Composing for the Interactive Medium

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Abstract—**We present a discussion of the role of the composer when developing content for the interactive, participatory medium. We describe compositional tensions which emerged during the creation and enactment of our interactive performance, *humanaquarium*, and discuss how the intertwined nature of interactive and aesthetic concerns inspired our creative innovation in the composition process.**

Participatory performance, interactive art, composition, musicianship, experience-centered design

I.   INTRODUCTION

Composing for the interactive, participatory medium poses significant challenges for the artist, who is knowingly giving up absolute control over the execution and presentation of his/her work by framing the creative work as a dialogue which includes the contributions and participations of those who encounter it.

The degree of interactivity in a piece of participatory art can vary broadly. The most conservative manner of encouraging participatory interaction sees the creative team tightly defining an interaction paradigm allowing users to explore a small range of actions in order to trigger a known set of potential outcomes. More abstract forms of participatory art may treat the interactive experience as a broad framework and canvas within which participants may explore freely, contribute content, and take part unrestrictedly in the shaping of experience.

Questions can be raised about the role of the artist who composes works that are necessarily so dependent upon the contributions of those who encounter them. If an artist defines his/her practice as a method of enticing participants to collaboratively shape a creative experience, is s/he actually functioning as the sole composer of the experience, or rather, to some degree is s/he instead responsible for a more facilitatorial role in designing the site and method of interaction?

In this paper we present a discussion of the role of the composer when designing participatory art media. We illustrate our discussion by describing considerations we made during the compositional process of *humanaquarium*, an interactive performance created by our research team [7,8,9] and discuss how experience-centered methodology applies to our design practice. We explore how various tensions surrounding the issues of discoverability, expressivity, and location of creative agency emerged during the process of developing *humanaquarium*, and how those tensions informed our compositional process when authoring content for the interactive medium.

II.   AUTHORSHIP AND AGENCY

Tanaka [6] addresses the question of authorship and agency, describing a participatory framework which allowed individuals to upload, remix, and re-present musical content via a shared network. He argues that his role as creator of that work was as the *"composer of the piece because I have created the system, I have created it as an environment where people must figure out how to react. [It is] an idiosyncratic artifact, a situation created by the artist that incites or naturally filters certain reactions. I am, as the composer, gently guiding or deviating the user or pulling him through my way of seeing things and inviting them to send in a piece of sound that becomes part of the piece."* [6, p. 279] Mandelbrojt et al. concur, stating "*As in conceptual art or installation art, the import of a work of interactive art lies thus in the idea that sets it in motion.*" [3, p. 214].

Winkler describes the challenge of composing content for the interactive medium as requiring the composer to achieve an aesthetically pleasing balance between predetermination and indetermination in the finished work. "*Structure, form, timing, order, development and transition: these are some of the issues that are of primary concern to composers of a traditional score. A composer employing nonlinear structures must be willing to give up total control of these important compositional decisions, delegating them to a performer or to improvisational computer processes.*" [10, p.31]. While

a purely indeterminate composition may lack cohesion if executed unsatisfactorily by the participants who shape its enactment, a well-crafted interactive composition allows participant-led improvisation to enhance and interrelate with the predetermined content, contributing a sense of spontaneity and ephemerality to the work. The composer must judge how much of the piece s/he will control, and how much of the piece will be left open as a space within which participants can experiment and create.

Viewing the composition of interactive works as the implementation of a space for collaboration and co-creation – a space intended to facilitate interaction which is guided and inspired by the vision of the creative artist – allows us to consider the role of the composer of interactive art as the designer of the boundaries, transaction mechanisms, and communication protocols of a medium which is intended to be opened and shared with the participating public.

III. AN EXPERIENCE-CENTERED APPROACH TO INTERACTIVE COMPOSITION DESIGN

We consider the question of whether the interactive platform's dual requirements of functionality and aesthetic consideration have necessitated us to perform the roles of 'artist' and 'interaction designer' alternately and sequentially, or whether the method of composing for audience interaction is negotiated in a more holistic fashion, blurring the distinction between what is an aesthetic choice versus what is a functional one. If interactive art depends fundamentally on its functionality to shape the aesthetic outcome, we feel that our two concerns cannot be separated, and that rather, a unique method of creative practice emerges when aesthetic content is considered in terms of a creative space which the artist crafts and shapes in order that it may eventually be inhabited by its consumers.

To address this interrelationship between aesthetic content and those who interact with it, we apply McCarthy and Wright's interpretation of technology as experience [4] to the design process of participatory media. During the design phase of our installations, we explicitly consider the technological content of the creative work as an artefact to be viewed within the sociocultural context of how it will be encountered. We consider the artistic artefact in terms of its "four threads of experience" – its *sensual, emotional, spatio-temporal* and *compositional* aspects, attempting to address the experience we were creating in a pragmatic, holistic way. This view of the "composition" addresses not only the audio-visual and tangibly interactive aspects of the performance content, but also considers the design in terms of the experience of those who will eventually interact with it – the performers, participants and spectators.

While sensual and compositional elements tend to be directly considered in the creation of both traditional and interactive forms of aesthetic works, we feel that the specificities of the interactive platform require us to be equally attentive to the emotional and spatio-temporal factors affecting the highly interpersonal and situational nature of collaborative interaction in public spaces.

Our compositional practice explicitly values the methodology found in experience-centered design research. We use the framework of McCarthy and Wright to structure our design process, considering a performance in terms of its sensual, emotional, spatiotemporal and compositional aspects [9]. We interrogate each of these experiential factors in turn in order to challenge our conceptions of how a participant might encounter and interact with a creative work. Borrowing from the practices of interaction design, we attempt to maximize participant engagement by exploring how participants encounter, understand, and appropriate interactive art.
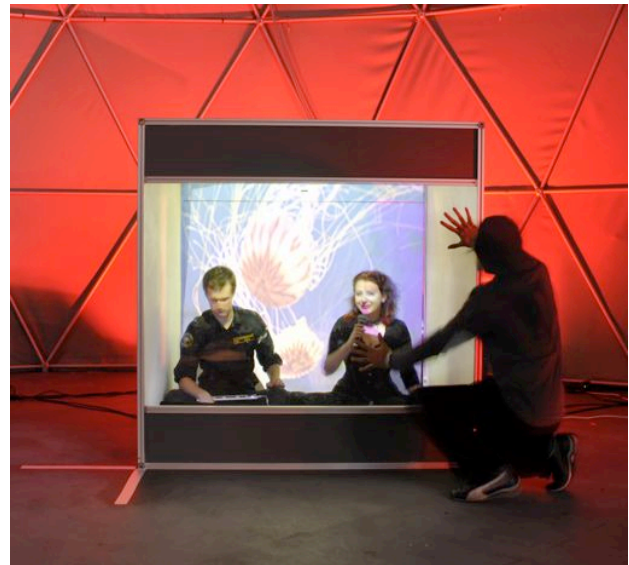

Figure 1 – The *humanaquarium* performance

IV. HUMANAQUARIUM

To illustrate our discussion of compositional considerations in the medium of interactive performance, we present the example of an art piece, *humanaquarium*, that our team has been developing and performing since 2009 [7,8,9].

humanaquarium's interaction platform is designed to support the composition of participatory performance pieces whose execution is determined by the interventions of audience members who enter the performance frame [5] and through their actions collaborate with two musicians to co-create the audio-visual aesthetics of the performance.

The *humanaquarium* interface consists of a large (1.5 m) cube, placed directly on the ground (see Figure 1.) The

installation is situated in public spaces where it can be encountered by passersby. The front wall of the cube is a transparent acrylic sheet, made responsive to touch by the implementation of frustrated total internal reflection (FTIR) technology [2] which enables audience touches to be detected and interpreted by a network of computers inside. Through the transparent front pane, passersby can see two musicians (authors Taylor and Schofield) who sing and play acoustic instruments in the manner of traditional buskers, and are accompanied by a soundscape of electronic music which is being controlled on-the-fly by Max/MSP and Ableton Live. The rear panel of the cube forms a projection surface, upon which visualizations created in Jitter are mixed in real-time by the performers inside the box.

The performers make eye contact with participants and encourage them to touch the interactive transparent panel on the front of the cube which separates the musicians from the audience. The intensity and placement of audience touches are then used to affect the parameterization of the Ableton Live soundscape, and the Jitter visualization, live-mixing the soundtrack, adjusting the timbre of the synthesizers, layering and manipulating the videos, and applying audio effects to the acoustic performance of the live musicians. Participants' touches result in distinct audio-visual feedback from the system, allowing them to explore the action space in order to discover how their interventions affect the performance. In response to audience contributions, the musicians can adjust their performance, entering into a dialogue of proposition/response with the participants who choose to join the performance frame and manipulate the touch sensitive interface in order to share control of the audio-visual progression of the performance.

Further detail about the physical construction and software implementation of *humanaquarium* can be found in a previous publication [8], and video documentation of performances can be viewed at http://www.humanaquarium.org

In developing and refining *humanaquarium*, our creative practice spans the disciplines both of interaction design and performance, allowing us to work closely as a team on all aspects of the design and compositional processes. We create aesthetic content together during group composition sessions, and the musicians who perform inside the *humanaquarium* installation are the authors Taylor and Schofield (with Shearer on-site to facilitate audience interaction.) Directly participating in the *humanaquarium* performance allows us to design, experience, and evaluate the installation literally from within its enactment [9]. By participating directly in the performance of the piece rather than taking a removed role as observers, our perspective as composers is enriched by having firsthand experiences with the work from which to draw new inspiration for creativity. We present the *humanaquarium* as an intentionally open

piece of work, which we have refined and extended over the course of a year's worth of public performances.

When creating content for *humanaquarium*, we are constantly mindful that we are creating compositions in the form of audio-visual parameterizations within which our participants can freely experiment and explore, giving them the agency with which they can collaborate with us to co-create the development of the performance. We describe in [7] the experience of composing content for such a medium, and how when composing musical pieces for the *humanaquarium* platform, "*interaction paradigms were established iteratively and concurrently with the content composition. The skeleton of the audio/visual content was outlined, providing a starting point for the development and refinement of interactions and musical ideas.*" We as composers provide the framework and boundaries defining what our participants can contribute, and enable them to enter into a dialogue with us via the tangible membrane of interaction – the transparent reactive surface which allows us to share communication and co-create.

By framing *humanaquarium* performances as dialogues between performers and participants, and composing the aesthetic content as a structured environment to encourage playful exploration and co-creation, we have practiced a method of composition which simultaneously considers artistic and functional concerns. Designing creative content by defining spaces within which users can interact, and considering the role of composer as he/she who determines the parameters of what can be undertaken within the boundaries of an aesthetic, creative system allowed us to develop a practice whereby we crafted a sketch of the anticipated performance experience, leaving room for its specifics to be realized by the dialogue between artist and audience at the time of performance.

V.   COMPOSITIONAL TENSIONS

During the process of designing the *humanaquarium* interface and creating audiovisual content for the performances, we were able to observe various tensions arising as a result of our need to function as composers both of aesthetic content and of interaction design. Creative choices which would have seemed valid in more traditional uni-directional performance contexts often had to be re-evaluated when consideration was given to the needs of composing art intended to be realised as a dialogue between performers and participants.

These tensions tended to surface when we considered the composition from the perspective of the novice participant's encounter of the installation. Often matters of composition were influenced by the concerns of interaction design as well as by matters of aesthetics. We identified three main areas where usability concerns were inextricably intertwined with the aesthetics of our compositional practices, influencing our creative choices: *discoverability*, *expressivity*, and *location of creative*

agency. The negotiations we made in order to balance our creative choices so as to satisfy both aesthetic and interactive concerns reinforced our conceptualization of the role of composer as both artist and facilitator. As we had opportunity to develop multiple compositions for *humanaquarium* [7], we were able to experiment with addressing these concerns using different strategies. Rather than considering interaction design as a limiting factor in our creative process, we suggest that in fact, it stimulated our creativity in novel ways.

A. Discoverability

humanaquarium is a particularly unique installation, with an interface that bears little relation to other interaction mechanisms found in the familiar world. People do not generally go around poking at transparent windows. And if they did, they would not expect the windows to generate sounds and images in response! As the *humanaquarium*'s front screen could be viewed as some form of traditional proscenium, we expected that the natural instinct of audience members would be to watch the performance inside from a respectfully distant vantage point. We had to determine how best to initiate participant interaction. We had to let people know that there was something they were able do with the interface, and that it was socially acceptable for them to enter the performance frame and take part in the ongoing performance. Initially we considered explicit methods of indicating to participants that the interface was touch-sensitive, but resorting to such blunt forms of instruction such as signage seemed unacceptably stilted and mechanical.

Figure 2 – Participants and observers gather

We quickly realised, however, that the performers inside the box could easily establish eye contact and gestural communication with the observing audience. Beckoning participants closer, reinforcing their actions with encouraging motions and facial expressions, and modelling for them the interaction of placing their hand upon the glass resulted in them rapidly gaining an understanding of their role in the performance. Children in particular were highly responsive to the coaxing of the performers, responding almost universally to the singer's placement of her hand upon the glass by mirroring her gesture, making contact that would have been physical had it not been for the separating barrier of the interactive screen.

After surmounting the initial obstacle of encouraging participants to enter the performance frame and take part in the experience, we then faced other issues surrounding discoverability, where we began to experience a tension between our desires to create complex, nuanced, and rich performances, and the practical need to make the results of participant interactions adequately legible. In laboratory experimentation we initially implemented the window interface as a large synthesizer, allowing the location of each touch to trigger the onset of specific notes. This very direct mapping between action and response was both satisfying and unsatisfying – essentially modelling the interactive screen as a large vertically arrayed keyboard allowed participants very direct control and expressive variability, but diminished for us the experimental, ludic [1] nature of participant exploration and discovery that more subtle forms of interaction allowed us to achieve. We wanted participants to be intrigued by the richness of *humanaquarium*'s responses – we didn't want them to become bored by a system which was too simple – but we were aware that by making the mappings overly intricate we would only succeed in making the interface too confusing to be controlled.

Throughout the development process we had to revisit the balance between complexity and legibility in order to produce compositions and interaction mappings that resulted in participant satisfaction. We settled upon interaction methods that encompassed both straightforward mappings (eg. spotlights would change colour when participation was initiated, and touches on the screen would manipulate a superimposed graphic that followed the user's fingers) in addition to more subtle, nuanced interactions (layers of synthesized audio would change in timbre and intensity based upon the geographic placement of touches upon the screen interface.)

Participants' discovery process was typically one of trial-and-error. They experimented with touching the screen and observed the audio-visual responses that their intervention elicited. As participants began to develop an understanding of how their actions influenced the performance, we could see them repeating motions and testing the system responses, clarifying their understanding of what they could make the system do.

Adjusting the obvious and non-obvious cues to increase or decrease interaction legibility allowed us to explore our desire to make the interface accessible, but intriguing. Creative tension arose during the compositional process as we found ourselves constantly negotiating and

renegotiating how to balance these concerns in order to achieve pleasing and stimulating performances.

We intentionally designed performances so that participants were not required to fully understand their agency in order to appreciate it. Although participants could not realistically identify each parameter that their touch was controlling, the degree of legibility needed to be such that they knew they were doing *something*, and that would stimulate their curiosity to discover further what that *something* was and how it could be controlled.

B. Expressivity

We had to consider the degree of expressivity we should allow participants to control, and define the boundaries of the interaction space they would explore. While allowing the interactions to be sufficiently nuanced as to permit a skilled and patient participant to experience increasing degrees of mastery over their contribution to the performance is desirable, we were cautious about allowing them to make "mistakes", concerned that this could scare them away from further investigation.

This presented a compositional challenge: in order to enable virtuosity, the degree of expressiveness and flexibility provided by the interface would likely also allow users' experimental and inexperienced contributions to be unpleasant or inaccurate due to inexperience. As previously mentioned, we experimented with mapping touches to discrete pitches. While this would allow patient and determined users to learn to "play" the interface quite competently, it could also permit elements of cacophony and discord to be introduced by unskilled or malicious players, unless the subset of all playable notes was selected such that all possible inputs resulted in pitches congruent with the key signature of the piece.

Our primary method of mapping touch to audio involved allowing the location of participant touches to affect the tracking of Ableton's synthesizers and the parameterization of real-time audio filters applied to the performance of the musicians inside the box. This meant that participants were able to intentionally modulate dynamic shifts in the timbre of the audio soundscape, and bring various instrumentations and melodies to the foreground of the orchestration. This strategy prevented participants from making any undesirable contributions (as their contributions were bounded by the pre-defined compositional space.)

We understood, however, that the more we made the performances robustly "safe" with restrictive boundaries upon what participants could do, we reduced the potential for creative participants to approach virtuosity with the performance interface. We continually struggled with determining how best to enable expressivity while ensuring adequate control over the aesthetics of the performance.

C. Location of Creative Agency

The tension we felt when addressing issues of interface expressivity essentially related to our need to determine how best to share creative agency amongst the composed content, the live performers, and the interacting participants. As composers, our efforts to manipulate the locus of creative agency within the performance were implemented by defining the boundaries of the interaction space and the transaction mechanisms by which participants could influence the parameterised audio-visual content as well as the improvised responses of the performers within the installation.

Initially, we envisioned *humanaquarium*'s creative agency to be placed nearly wholly on the participant interaction, with the live performers inside functioning in a reactive role, improvising in response to the participant-driven manipulations of audio-visual parameters. Our initial composition, *Mariana*, was extremely open in form. Choosing to explore with a highly indeterministic form of composition, *Mariana*'s soundscape contained only sparsely detailed pre-composed content, highly reliant on participant manipulation of a widely varying audio-visual parameterization. This resulted in a performance that was extremely responsive to participant intervention. To further place the location of creative agency upon the participants and away from the live performers, we experimented with participant-driven audio filters that were intentionally difficult for the performers to control (eg: arpeggiators whose repetition rate fluctuated wildly based on participant intervention, vocal filters applying high levels of distortion.) This forced the performers to sacrifice control in favour of allowing participants to shape the development of the performance.
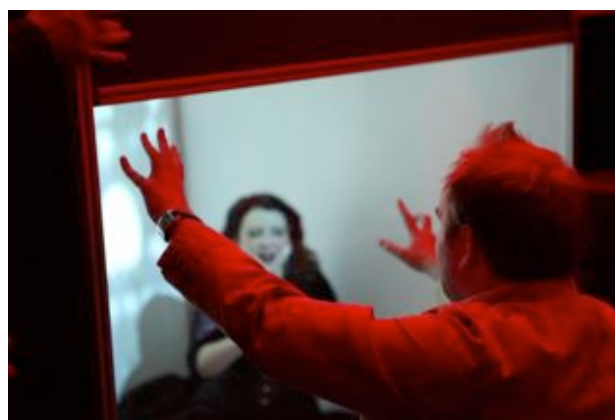

Figure 3 – A participant interacts with the performer

Not surprisingly, this resulted in a mixed response: while we were stimulated as performers and composers by the creative challenge of improvising within such a variable soundscape, our instincts (honed from years of traditional performance) tended to resist this strategy due to our desire to perform "interesting" musical lines and improvisations. Our next performance, *Darkshines*, featured a distinctly more rigid structure and complex

pre-composed content. In a subsequent piece, *Phantasmagoria*, we even attempted to introduce rudimentary narratives into the production (replacing the abstract imagery with content evoking Gaston Leroux's *The Phantom of the Opera*, and more explicitly casting the humanaquarium as a virtual theatre set.) As performers and composers, we felt that allowing "our" contributions (performances and audio-visual material) a significant amount of agency in the determination of the performance outcome was aesthetically beneficial, since that allowed us to use our skills as performers to contribute more complex and sophisticated musical content to our productions.

Upon review of our documentation of a year's worth of performances, however, we were interested to re-evaluate this compositional choice. While we concurred that a more structured form of performance allowed us to execute more polished and theatrical-style productions (and granted us personal satisfaction as performers and musicians) revisiting the early performances from the perspective of a temporally displaced and external observer allowed us to more greatly appreciate the compelling nature of the participant-driven performance enactment that was afforded by our initial treatment of the *humanaquarium* as a largely blank canvas for participant improvisation. We admitted that our return to more traditionally structured and performer-driven compositions was partially influenced by our own personal desires to acquit ourselves well as musicians – losing, in some ways, the focus of sharing agency with the audience by placing too much value upon the technical merit and aesthetic quality of our own musical contributions. We had worried that our free-form, audience-led compositions had lacked cohesiveness, but upon a re-evaluation of the year's trajectory, we realised that perhaps their openness and immediacy had provided a spontaneity and genuineness which was not fully realised by our later, more stylized productions. With this awareness in mind, we were able to revisit and perform our earlier pieces with a greater appreciation of their compositional value.

VI. CONCLUSION

Our experience in developing content for the *humanaquarium* participatory performance platform led us to reflect upon the role of the composer when creating for the medium of interactive aesthetic experience. We assert that the concerns of the interaction designer are inextricably intertwined with those of the content composer, and that they must be approached holistically. While practicality designates that it is sometimes necessary to alternately prioritize the concerns of one aspect over the other in order to address specific aspects of implementation or creative desire, recognizing their inherent interdependence allows us to stimulate novel ideas in compositional development. Design problems can be ameliorated by adjusting the aesthetics of the content, and conversely, inspiration and innovation can

be achieved by experimenting with the creative content in response to issues that emerge during the refinement of interaction design. Our experiences with *humanaquarium* allowed us to bring a piece of art into the public realm, and through experience, experimentation, and ongoing re-evaluation, use the continually evolving performance as a way to further our understanding of how our compositional choices could affect the public's engagement with our work. Approaching the composition of participatory art as the definition of boundaries, transaction mechanisms and exploration spaces allows composers to structure and facilitate a dialogue with participants that forms the emergent enactment of the creative experience.

VII. ACKNOWLEDGEMENTS

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