

Intelligent Music Interfaces: When Interactive Assistance and Adaptive Augmentation Meet Musical Instruments

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ABSTRACT

The interactive augmentation of musical instruments to foster self-expression and learning has a rich history. Over the past decades, incorporating interactive technologies into musical instruments has emerged as a research field requiring strong collaboration between disciplines. The workshop “Intelligent Music Interfaces” covers a wide range of musical research subjects and directions, including (a) current challenges in musical learning, (b) prototyping for improvements, (c) new means of musical expression, and (d) evaluation of the solutions.

CCS CONCEPTS

• **Human-centered computing** → **Interactive systems and tools**; **Interaction techniques**; **Interaction devices**.

KEYWORDS

Music Interfaces, Musical Instruments, Self-Expression, Augmented Instruments

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1 BACKGROUND & RELEVANCE TO THE CONFERENCE

Since the first musical expressions of humans over 42,000 years ago, countless ways of creating and experiencing sound have been created and refined. Today, new sensors and computational capabilities of musical instruments are leveraged to broaden the artists’ expressiveness [11, 20], enhance teaching scenarios [9, 10, 18] or allow remote collaboration of musicians. Ultimately, *intelligent musical interfaces* can augment humans’ capabilities to express themselves by creating sound and music.

Initial work in the domain of intelligent music interfaces focused on improving the play performance of students through learning-by-demonstration [12, 17, 22] or by reflecting the performance directly to the student for real-time improvements [3, 8, 15]. Further, musical instruments were augmented by technologies to extend the musical sound space. For example, gestures and musical instruments can be combined to change the pitch of a sound [7, 11, 20]. We expect future musical instruments to integrate interactive features, promote self-expression, change stage performances, and augment the audience’s perception of a performance [6]. Consequently, intelligent musical interfaces are highly connected to human augmentation. Not only is the creation of music and sound augmented, but so is the experience of it. The second edition of the IMI workshop was held in 2023 in conjunction with the AHs ’23 conference [2].

2 WORKSHOP CONTENT

The workshop “Intelligent Music Interfaces” (IMI) lays the foundation for a research field concerning integrating interactive components into musical instruments for creating new ways of musical expression and creating immersive performances for audiences. We aim to connect recent research revolving in this field with the workshop to start, grow, and foster a community around intelligent musical interfaces. This includes presenting, demonstrating, and

discussing existing, augmented, and novel musical instruments and technology used during stage performances.

Our workshop offers various research topics in (a) new ways of musical expression and perception, (b) prototyping for improvements, and (c) evaluation of the solutions. Musical expertise is optional for participation in the workshop since we aim to connect researchers from different disciplines.

We plan an in-person workshop led by 1-2 of the organizers, but we are prepared to switch to full virtual participation if the circumstances do not allow physical participation. Either way, we intend to offer an inclusive format and enable remote participation via Zoom in case special circumstances prevent in-person participation. Details for that are given in the workshop structure below; details for the submission formats are provided in the call for participation. We plan interactive sessions where participants can engage with several intelligent music interfaces to foster discussion. The exhibits are from workshop participants and the organizers. The organizers will ensure that there are enough exhibits to fill this workshop. We need one projector and several power sockets for the participants and demos.

3 GOALS AND OUTCOME

IMI brings together researchers, artists, and practitioners from different disciplines to foster interdisciplinary research. After the workshop, we encourage researchers to rework their publications based on the discussions and feedback from the workshop. We will support researchers in submitting their final papers to arXiv or as preprints on our website. Based on the group work and moderated discussion, the organizers plan to distill critical aspects and the workshop's outcomes into a position paper published open access. The anticipated results are available to research questions concerning prototyping, the study design, and the evaluation of intelligent music interfaces. The feedback from the workshop attendees accompanies these research questions to inspire researchers interested in tackling the research questions. Based on the interest of the workshop attendees, we organize regular meetups. We plan to establish a long-term format with a potential future invitation for the authors to contribute to a journal.

4 SCHEDULE

Pre-Workshop Plans: We will distribute information and materials on our workshop website. Information includes the intention, motivation, and potential outcomes of the workshop. Furthermore, the website serves as a platform to advertise and acquire potential workshop participants. The workshop website will be available under the domain sneesh.com/imi/. The website includes a workshop description, objectives, and possible submission topics. It also hosts the call for participation, a link to the submission system, the workshop schedule, further organizational information, and information about the workshop organizers. Accepted papers will be made publicly available on the website before the conference to maximize the preparation time for the workshop and foster discussions. Finally, workshop participants can join our Slack channel to receive updates about the workshop and join our community.

Workshop Plan: We plan a full-day workshop for around 20 participants and the following schedule:

- (1) **Workshop introduction** (15 min): the organizers introduce themselves, the workshop topic, and the schedule.
- (2) **Moderated speed dating** (approx. 15 min): the workshop attendees participate in speed dating sessions to get to know each other by physically grouping them.
- (3) **Introduction of interactive session** (10 min): the organizers introduce the interactive session and answer questions. Interactive presentations and demonstrations will be set up before the workshop.
- (4) **Interactive music session** (60 min): hands-on experience with different intelligent music interfaces for the participants.
- (5) **Short break**
- (6) **Keynote** (20 min + 10 min discussion): the keynote speaker will be announced one week before the workshop. For the keynote, we *requested* the German tech journalist Pina Merkert¹ who does creative tech projects.
- (7) **Lunch break**
- (8) **Art Pieces** (approx. 3×10 min): participants perform their art piece.
- (9) **Short break**
- (10) **Pitch presentations** of short papers and research statements (total 70 min): 5 Research Statements 3+2 min (25 min), short break (5 min), and 6 Short Paper 5+2 minutes (42 min).
- (11) **Coffee break**
- (12) **Moderated discussion and closing** (60 min): the organizers moderate a discussion based on the pitch presentations, art pieces, and interactive demonstrations. Finally, the workshop is closed.

5 RECRUITMENT & REVIEWING

The organizers use their social networks and mailing lists to disseminate the call for participation (see below). Submissions will be collected via EasyChair and reviewed by the IMI PC. Each submission will receive 2-3 reviews from the PC members and external reviewers.

Call for Participation: Playing a musical instrument has many benefits, such as positively impacting mental health or dexterity. Electronic elements were integrated into traditional musical instruments in the early 1930s to create instruments, such as E-guitars, that offer new musical expression. Electric instruments evolved by combining networking and computational capabilities. These new capabilities can further broaden artists' expressiveness, enhance learning scenarios, allow musicians to collaborate remotely, and create new musical instruments.

In this workshop, we will discuss and interact with intelligent music interfaces of any form. Novel music interfaces could be a new adaption of a traditional musical instrument, an interface for learning, or even supporting software. The workshop will be held in person with the Augmented Humans International Conference

¹<https://www.heise.de/autor/pina-merkert-4265420> – accessed 20-March-2024

on April 4th in Melbourne, Australia, while offering to participate virtually.

Submissions should follow the ACM two-column format with a length between two and four pages, excluding references. We solicit the following types of submissions: *position papers*, *research statements*, *art pieces*, and *interactive demonstrations*. The duration of an art piece is limited to 15 minutes. As interactive demonstrations, we consider demonstrating an intelligent musical interface that workshop participants can try out during the workshop. The authors of interactive demonstrations and art pieces are invited to present a prototype in the interactive workshop session.

Information about submitting papers can be found on the workshop website². Participants will be selected based on the merit of their contribution to the workshop. We encourage authors to make their research available on arXiv³ after the workshop. At least one author of each accepted submission must attend the workshop. All participants must register for the workshop.

6 ORGANISER BIOGRAPHIES

The first version of the IMI 2022 workshop was conducted in conjunction with CHI 2022 in New Orleans [16]. The second version, IMI 2023, took place during the AHs 2023 conference with great success [2]. The organizing committee of the third IMI workshop consists of the following researchers and professional musicians. Each of them contributes long-term experiences in organizing workshops including Handling IoT in HCI (IoT '17), Reading the Mobile Brain (MUM '17) [5], Designing Assistive Environments for Manufacturing (PETRA '17 - '21)⁴, SmartObjects '18 (CHI '18) [21] and SmartObjects '22 (ISS '22) [25], a series of workshops and events about vulnerable road users [13, 14, 19, 23, 24, 30] as well as several local workshops for bands and musicians.

Thomas Kosch is a professor at the Humboldt University of Berlin. His research focuses on physiological interaction, including designing, prototyping, and evaluating physiological user interfaces. In addition, he is an expert in integrating physiological sensing into musical instruments using EMG [7, 8, 11] or customized 3D-printed sensors [26] to implicitly and explicitly augment musicians. Thomas is deeply interested in new ways to create music, augment existing instruments, and create tools and feedback mechanisms supporting musical students. He will provide his experience in prototyping and evaluating novel music interfaces. He has played piano, guitar, drums, and alto saxophone for several years.

Andreas Weiß has over 30 years of experience as a musician, composer, and music teacher. He is part of several band projects and co-owns the music school Schallkultur in Kaiserslautern, Germany. In addition, he collaborates with several research institutions by contributing his expertise as a musician to develop and evaluate new innovative music interfaces, such as Let's Frets [17, 18]. Andreas' practical didactic experience will allow workshop attendees to quickly identify challenges and opportunities when using interactive technologies in learning scenarios.

Snehesh Shrestha (<https://snehesh.com>) is a PhD candidate at the University of Maryland (UMD) College Park. His research focuses

on AI-assisted music education. He develops technology, tools, and applications to provide real-time feedback during practice for music players. He has an open-sourced fast video annotation tool, FEVA [28], developed perception models such as high temporal resolution 3D human pose estimation, AIMusicGuru [27], and is currently working on music understanding and feedback models. He is interested in empowering music teachers by creating super-tools that augment their capabilities in understanding their students' strengths and weaknesses. He is also interested in developing technologies that foster good form and habits to avoid injuries and learn better techniques. He has been playing the guitar for 25 years and is currently learning to play the violin.

Matthias Hoppe is a PhD student at LMU Munich, where he focuses on mixed reality as a new medium and investigates the application of haptic feedback in virtual reality to alter one's perception. Therefore, he is also interested in how such novel interactions can enhance experiences with novel music interfaces. Matthias has experience in evaluating supportive tools while practicing musical instruments.

Jordan Aiko Deja (<https://jrdndj.com>) is a PhD candidate working on augmented reality, music learning, and adaptive visualizations in the HICUP research group at the University of Primorska, Slovenia. He is researching augmented reality techniques to teach improvisation on the piano. His main goal is to design interfaces that enable people to be more creative. He has also worked on several instruments and interfaces such as the EMG-based guitar [29], Vi-Tune for the Deaf and Hard-of-Hearing [1], and the ImproVise for the Piano [4]. He is also part of the Center for Complexity and Emergencies Technologies (COMET) research group from De La Salle University, Philippines.

Andrii Matviienko is an assistant professor at KTH Royal Institute of Technology in Stockholm, Sweden. His research focuses on assisting technology in urban environments, mainly designing, constructing, and evaluating multimodal and mixed-reality interfaces for vulnerable road users. Additionally, he has over 20 years of experience playing trombone in amateur and semi-professional orchestras in Ukraine and Germany and a bass guitar in jazz/funk/rock bands.

Karola Marky is a professor at the Ruhr-University Bochum. Her research focuses on the self-determination and self-expression of individuals in digital spaces, explicitly considering ubiquitous technology and novel (security and privacy) interfaces based on tangible interaction. She leverages novel interfaces and interaction techniques to improve musical instruments dedicated to beginners and students (cf. [18]). In her free time, she plays the piano and sings. She will coordinate the workshop organization and contribute with her expertise in evaluating novel intelligent music interfaces.

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²<https://www.thomaskosch.com/imi/> – accessed 20-March-2024

³<https://arxiv.org> – accessed 20-March-2024

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