SensoryX '21 Workshop on Multisensory Experiences at ACM IMX '21

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Multisensory experiences have been increasingly undertaken in the digital world. With the emerging interest in immersive applications (i.e. 360 videos and virtual reality), more and more researchers and practitioners are in pursuit of ways to take these experiences to the next level, adding sensations that go beyond that of seeing and hearing. This one-day workshop aims at identifying the current practices, challenges, opportunities, and limitations to be overcome in the quest to transcend the overwhelmingly bisensorial nature of digital multimedia into a multisensory one by fostering discussions on the use of olfactory, gustatory and tactile effects in digital experiences.

CCS Concepts: • **Human-centered computing → Virtual reality**.

Additional Key Words and Phrases: Multisensory experiences, Mulsemedia, Sensory effects, Immersive media

ACM Reference Format:
Alexandra Covaci, Estêvão Bissoli Saleme, and Gheorghita Ghinea. 2021. SensoryX '21 Workshop on Multisensory Experiences at ACM IMX '21. In *SensoryX '21: Workshop on Multisensory Experiences, together with IMX 2021: ACM International Conference on Interactive Media Experiences. June 21-23, 2021. NY, USA.* 5 pages.

1 BACKGROUND, SCOPE, AND AIM

Multimedia applications have primarily engaged two of the human senses aural and visual. With recent advances in computational technology, however it is possible to develop multisensory applications across all senses [7, 9–11, 22, 25]. Important findings from psychological and neuroscience research, as well as technological advances responsible for increased diversity of devices with higher computational power and communication capabilities, augmented by various sensor and display technologies have enabled targeting other human senses [15–18]. In entertainment, video players, virtual and augmented reality applications, games, and movie theatres have employed mulsemedia to enhance enjoyment [6, 14, 26, 27]. In healthcare, multisensory applications have been used for simulation, training, and treatments [19–21, 24]. In education, it is believed that multisensory learning can be more effective for students [1, 2, 5, 23, 28]. In culture, museums and exhibitions have engaged users in multisensory artwork [3, 4]. In marketing, Petit et al. [13] have pointed out a plethora of technologies to deliver in-store multisensory experiences to offer to customers. The possibilities and opportunities for multisensory experiences are potentially countless [8–10, 12, 22].

Importantly, multisensory experiences have the potential to bridge the physical-digital divide. To be sure, the amount of work targeting the exploration of multisensory experiences in the physical, non-digital world, is rather lopsided when compared to that in the digital world. More importantly, one cannot assume that multisensory phenomena and experiences manifesting themselves in the non-digital world will seamlessly lend themselves to translations towards their digital counterparts.

This is by no means obvious and not even straight forward. There is thus the need for further work exploring multisensory experiences in the digital realm.

Indeed, mixed-reality is often seen as half-way house between the physical and the digital worlds, and the state of the art for multisensory systems has been pushed forward with the evolution of mixed reality-related technologies that allowed several senses to be stimulated at the same time, presenting users with 'real experiences' designed in virtual worlds. This enables a more immersive, coherent, and credible experience, raising the level of presence. In this context, it becomes important to explore and understand how one can design effective multisensory experiences in a variety of domains (e.g., education, arts, entertainment, etc.) and how technology can be used to meaningfully stimulate these experiences. Moreover, it is essential to identify the current practices, challenges, opportunities and limitations needed to be overcome in the quest to transcend the overwhelmingly bisensorial nature of digital multimedia into a multisensory one - the realm of mulsemedia, multiple sensorial media. The aim of this workshop is to deepen the discussion on multisensory experience design as well as to inspire and support participants in fostering the advancement of multisensory interfaces and experiences.

1.1 Context and Topics

The workshop focuses on putting the following multisensory media topics in an actualised context:

- An understanding of how digital content can be enriched with multisensory features in different phases of the production-distribution-rendering workflow
- The exploration of various opportunities that provide designers and developers with the means for creating meaningful multisensory experiences by making use of a wide spectrum of sensory experiences
- An overview of different application areas and interaction scenarios that can benefit from multisensory stimulation

Topics of interest include, but are not limited to, the following:

- Multisensory Experiences QoE evaluation (subjective, objective, online vs offline)
- Human Factors (including user modelling) in Multisensory Experiences
- Application areas for Multisensory Experiences (Health, Education, Arts, Tourism, e-Commerce, etc.)
- Multisensory Experiences Standardization
- Multisensory Experiences in Augmented and Virtual Reality
- Cross-layer Mulsemedia design for Multisensory Experiences
- Multisensory Experiences datasets/databases

2 ORGANISERS

2.1 Workshop Chairs

- **Alexandra Covaci** is a researcher in the field of virtual reality, currently Lecturer in Digital Arts and Technology at the University of Kent, UK. Her main research area is on the interface between computer science and neuroscience, where she design and develops environments focused on skills training. She has an interest in the design of meaningful multisensory experiences by exploiting different combinations of sensory modalities and she is working towards creating a systematic understanding of multisensory experiences for interactive technologies.
- **Estêvão Bissoli Saleme** obtained his PhD degree in Computer Science from UFES, Brazil, in 2019. During his PhD, he was an Academic Visitor at Brunel University London, UK, supported by CAPES, had his thesis nominated among the top six 2019 PhD theses in Computer Science

by the Brazilian Computing Society, and received an honorable mention at the Brazilian Symposium on Multimedia and Web. His research interests include multimedia and human-computer interaction with a focus on digital multisensory systems, quality of experience of users, immersive technologies (VR/AR/XR), signal processing, middleware, and frameworks.
- **Gheorghita Ghinea** is a Professor of Mulsemedia Computing in the Computer Science Department at Brunel University London, UK. His research activities lie at the confluence of Computer Science, Media and Psychology. In particular, his work focuses on the area of perceptual multimedia quality and how one builds end-to-end communication systems incorporating user perceptual requirements. Currently, his research pursuits are centred on extending the notion of multimedia with that of mulsemedia a term which he has put forward to denote multiple sensorial media, ie. media applications that go beyond engaging the by now traditional auditory and visual senses, engaging three of our other human in a realistic manner akin to our experiences of everyday life.

2.2 Technical Program Committee

- Céline Jost, Associate Professor, University Paris 8 (France)
- Debora Christina Muchaluat Saade, Professor, Fluminense Federal University (Brazil)
- Kemi (Oluwakemi) Ademoye, Lecturer, University of Kent (UK)
- Stefania Serafin, Full Professor, Aalborg University Copenhagen (Denmark)
- Yevgeniya Sulema, Associate Professor, Igor Sikorsky Kyiv Polytechnic Institute (Ukraine)
- Celso Alberto Saibel Santos, Assistant Professor, Federal University of Espírito Santo (Brazil)
- Fernando Boronat Segui, Assistant Professor, Universitat Politècnica de València (Spain)
- Frederic Andres, Associate Professor, National Institute of Informatics (Japan)
- Niall Murray, Lecturer, Athlone Institute of Technology (Ireland)

3 PROGRAMME

This one-day workshop will offer an interdisciplinary forum of discussion interested in research on designing experiences that align rich data from multiple human senses. It will take place in New York (Online), USA, on June 21st, 2021, in conjunction with the the ACM International Conference on Interactive Media Experiences (ACM IMX 2021). The workshop will feature world-class keynotes, including Dr. Nimesha Ranasinghe, from the University of Maine, USA, on "*Sensperience: Digital Multisensory Interactions to Inspire a New Age of Experience Media*," and Dr. Oussama Metatla, from the University of Bristol, UK, on "*On Inclusion and Multisensory Interaction: Insights From Co-designing With/For People With Mixed Visual Abilities*." The accepted papers encompass studies revolving around crossmodal perception in virtual reality, colour prediction based on odour, remote health monitoring systems to capture physiological data in multisensory applications, multisensory technologies, and an authoring tool for immersive mulsemedia applications. The full programme is detailed in Table 1.

SensoryX '21 will focus on enhancing the multisensory scope of both designers and developers of multimedia and Mixed Reality experiences who could thus harness the whole spectrum of sensory experiences. For this, the workshop will foster and challenge current practices in designing experiences, and will explore and identify future research directions for creating experiences at the intersection of various sensory dimensions.

ACKNOWLEDGMENTS

We thank the organisers of the ACM International Conference on Interactive Media Experiences for the opportunity to host this workshop. Moreover, it would not have been possible without the high quality reviews of the TPC members.

Table 1. Detailed programme for the workshop. The schedule is set in Eastern Time Zone, NY, USA, UTC -4.

Hour	Activity
09:00 – 09:15	Welcome to the workshop and participants' introductions
09:15 – 10:15	Opening keynote speech. Dr. Nimesha Ranasinghe
10:15 – 10:30	Short break
10:30 – 11:30	Papers session I: – *Exploring Crossmodal Interaction of Tactile and Visual Cues on Temperature Perception in VirtualReality: a Preliminary Study* Clémentine Helfenstein-Didier (Univ Lyon, France), Amira Dhouib (National Engineering School of Saint-Etienne, France), Florent Favre (National Engineering School of Saint-Etienne, France), Jonathan Pascal (National Engineering School of Saint-Etienne, France) and Patrick Baert (National Engineering School of Saint-Etienne, France) – *Predicting the colour associated with odours using an electronic nose* Ryan Ward (University of Liverpool, UK), Shammi Rahman (University of Liverpool, UK), Sophie Wuerger (University of Liverpool, UK) and Alan Marshall (University of Liverpool, UK) – *Applying remote health monitoring to understand users' multisensory perception in real-time* Jordano R. Celestrini (Federal University of Espírito Santo, Brazil), Estêvão Bissoli Saleme (Federal Institute of Espírito Santo, Brazil), Niall Murray (Athlone Institute of Technology, Ireland), Celso A. S. Santos (Federal University of Espírito Santo, Brazil) and Rodrigo A. Varejão (Federal Institute of Espírito Santo, Brazil)
11:30 – 12:00	Lunch break
12:00 – 12:40	Papers session II: – *Using Multisensory Technologies to Stimulate People: a Reflexive Paper on Scenagrams* Céline Jost (Paris 8 University, France) and Brigitte Le Pévédic (South Brittany University, France) and Gérard Uzan (Paris 8 University, France) – *AMUSEVR: A Virtual Reality Authoring Environment for Immersive Mulsemedia Applications* Flavio Miranda de Farias (MídiaCom Lab, Brazil), Douglas Paulo de Mattos (MídiaCom Lab, Brazil) and Débora C. Muchaluat-Saade (MídiaCom Lab, Brazil)
12:40 – 13:40	Closing keynote speech. Dr. Oussama Metatla
13:40 – 14:00	Final discussion and Concluding remarks

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