

Research Visions

As an outcome of my PhD work, I plan to extend my research on participatory interactive technology for creative co-creation among audiences and performers with a focus on HCI and autonomous music technologies. In the following, I will present some of the most preferable ones.

Musical HCI. My work with interactive concert technologies focussed on the use of smartphones for audience members and accelerometers on the performer side so far. However, I see great potential in the use of movement data on the side of the audience as well, which them to contribute to performances more unconsciously. Further work should not only expand on accelerometry, but also explore camera signals for obtaining movement data. In addition, I developed a concept for the use of audience feedback for creative participation via emotional response models during my time at Georgia Tech which I would like to implement in the near future. I think this not only is interesting creatively, but also carries potential for learning about audience response from an analytical perspective. Taken into account the many new generative AI prototypes, this is envisioned a powerful tool for audience-performer interaction in the years to come.

Tactile interactive technology and robotics. In contrast to those rather invisible approaches that try to sustain the concert behavior as it is and use sensors in a more hidden way, I see potential in the use of playful interactive technology that uses ergonomically elaborate tactile technologies for the use among audience members. I developed a draft for a study that uses easily accessible handheld devices that interact with robotic technology as part of the audiovisual stage design as a further development of the second concert study done as part of my PhD work. These ideas evolved in the robotics lab at Georgia Tech and it could be interesting to test this in a smaller concert study later this year. Additionally I see connections to immersive audio in venues that offer 3d audio environments or implementations for virtual spaces as an extension of the approach eventually.

Analyzing interaction and motion data. Up until now I was mainly using log data of the interaction and motion data of sensors placed on wrists and ankles for analysis that were aggregated with questionnaire data taken from audience members after the live experiments. However, it could be interesting to record emotional feedback in a more continuous way and also try to work on cross-analysis looking into correlations of interaction data, continuous emotional feedback, and musical parameters. Such a research design would allow to get a fuller picture of the interactive behavioral aspects during live events. Ultimately, such records could eventually be used to build models for audience reaction, offering simulations to certain groups that can then train systems during live events for later use during studio work. This is regarded an interesting tool for creative individuals and groups during conceptual work such as songwriting or the creation of performances.

Symbiogenesis. Finally, on a more theoretical level I envision some interesting developments in the fields of genetic algorithms and genetic coding. Alternative approaches to neural networks or combinations with other biological metaphors can be very powerful for creative fields. I recently did some work on symbioses and symbiogenesis as alternatives to genetic algorithms which usually are based on Darwinian principles. Combining those approaches with real biological matter is another interesting field of work, especially when it comes to non-realtime settings, where participants develop work over a certain amount of time. This then can include processes that allow more latency, but still can be integrated in event-based realtime applications eventually.

Audience cognition. I did some excursions into audience perception and collective cognition, but there is so much more to explore in this domain that I could not include in my PhD (I only measured big 5 with a set of prior music (listening) experience measures). I would like to understanding the affect- and emotion-related dimensions of applause better, and integrate them with entrainment (and synchronization) effects for

collective listening scenarios. My PhD was mainly focused on participatory aspects and I could include the analytical findings only to a certain extent, which is why it would be really exciting to do this in future projects together with more data available.

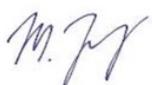
Advanced audio-visual analytical methods. I could see some value in exploring advanced microphone array techniques for getting the best recording of the spacial scene of a concert, combined with an intelligent listening algorithm to make sense of such networked audio data. For the visual domain, I could see some sense in focusing on video analyses methods rather than infra-red motion capture systems, given that video is less intrusive into the ecological nature of a concert. In my own concert research, I collected camera signals, but ended up not including those in the analyses to focus on the individual interface data points. For future projects, I would also like to look into clustering of combined audio-visual datasets, and find patterns of audience behavior that way. Together with performer-related data this is a really strong basis for testing hypothesis or exploring perceptive and behavioral patterns.

Performers' perspective. It is critical to include the performers' perspectives not only via analytical performance technologies and interview data, but also for the research design and analytical methods used for the studies. In my experience, they provide new aspects of performer-audience interaction, that can be easily overseen by the researchers. As a research perspective, I could imagine to work closer with the performers (and where possible also the composers) of the works, in order to understand the intentions, the pivotal points in the composition, and their previous experience with audience feedback of the works. It could be beneficial to investigate the methodology of designing audience experiments deeper and experiment with unconventional methods that go beyond conventional project work and concert settings.

Audience interfaces for continuous feedback. During my concert studies, I recorded audience feedback as inputs into the co-creative compositions, logging their individual inputs as continuous feedback. These channels could provide interesting supplementary data for understanding audience members feedback and reaction patterns during the parts of the concert, where there is no applause, and in turn, relate this data to the applause signals given at a later point. I also found that pressure-sensitive feedback devices are better suited than smartphone-based methods, which is why I recently built a squeezable ball which I use for measuring the arousal among the audience. These balls are sending continuously via Wifi and last for about 2 hours of time which is usually enough for a concert (or at least part of it). While this audience instrument is used for direct input in my case, it could be interesting to use it as feedback device in the concert hall together with the accelerometer/gyroscope data or even use it as a playful device complementary to the applause studies.

Participatory works. I am also interested in participatory work in the concert hall. While most of my previous work in audience studies centers around popular music, I would like to take the opportunity to explore works with orchestras, which is naturally much harder to organize than working with smaller ensembles as done for the concert studies during my PhD. There is potential to expand the methods and materials I developed for those studies to the context of classical music and other performative works within the concert hall. Given the intention to use sophisticated analytical methods, specifically in the visual domain, affords interesting scenarios to use this data for the real-time context, both for audience display and interaction, as well as for performer-audience-interaction.

More research aims that go beyond concert studies can be found in the chapter on future work of my PhD thesis (chapter 9.5). I also present some ideas and sketches for future audience study setups there.



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