December 2021


Mostafa Hashem Sherif
Technical Programme
Committee Chair




Chaesub Lee
Director of Telecommunication
Standardization Bureau

➤ **1st prize** (CHF 3 000.-): *Towards a robust new radio compatible with XR* [[Presentation](#)]. This paper is available on pg. 9 of the [Conference proceedings](#).

Authors: [Yuzhou Hu](#), [Jiajun Xu](#), Xiaoying Ma, Mengzhu Chen, Hong Tang and Jun Xu (State Key Laboratory of Mobile Network and Mobile Multimedia Technology, ZTE Corporation, China)



Best Paper Award

The International Telecommunication Union
together with the Steering Committee of the Kaleidoscope Academic Conference
"Connecting physical and virtual worlds" are honoured to award the paper entitled:

COLLABORATIVE 5G MULTIACCESS COMPUTING SECURITY: THREATS,
PROTECTION REQUIREMENTS AND SCENARIOS

Hongyang Zhang

China Mobile, China

Co-Authors: Gang Zhao; Feng Zhang; Le Yu; Qin Qiu; Sijia Xu

with the second prize at Kaleidoscope 2021
6-10 December 2021


Mostafa Hashem Sherif
Technical Programme
Committee Chair




Chaesub Lee
Director of Telecommunication
Standardization Bureau

➤ **2nd prize** (CHF 2 000.-): *Collaborative 5G multiaccess computing security: Threats, protection requirements and scenarios* [[Presentation](#)]. This paper is available on pg. 85 of the [Conference proceedings](#). It is relevant to ITU-T SG17 and makes references to three recommendations under study.

Authors: Gang Zhao, Feng Zhang, Le Yu, [Hongyang Zhang](#), Qin Qiu and Sijia Xu (China Mobile, China)

- **3rd prize (ex aequo)** (CHF 500.-): *Reinforcement learning for scheduling and MIMO beam selection using CAVIAR simulations* [[Presentation](#)]. This paper is available on pg. 141 of the [Conference proceedings](#) and it is authored by contributors of the AI/ML5G Challenge. The Challenge problem statement related to this paper is: <https://challenge.aiforgood.itu.int/match/matchitem/39>.



Best Paper Award

The International Telecommunication Union
together with the Steering Committee of the Kaleidoscope Academic Conference
"Connecting physical and virtual worlds" are honoured to award the paper entitled:

REINFORCEMENT LEARNING FOR SCHEDULING AND MIMO BEAM SELECTION
USING CAVIAR SIMULATIONS

João Paulo Tavares Borges

Universidade Federal do Pará, Brazil

Co-Authors: Ailton P. Oliveira, Felipe H. B. Bastos, Daniel T. N. N. Suzuki, Emerson Oliveira, Jr.,
Lucas M. Matni Bezerra; Cleverson Nahum, Pedro dos Santos Batista, Aldebaro Klautau

with the ex aequo third prize at Kaleidoscope 2021
6-10 December 2021


Mostafa Hashem Sherif
Technical Programme
Committee Chair




Chaesub Lee
Director of Telecommunication
Standardization Bureau

Authors: [João Paulo Tavares Borges](#), Ailton Pinto de Oliveira, Felipe Henrique Bastos e Bastos, Daniel Takashi Né do Nascimento Suzuki and Emerson Santos de Oliveira, Jr. (Universidade Federal do Pará, Brazil); Lucas Matni Bezerra (Universidade Estácio de Sá, Brazil); Cleverson Veloso Nahum (Universidade Federal do Pará, Brazil); Pedro dos Santos Batista (Ericsson Research, Sweden); Aldebaro Barreto da Rocha Klautau, Jr. (Universidade Federal do Pará, Brazil)

- **3rd prize (ex aequo)** (CHF 500.-): *Security vulnerability expressions: A technology for empowering novice practitioners around the world with security maturity capabilities* [[Presentation](#)]. This paper is available on pg. 93 of the [Conference proceedings](#) and makes

reference to the work of the ITU-T SG17, including recommendations, technical reports and manuals.



Author: [Jacques Francoeur](#)
(Security Inclusion Now, USA).

Best Paper Award

The **International Telecommunication Union**
together with the Steering Committee of the Kaleidoscope Academic Conference
“Connecting physical and virtual worlds” are honoured to award the paper entitled:

**SECURITY VULNERABILITY EXPRESSIONS: A TECHNOLOGY FOR EMPOWERING NOVICE
PRACTITIONERS AROUND THE WORLD WITH
SECURITY MATURITY CAPABILITIES**

Jacques Francoeur

Security Inclusion Now, USA


Mostafa Hashem Sherif
Technical Programme
Committee Chair

with the ex aequo third prize at Kaleidoscope 2021
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Chaesub Lee
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Standardization Bureau

Alongside the winners of the best paper awards, 18 entrants received **Young Author Recognition Certificates** that are delivered to young authors of up to 30 years of age presenting accepted papers: João Paulo Tavares Borges, Universidade Federal do Pará, Brazil; Eric Brigham, Waseda University, Japan; Jinxue Cheng, China Mobile (Hang Zhou) Information Technology Co. Ltd, China; Rikiya Eguchi, Waseda University, Japan; Jing Geng, University of Auckland, New Zealand; Yuzhou Hu, ZTE Corporation & State Key Laboratory of Mobile Network and Mobile Multimedia Technology, China; Ming-Han Li, CAS Quantum Network Co., Ltd. & Jinan Institute of Quantum Technology, China; Yusuke Maruyama, Waseda University, Japan; Mohd Faredzuan Mohd Noor, International Islamic University Malaysia, Malaysia; Xin Qi, Waseda University, Japan; Ghazal Rahmanian, Iran University of Science and Technology, Iran; Harsh Shroff, Vishwakarma Government Engineering College, Ahmedabad, India; Takanori Tokutake, Waseda University, Japan; Zheng Wen, Waseda University, Japan; Jiajun Xu, ZTE Corporation & State Key Laboratory of Mobile Network and Mobile Multimedia Technology, China; Keping Yu, Waseda University, Japan; Chenchen Zhang, State Key Laboratory of Mobile Network and Mobile Multimedia Technology, ZTE Corporation, China; and Hongyang Zhang, China Mobile, China.

All papers presented at the conference are included in the [Conference Proceedings](#), which are freely available for download on the Kaleidoscope 2021 webpage. They will be also listed in the IEEE *Xplore* Digital Library in January 2022.

Programme, presentations, and biographies are available [online](#).

Relevant recommendations and conclusions from the technical sessions, as drafted and presented by the Session Chairs, are available online in PDF format on the programme webpage, [Wrap-up session](#).

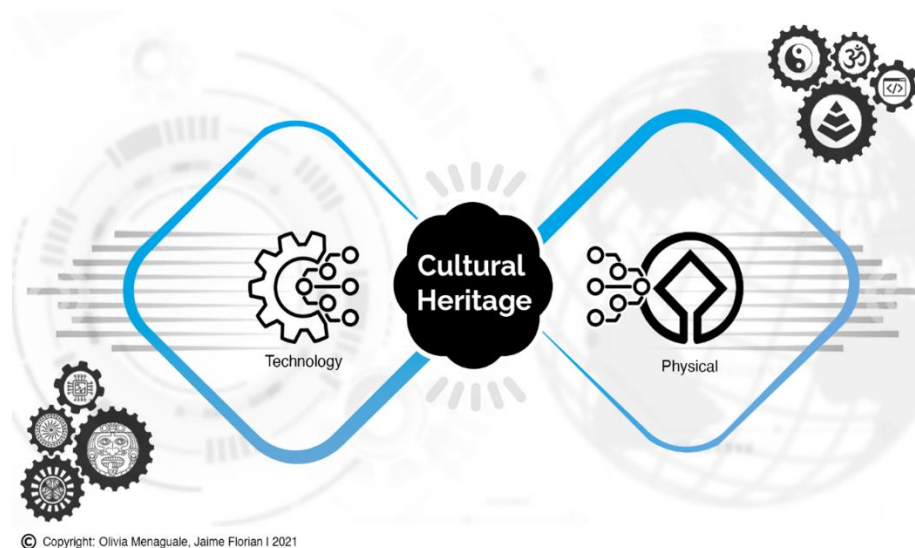
The conference programme also included two invited special sessions and the Video Demonstration Track that are described in the following sections.

3. Invited special sessions

The invited special sessions explored the cultural dimensions of digital transformation, with the first considering the reciprocal relationship emerging between digital technologies and cultural heritage, and the second looking 20 years ahead to forecast the future of art, culture, and technology.

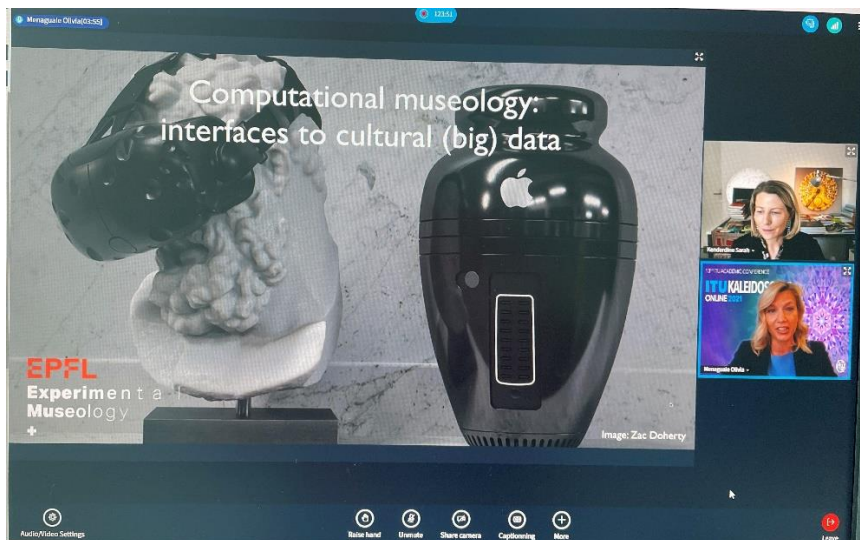
Digital empowering Cultural Heritage... and vice-versa

The special invited session on [Digital empowering Cultural Heritage... and vice-versa](#) was designed by [Olivia Menaguale](#), Chair of IEEE IoT for Tourism and Cultural Heritage.



Over the last 20 years, the Cultural Heritage sector has reaped many of the enormous benefits that technology offers, especially in conservation and access. The COVID-19 pandemic has given that digital synergy a huge propulsion. Today, digital cultural heritage is growing exponentially,

day by day, reaching 100s of millions of people from around the globe, that would certainly not have otherwise had the opportunity to experience its magic, due to its physical constraints. The focus of this panel was to showcase and analyse the key technologies that are used in the Cultural Heritage sector and discuss the impact it has. For example, its effect on global cooperation, communications, and how digital has brought greater access and interaction for multidisciplinary collaboration.



The panellists, [Sarah Kenderdine](#), Professor of Digital Museology, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, [Olivia Menaguale](#), [Victor M. Larios](#), Professor of Information Systems and Director of the Research Centre in Systems & Information Management (CISGI) at the University of

Guadalajara, Mexico and [Hong \(Norman\) Chen](#), Professor at Beijing University of Posts and Telecommunications, China, and Rapporteur of ITU-T Q23/16 (Digital culture-related systems and services) explored the different topics that the physical-digital connection is generating. For example: how digital copies of real cultural heritage attract and broaden the interest in it; what types of new professions are arising in this sector because of digital; how we can set standards for beneficial and proactive global collaboration; if digital is becoming a common language amongst contemporary artists; and lots more.

In addition, the session took the participants on a virtual journey, hosted by a famous international Research Lab, to take part in the creation of the digital twin of an artwork, to dive deeper into understanding the multi-layered potential that digital is already developing and has in store, in the very near future, for Cultural Heritage. This presentation was delivered by [Martin Schurig](#), Fraunhofer Institute for Computer Graphics Research, Darmstadt, Germany.

The future of art, culture and technology in 20 years or more: A fusion or a conflict? And for whom?

The second invited special session on [*The future of art, culture and technology in 20 years or more: A fusion or a conflict? And for whom?*](#) was organized and chaired by [Tiziana Margaria](#), University of Limerick, Ireland and Lero Confirm.



Yang Ah Ham, *Undefined Panorama 3.1* (2021), *Transmediale festival 2021-22*, Photo by Luca Giardini

Over the past year many institutions and arts organizations invested in digital platforms as a way to offer a continuation of programming and engagement for their audiences and artists. Online exhibitions and social media live conversations aiming to address the ramifications of the pandemic on culture quickly became an everyday norm. While on the one hand these events

created important discourse, immediately reactive to socio-political concerns that emerged during the pandemic, they inevitably fell short in facilitating long-term solutions. The panellists [Clara Hermann](#), Akademie der Künste, Berlin, Germany, [Nora O' Murchú](#), Transmediale Festival, Berlin, Germany, and University of Limerick, Ireland, and [Stefania Serafin](#), Aalborg University Copenhagen, Denmark [[Presentation](#)], explored how cultural institutions will operate in a post-covid world that is facing increasing inequality and a climate emergency.

As a microcosm of society, museums and artistic and cultural institutions reflect the profound socio-economic and cultural divides that are often present in society. While in the digital space the acceleration of information is a defining character, the abundance of online events, panels, and exhibitions has resulted in audiences becoming overwhelmed and exhausted, as their attention is continuously sought for. This emerging tension between techno-possibility and human well-being raises multiple questions about how the techno-cultural field will look in 20 years from now.

The panellists and the moderator also discussed how emerging socio-political realities and the availability of fundamentally new technologies point to trends for the deep future; which new opportunities and experimental approaches will or will not succeed for rethinking how technology can engage with the conditions of expression, sustainability and precarity that impact on artistic labour; how they will shape, enable and transform cultural phenomena, and education in arts and technology; and how they will meet the ambition to build resilience around climate and inequality concerns.

4. Video demonstration track

For the second time at Kaleidoscope, the Video demonstration track was included in the programme, and four video demonstrations were selected by the Steering Committee for presentation at the conference. They showcased 5G and beyond-5G system simulations, eco-friendly tethered drones to monitor electromagnetic fields, standardization bolstering cyber defence in Africa, and ways to discover security vulnerabilities in critical infrastructure.

- *Enabling cyber defence in Africa through standardization* [[Abstract](#)] [Mwende Njiraini](#) (DiploFoundation, Kenya), [Racky Seye](#) (Ministry of Digital Economy and Telecommunications of Senegal, Senegal)
- *Securing critical infrastructures by discovering hidden vulnerabilities* [[Abstract](#)] [Talha Siddiqui](#) (aDolus Technology Inc., Canada)
- *The CAVIAR framework: Simulation of 5G/B5G systems in virtual worlds* [[Abstract](#)] [Felipe Bastos](#), [Daniel Suzuki](#), [Ailton Oliveira](#), [João Borges](#), [Cleverson Veloso Nahum](#), [Ingrid Nascimento](#), [Ilan Corrêa](#) (Federal University of Pará (UFPA), Brazil), [Pedro Batista](#) (Ericsson Research, Sweden), [Aldebaro Klautau](#) (UFPA, Brazil)
- *Green tethered UAVs for EMF-aware cellular networks* [[Abstract](#)] [Zhengying Lou](#) (King Abdullah University of Science and Technology (KAUST), Saudi Arabia), [Ahmed Elzanaty](#) (University of Surrey, UK), [Mohamed-Slim Alouini](#) (KAUST, Saudi Arabia)

All videos are available at the [Video Demonstration Track](#) webpage.

The best video demonstration was awarded to [Enabling cyber defence in Africa through standardization](#), relevant to the work of ITU-T [SG17 - Security](#).



Best Video Demonstration Award

The International Telecommunication Union
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ENABLING CYBER DEFENCE IN AFRICA THROUGH STANDARDIZATION

Mwende Njiraini

DiploFoundation, Kenya

Racky Seye

Ministry of Digital Economy and Telecommunications of Senegal


Mostafa Hashem Sherif
Technical Programme
Committee Chair

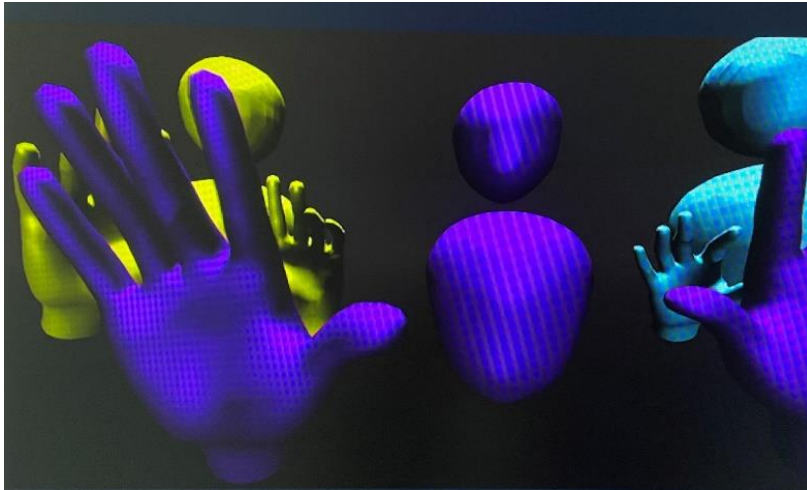
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5. Entertainment in the coffee breaks

This year's programme included two interactive coffee breaks comprising insightful contributions from artist-researchers working in the intersection of art and technology, with a particular focus on virtual reality and augmented reality technology. These contributions were provided with the support of [Laetitia Bochud](#), Director of [Virtual Switzerland](#), a Kaleidoscope 2021 partner.



Ariella and Claudio's artwork

On Day 3, Wednesday, 8 December, [Ariella Vidach](#) and [Claudio Prati](#), presented their work in the area of dance and technology. As co-directors of the dance association [AVVENTURE IN ELICOTTERO PRODOTTI](#) the pair presented their research into the relationship between the body movements and technology.

Showcasing their work from 1997, the session also included a presentation of their latest social experimental project in 2020-2021, Dance the Distance, in response to the social distancing measures put in place during Covid 19. Using VR technology, dancers are able to interact from various locations in virtual environments and dance studios.



Ariella's performance



Judith Guez' artwork

The second presentation to showcase the use of technology in the way people experience art was by [Judith Guez](#) on Friday, 10 December. Dr Guez is the Founder and Director of the artistic department at Laval Virtual and Creator of the International Digital Art Festival Recto VRso (founded in 2018). Attendees were presented with the insights of the 2021 Recto VRso which included an online art gallery as well as a virtual exhibition space under the theme Virtual exhibition / Real exhibition: Online art.



Judith's artwork

Both sessions were well received by the K-2021 audience who expressed an interest in highlighting the role of Art within STEM, such that we recognize the importance of STEM. Further, questions on the necessary standards and technology to promote immersive experiences in art, and role of legal rights to art in the virtual space were also raised by the audience.

6. Next Kaleidoscope

Please stay tuned for news on the 14th edition of the ITU Kaleidoscope academic conferences [here](#).

ANNEX – screenshots from the conference

207:34

Sherif Mostafa Hashem[00:42] Magliarditi Alessia[06:46] Francoeur Jacques[00:02]

Focus Speaker

ITU KALEIDOSCOPE ONLINE 2021

Borges, Joao

Franoeur Jacques

Magliarditi Alessia

Sherif Mostafa Hashem

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Magliarditi Alessia[06:29] Sherif Mostafa Hashem[00:29]

Focus Speaker

ITU KALEIDOSCOPE ONLINE 2021

Franoeur Jacques

Magliarditi Alessia

Sherif Mostafa Hashem

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Jacques Francoeur

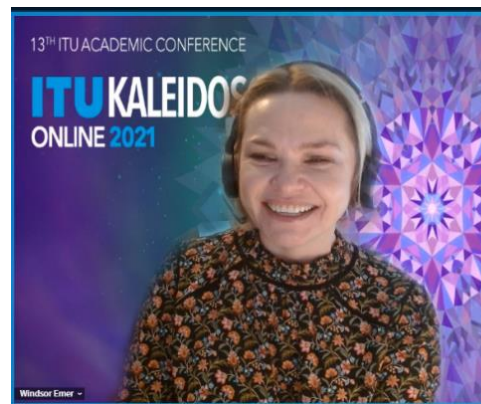
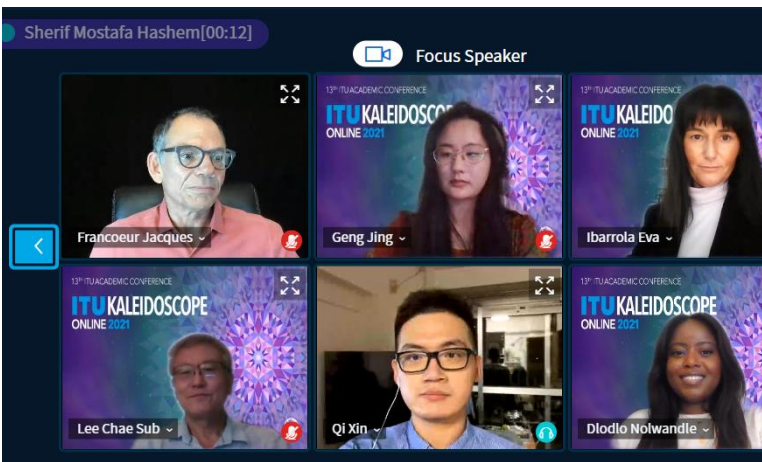
Security Inclusion Now, USA

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Standardization Bureau



224:24

Sherif Mostafa Hashem[00:27] Dlodlo Nolwandle
Focus Speaker

Zhang Hongyang

13th ITU ACADEMIC CONFERENCE
ITU KALEIDOSCOPE
ONLINE 2021
Campilongo Erica

Abdullah Fadzidah

225:04

Dlodlo Nolwandle[00:02] Sherif Mostafa Hashem[00:35]
Focus Speaker

Borges Joao

13th ITU ACADEMIC CONFERENCE
ITU KALEIDOSCOPE
ONLINE 2021
Francoeur Jacques

Gharsallaoui Kouraich

Kumar Dhananjay

Lee Chae Sub [Switzerland (C...

13th ITU ACADEMIC CONFERENCE
ITU KALEIDOSCOPE
ONLINE 2021
Dlodlo Nolwandle