INTERACTION AT A CLASSICAL CONCERT

In collaboration with The Royal Danish Theatre,
and The Royal Danish Academy of Fine Arts - The School of Design

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The photos in this thesis are primarily our own photos from our work with the process, except in the chapters *Related Work* and *The Concert* which is a mix of photos by Ewa Moskala and Jesper Frølund Hansen, as well as screenshots from The Royal Danish Theatres video of the concert.
Abstract

This thesis introduces the research of combining the field of interaction design with the domain of the classical concert. The research is framed around a curiosity about why interaction at big stages tend to fail: how can mass interaction support the concert experience in a way that interactivity becomes a dialogue between artistic intention and audience experience.

The work is centered around a collaboration with The Royal Danish Theatre and The Royal Danish Academy of Fine Art – The School of Design, focused on a scheduled classical concert at The Royal Danish Opera, where a concept is tested. The work is carried out as an explorative work of a design space through interweaved processes of design practice and reflection, emphasizing the need to include the artistic intention and to support the experience of the performance.

Validation of the work is triangulated: empirical results from interviews and observation at the concert, supported by theoretical aspects, related work, reflection, and analysis. Additionally validation is drawn from the collaboration, as well as on a micro level: all engagements are part of the validation, making reflections in iterations and through material exploration.

With a focus on the whole, both regarding methodological points of view as well as the specific ideal to include artists and artistic intention, the work adds a new layer to the HCI (Human Computer Interaction) tradition otherwise dominated by a focus on the user.
In conclusion, the work brings forth four provisional takeaways to the design space of mass interaction: Reserve interaction for dramaturgical significant moments, Breaking norms creates social playfulness and disruptive behavior, Create tight coupling between action and meaning, and Tie the stage to the whole space.

The specific concept at the concert will be part of a repertoire and possibly be an inspiration to the design community and cultural institutions.
An auditorium experience

Coded Narratives by Vanessa Ramos-Velasquez with guest musician A Guy Called Gerald. At Transmediale festival 2013¹.

In February 2013, we were sitting in the auditorium of Haus der Kulturen der Welt in Berlin, with approximately 700 (Ramos-Velasques, n.d.) other people. Curious by the promise of active audience participation, the scene was set for an interesting mass-interaction experience. That expectation was not honoured.

Fifteen people from the audience were invited on stage by the artist - a woman dressed like a goddess character with reference to ancient Egypt. They were seated around a bonfire setting and instructed to:

¹ A leading media art event with focus on the connection between art,
write two lines of text related to the themes demotion, displacement, and irrelevance on an iPad being circulated. The artist encouraged them to write their two lines as a reaction to the previous line or a question to other audience members and further explaining that the text would be displayed on a big screen visible to the audience.

The goddess dressed artist entered the first two lines and passed the iPad to the circle of the fifteen audience members around the bonfire. Afterwards the iPad circulated the auditorium one row of seats at a time. It never made it to the back rows, and only a very limited amount of audience members got to participate in writing the text.

The text was transformed into morse code sounds with a binary feeling, that feeded into the music, performed by the musician A Guy Called Gerald, making electronic music.

The intention to create a dialogue between audience members failed. In practice audience members did not comment on other audience members texts. Most likely because the few that received the iPad had been thinking for a long time about what to write, not focusing on responding to other comments, and the feeling of dialogue and cross audience communication got lost.

The intention to create a dialogue between audience members and the performers failed too. The music seemed like a separate element. Even though some of the sounds came directly from the texts. A clear connection between action and meaning was missing. The connection between the interaction and the music seemed merely theoretical to us. A very small part of the audience was physically engaged. And the lack of flow in the meaning of the text made our experience a long wait for the one iPad to travel faster through the room.
In 2013, after Transmediale Festival, we decided to make a joint thesis.

After five years of education alongside each other, we have a shared understanding of the field of interaction design. There has been many discussions throughout the years. Through our shared interest in big scale interaction and digital art, as members of the collaborative art community Illutron, throughout our education, and as interaction designers; we have done numerous collaborative projects and writings together.

After two years together at Humanities and Technology Basic Studies at Roskilde University, we did the final bachelor year separately. Halfdan as BSc in Informatics and Computer Science. Maja as BSc in Computer Science and Performance-design. The past two years we have spend reunited at Malmö University, doing the master programme: Interaction Design.
1. Introduction

We experience that audience engagement, participation, and interaction on big stage settings tend to fail. Even though audience engagement, participation, and interaction are evolving in cultural production and the development includes some highly prestigious stages, our experience is, that it becomes a superficial layer on top of the core of the existing art form. There seems to be a lot of potential and resources available, but something often goes wrong when trying to make new formats, work in practice.

We are interested in how interaction can be a strong part of a big stage performance, adding quality to the overall experience, and creating an interactive dialogue between artistic intention and audience experience.

The term *mass interaction*, which we use in this thesis, is how we define and position our interest in interaction at big stage events. Embedded in this term is a seated audience in an auditorium-like setting, more than 200 audience members are participating, and everyone in the audience is part of the interaction. Furthermore the interaction includes technological digital material.

Though more importantly, this understanding of the term mass interaction, is used as a description that encapsulates a certain perspective usable about a lot of different events. The key is that the events we describe as mass interaction situations, are events where the complexity of the interaction is very different from that of a small scale concert with, for example, 20-50 audience members, where the artists, for instance, can make eye contact with each audience member before the concert is finished. This becomes more complex when the number of audience members increases. It gets harder for
the artists to reach out for each audience member in a direct way. There is an interesting complexity in the challenges of representing the audience interaction when the number of audience members increases. In a small scale, where the different audience members can take turns to interact one at the time, it is possible to give quite a lot of power, or effect, to each audience interaction, on a representation of the interaction output. When many people interact at the same time, it becomes a challenge to find a good way of representing an output of many audience interactions at the same time.

With this definition we are considering a concrete way of understanding interaction as a physical action with an understandable outcome involving technological digital material. We realize that interaction in a concert situation can include many different things. Some would argue that one artist on stage can create a felt interaction with thousands of audience members at a stadium. We use this definition as a way to address our of view interaction at big scale events, and it should not be seen as a general way of defining interactivity in these settings. This is also seen in the way the project focuses on the whole experience, not only looking at the actual moment of physical interaction with a digital outcome, but also including the existing interaction cycle of listening and playing music; musicians and audience members affect, and are affected by, each other. With the inclusion of digital material and auditorium setting in our definition of mass interaction we add artefacts and context to the equation; musicians, audience, artefacts, and context influence each other.

We consider it a need to include the artistic intention and collaborate with artists alongside the traditional HCI (Human Computer Interaction) focus on the audience in order to design an interactive creative collaboration between artistic intention and audience experience, and respect the integrity of the music experience.
Interaction should support the experience of the performance.

**Problem domain**

Our main focus in terms of genre is classical music, the classical concert. The project will be carried out in collaboration with The Royal Danish Theatre (RDT), with two scheduled classical concerts as research and design case, featuring the RDTs symphony orchestra: The Royal Danish Orchestra.

We will work in close collaboration with a design team from the The Royal Danish Academy of Fine Arts, The School of Design (the design school) and key actors within the RDT; musicians, technicians, and personnel with organisational and artistic responsibility for the concert.

**Classical music**

As a domain the classical concert is particularly interesting to combine with interaction since its quiet individual immersive nature can be perceived as contradictory to interaction. Listening to music and being at a live concert in the setting of an auditorium is a setup for an individual experience that should not be disturbed.

The classical concert is bound by rituals and traditions. “By following a single formula of virtuosity, tradition and formula, it is almost as if they are holding themselves hostage to a fixed idea around what a performance is” (Idema, 2012, 41). There is a need for new ways to connect the classical music with its audience, many have tried new formats and experimentation, but they are merely admirable exceptions (Idema, 2012, 43).

A lot has been done in the field of audience participation at the classical concert, but typically with a focus on interactivity and
technology with the consequence that the experience is often a forced layer of technology and the interaction is perceived as a disturbance to the art-form on the stage.

We want to combine interactivity with the domain of the classical concert to create a better concert experience, not for the sake of more interaction.

To create a better concert experience, we need to consider the full cycle of playing and listening to music. The musicians, the music, and the audience. We need to understand the genre and the classical music community to maintain the key intention behind the music and the concerts, to meet with and involve the musicians in the process.

One obvious challenge in mass interaction is reaching all of the audience in a way that supports the concert experience. When the number of audience is upscaled, it is unlikely that the performer can engage in a meaningful dialogue with each member of the audience during the concert.

We are interested in the balance between individual and shared concert experience supported by interaction. How attending a concert and listening to music is a personal immersive experience though inherently in a social setting, and whether that affects the personal and shared creative expression in relation to the music.

**Research focus**
We will explore interactivity at culture productions, mass interaction on big stages. Our initial research is framed around a curiosity of how to turn mass interaction into a dialogue between audience and artists in the domain of classical concerts. More specific: how can mass interaction support the concert experience, in a way that interactivity
becomes a dialogue between artistic intention and audience experience.

We use the term *artistic intention* as an umbrella term as there are obviously multiple intentions in play regarding artistic intention surrounding a concert. Besides all the different actors: the musicians, the conductor, the composer, the programme coordinator, the technicians, and several other personnel, we also include the actual live music and its expression. Also worth mentioning is our ideal to create a dialogical relationship between audience engagement and artistic intention; these are already connected in the listening/playing experience - where intention exists in balance with interpretation of those playing or listening. As such the listening and playing experience are intertwined in the live performance and we wish to apply this to the interaction experience.

To explore interaction with a big audience at a classical concert, we will address and search to understand some of the challenges in designing interactions that accommodate and support the qualities and artistic intention from the existing art-form on the stage: classical music.

To create a collaborative musical interaction between members in an orchestra and the audience it is crucial to understand the genre, the classical music community and artistic intention:

> [...] the practice of Music Interaction is intimately bound up with the practices of the music community. For many purposes, Music Interaction must answer to that community. When competing practices conflict, sometimes the judgements of the music community will take precedence. After all, what good is an interactive musical system if it is unsatisfactory for musical purposes? (Holland et al., 2013, p. 3)
We believe that a way to do that is not to understand and consider the interaction as a one way interaction, but rather a dialogue between artistic intention and audience experience.

In ‘Making Sense of Audience Engagement’ Brown and Ratzkin (2011) formulate a spectrum of audience engagement ranging from readers who just read the program to active learners who want to get their hands dirty: “They might enjoy learning a few steps of choreography after a performance, or having the opportunity to touch and play musical instruments in the lobby in advance of an orchestra concert” (Brown & Ratzkin, 2011, p. 24).

This represents a focus on audience engagement before or after the performance. We want to focus on live interaction during a performance. Here we see a promising design space for interaction design in dialogue and collaboration with the performed art.

This area is not covered in research and literature to a significant extent already. Many projects have worked with interactivity in performance settings from an interaction design angle, or technological angle, but not with a focus on the big audience group issues, and not with a focus on merging artistic intention with the interaction to avoid the audience experience to appear superficial.

An example of other people working with similar research projects, is the conceptual work of the Hyperaudience system by Van Troyer (2012).

Van Troyer works in a similar domain and touches upon similar considerations, but from a more classical HCI point of view, with a focus on the audience and the system. The essence of his framework is:
The system empowers the audience to be expressive, [...] The system supports active audience participation [...] The system encourages audience members to be communicative, co-creative, and co-explorative [...] The interface that audience members use to participate in the performance is transparent and user-friendly [...] The system is robust and modular, in order to accommodate the spontaneous changes to the development of a performance production and the improvisational nature of an actively participating audience (Van Troyer, 2012 p. 25).

He further includes very interesting aspects like expressiveness, learnability and scalability when designing real-time interactive performance systems, but do so from the one sided perspective of technology and audience.

We consider an interaction experience as a whole, that cannot be broken into parts, and we include technology, audience, the music, the musicians, as well as time and place in our design space.

The collaboration
The collaboration with RDT and the design school is centered around the two scheduled events at The RDTs Opera House: Music2Go 3 and Music2Go 4. The Music2Go concerts are performed by The Royal Danish Orchestra, Music2Go 3 is exclusively the percussion group and titled Concert with Impact, and Music2Go 4 is performed by the brass section of The Royal Danish Orchestra and titled Bundle of Brass.

Music2Go 3 and 4 are part of a series of four events with The Royal Danish Orchestra, with the shared agenda to challenge the classical concert and explore and do experiments on experience design. The RDTs collaboration with the design school is part of a collaboration, called Musical Experience Design, between five (Danish and Swedish) institutions funded by the EU Interreg program.
As part of that program we worked with a group of ballet dancers at The RDT, in the fall of 2013. Through workshops we worked collaboratively to explore how we could merge audience experience, dance expression and technical intervention. It was a fruitful and very interesting collaboration, but we ended the process without closure. One of the insights we kept from the process was that in order to make a collaboratively full concept we needed a deeper understanding of the performance, and in order to understand the performance we needed an understanding of the concept.

During our work with the ballet dancers, we got to know some of the collaborators as well as getting acquaintance with the house, the organisation and mechanisms of the cultural institution, the RDT.

We are four main collaborators working together around Music2Go 4: RDT, including both organisational personnel, technicians and musicians, The design school represented by two teachers and five students, a visual artist, and ourselves. Besides our three main stakeholders we are using our own network of professional musicians and have gathered a focus groups representing the audience.

Our role during Music2Go 3 has been a more passive observing role as the planning and concept development was already in motion when we joined the project. We have followed the process to gain insight on the use of technology and development of the concept to maintain consistency between the two concerts. During Music2Go 4, we have had a more central role in the concept development and with designing the interaction for the concert. The labelled division of roles between us and the design school is based on our respective domains: visual identity is their domain and interaction is ours.
Reader's guide
As a consequence of a programmatic research inspired way of working, the structure of this thesis is somewhat different than the typical interaction design thesis. The thesis has eight chapters divided into four main parts: Introduction, Design process, The concert, and In conclusion.

Part one: Introduction. The introduction includes the current chapter, Related work, Project frame, and Methodology. Project frame is unusual as it represents our optics and understanding of the project, and summarize some of our main results. We have kept developing the project frame throughout the design process up until the Music2Go 4 concert. Therefore it represents both initial research into the design domain as well as some of the main findings of the project, before the debriefing of Music2Go 4.

Part two: The design process. The design process is the chapter that describes all of our engagements leading up to the concert. This is where we detail and reason how the final design came to be, based on our design process, our motives, considerations and challenges. The chapter include Collaboration activities, Case:Music2Go 3, Ideation, Experiments, Concept, and Production.

Part three: The concert. Is represented by the two chapters: The concert and Debriefing the concert. It is a description of the concert and the debriefing of the experience through observations and interviews.

Part four: Conclusion. The last part is the chapter In conclusion where we relate our findings to the frame and present provisional takeaways, methodological considerations, and future work.
2. Related work

We have been working with related work as a way to frame the design space. Through different mapping sessions we have examined qualities and clustered concepts in relation to our research focus and relevant themes.

We have researched and observed a great number of related projects, and find that there is not one or two really good examples encapsulating the wholeness of the problems and qualities we are looking at, when designing a dialogical relationship between artistic intention and audience experience for mass interaction. As a result, the small sample of projects described in this chapter, has been selected specifically to communicate different qualities and matters we have found significant and helpful. It is far from all of them that can be considered as mass interaction, but each of them show different ways of approaching the design situation. We find that it is in the way they relate and differ from each other, we gain a nuanced picture of the design space.

The different clusters of themes that we will discuss and describe is divided into four: The ideal concept, New formats, Individual and shared, and Interaction as a dialogue.

**The ideal**

This thematic cluster only has one concept, which perhaps is the one furthest away from our focus on mass interaction and the auditorium setting. None the less, this represents the one example of related work that we find best communicates our ideals, both regarding experience as well as design process intention, as the idea behind is music composed to be interactive. Here interaction is not a layer put
on top of an art-form, but music and interactivity that creates a whole together.

The National Mall
The National Mall is an album with location aware music by the brothers Ryan and Hays Holladay. It is music played in coordination with the landscape around the listener, based on his/her location via the gps in a smartphone.

Hundreds of musical segments are geotagged throughout the entire park, so that as a listener traverses the landscape a musical score is actually unfolding around them. So this is not a playlist or a list of songs intended for the park, but rather an array of distinct melodies and rhythms that fits together like the pieces of a puzzle, and blend seamlessly based on the listeners chosen trajectory. So kind of think of this as an choose your own adventure of an album. (Holladay, 2013)

Figure 2: The National Mall

The concept is, that the album is created specifically for the National Mall park in Washington. The album is not a CD or a download in Itunes, it only exists in the form of a smartphone app, and only when walking around the National Mall. The music is composed as different
layers of music, made to overlap and replace each other as you walk around the monument. By connecting sequences and layers of music to locations in enables the listener to creates changes in the music by walking around, and through moving decides how the music plays out (Borisk, 2014).

We find distinct qualities in this project that have inspired and been an important reference point in our own concept development. First and foremost, because of the way the interaction become an integrated part of the experience; the music is made for walking around in the park, and the musical experience only exists in the moment when the listener walks in the specific park. In other words, the artistic expression seems in perfect dialogue with the listeners interaction with the experience.

Furthermore, in this project, we see an understanding of the experience only existing in the live exploration of the material, also regarding the design process:

[...] the process is totally different, writing, recording, and then plugging it into the app, walking the park, and then going back and doing it again and again, until it’s right. (Bluebrain, 2013)

This experience seems so unique that it is unlikely to mainly prototype and test it in a lab setting. It is only by taking it to the field (the actual site) for testing and adjusting it will be revealed how the music and interaction should, and can complement each other.

**New formats**

New formats is a cluster of concepts within the genre of classical music playing with new formats. This cluster is typically initiatives gently pushing the limits of the norms and traditions of the classical concert, either by placing the concert outside of its physical domain -
the auditorium - and taking it to a new setting, or by mixing different medias into new expression forms.

In Present!: Rethinking Live Classical Music, Idema (2012) go through a collection of examples of new ways to present classical music. With the argument that the concert ritual is to blame for the stagnation of the classical concert, it is stated that classical music does not have to live within the walls of the concert hall or within the restraints of the concert ritual:

What I find surprising is how even though there are countless potential solutions out there, most of us classical music professionals actually spend little time in finding, creating, analyzing, testing and evaluating them. Our overreliance on performance traditions somehow prevents us from experimenting with new directions. (Idema, 2012, p.42)

**Water Music**

Among the new formats placing the concert in a new setting is The West Yorkshire Symphony Orchestra, playing Händels Water Music live in the water of a swimming pool, while about 80 audience members were swimming around listening to the music. Water Music was originally composed in 1717 for a royal evening outing, performed on a barge placed near King George’s boat (Idema, 2012).

By taking the music piece back to its intended setting, this example represents both the cluster of concerts placed outside of its physical domain and the addition on the historical place specific setting.
Figure 3: Water music, The West Yorkshire Symphony Orchestra, 2011

Nachtmusik
Yet another example of a new format is Nachtmusik by RADIALSYSTEM V based in Berlin. They do night-time concerts where the audience can chill out without the need for formal suits or the usual pomp. Audience members at the Nachtmusik concerts relax on yoga mats with pillows while listening to concerts by small ensembles and soloists during the late hours (Radialsystem, n.d.).

Lunapark plays Aphex Twin
Idema argue that by adding new layers to classical music the work can be renewed and recycled. An example of this is *Lunapark Plays Aphex Twin*. Here the ensemble Lunapark perform and reinterpret the music of electronic musician Aphex Twin by rearranging the music to match their own classical instrumentation (Idema, 2012).
**Up-Close**
Up-Close is a score for cello, strings, soundtrack, and film, performed at a two-piece stage. Right of the stage a solo cellist and a string ensemble was situated, and left of the stage, a video screen projecting a woman playing the alter ego of the cellist. During the climax of the concert the video starts generating music represented by a mechanical decoding device in the video merging soundtrack, video, and music into a multifaceted concert-story (Idema, 2012).

**Extracts**
Idema has good arguments for changing the rituals and traditions in the domain of the classical concert. Though the examples of mixing media and moving the concert out of the concert hall, does not solve the issue at hand when we position the domain of classical music in its own room (the auditorium), and the aim is exploring the tension between passive immersion and active interaction. Therefore this cluster is mainly informative and inspirational in terms of new formats an understanding the genre.

**Personal and shared**
Is a cluster of work where the distinction between ways of interacting can take place within a personal space as well as in a more collaborative shared space. A concert experience is always a mix of an individual more immersive listening experience combined with the fact that many people are seated together at a social gathering influencing each others actions.

**Glimmer**
Glimmer (2005) by Jason Freeman is an example of a concept exploring both the personal and shared side of an interaction experience: each member of the audience is given an individual object with which they can affect the performance. The outcome of
the action is focusing on the activities of the audience as a whole, not as individuals.

Figure 4: Glimmer, 2005

The individual object was a light stick, a battery-operated LED light, they could switch on and off, which they used to flicker with during the performance. The audience were divided into seven groups each controlling a matching group of four musicians. The flickering was captured and analysed with a computer vision system, translating it into score notation instructions for the musicians, and video animation for the audience, creating a loop of the audience reacting to what they see and hear, based on their own activities. The direct activation of the stick controlled the dynamic of the music group based on the percentage of the audience group having their stick turned on or off. The more light sticks turned on, the louder the music from their matching musician group, and reverse, the fewer sticks turned off, the lower the music. (Freeman, 2005).
Glimmer was premiered in 2005 and created as a composition for chamber orchestra. The aim was to engage the concert audience as musical collaborators actively shaping the performance not just as listeners. Freeman articulates his curiosity in exploration and group behavior: “[...] I wanted to create an environment for them to explore and an opportunity for group behaviors to emerge” (Freeman, 2005, p. 758).

Focussing on the activity of audience groups as opposed to individuals, created problems in the group behavior. The audience had a hard time working together to influence the performance, as they cancelled each others activities when they rapidly switched their lights on and off out of sync (Freeman, 2005).

**In case of emotions**

In Case of Emotion is another concept centered on individual objects for the audience, with a general shared output. This was a classical concert at the RDT, where the audience could express emotions through a color system with their mobile phones. The dominant color from the audience got interpreted and the color settings and visuals changed accordingly. This was done with an app on the phone where the audience could choose a color that the screen would show, and then by holding the phone up, they expressed their emotion. e.g yellow happy or blue aggressive. When the majority of audience showed a certain color the light setting in the concert hall started to change towards that color. (Redaktören, 2013).

In case of Emotion has been a great reference point throughout our process, as it is part of a shared repertoire with our collaborators. It was set at the RDT, and was also part of the Interreg project.
A general opinion from our collaborators participating or seeing the concert was that the lack of personal output, made them unsure of their actions. Another issue was the mobile phone in combination with the analytical action of linking one’s feelings to colors. The action was too analytical and would break the immersive state of listening to music. And yet another issue was that the interest from the audience died out, the concept of matching emotions to three colors could not last an entire concert, it did not have any dramaturgical build up.

**Extract**
What both *Glimmer* and *In Case of Emotion* seemingly lacked was an individual output. Where the intention of *Glimmer* was based on a collaborative way of working, the issue could be solved by changing parameters in the system, so the audience could work collaboratively instead of cancelling each others actions. *In Case of Emotion* lacked a feeling of a direct output, and furthermore a clear connection
between the object and meaning making in relation to the art form. The mobile phone is a disturbing foreign object in the concert auditorium, breaking the norms, but at the same time the obvious technology at hand.

The issue of the balance between analytical action and the immersive state of listening to music poses the question how the kind of action the audience are asked to do, fits with the way they experience the performance. It seems important to respect the flow and immersive nature of the act of experiencing the performance.

**Interaction as a dialogue**

This is a cluster of work representing concepts that address the dialogical relationship between artistic intention and audience experience. Interaction is not merely a one way relation, the audience can experience, but rather a continuous dialogue working both ways, for both musicians and the audience to benefit from.

**Dinner of Luciérnaga**

Is a theatre dance performance from 2011 where the audience engage and interact with the performance through an iPhone. It is an interactive play between audience and dancers, where the phone serves as both input and output device, in various different ways.

The whole performance is divided into five sections each with different stage projections and part of the overall narrative about light and food: “[...] light is a resource of energy resembling the role of food. The light is the key elements to construct a kitchen. It could be the cooking material and could be the dinner ingredient. At the end of the performance, the light in itself is a dinner” (Tseng et al., 2012, p. 561). Throughout the whole performance audience and performers collaborate in creating music and visual expressions.
The concert starts with each audience member becoming a light dot on the stage walls, which they can control the location of, from their phone. Further, by waving their phones, the audience make sound contributing to an overall soundscape. When the dancer enters the stage the dots disconnect from the phones and get a more random behavior, while the dancer plays around with the light dots in his dance choreography. During the rest of the performance the light dots slowly start visually building up a kitchen, where food is being cooked, and a dinner is intended, but no guest show up. During this, the audience trigger audio samples stored on their phone and creatures, eg. a cat, appear and disappear on the stage, only to show up again on the audiences’ phones. In the final stage the dancer leaves the stage and appears on the audiences’ phones (Tseng et al., 2012).

**Humanaquarium**

Humanaquarium is a performance space where participants can collaborate with musicians to co-create an aesthetic audio-visual experience. The nuances of the Humanaquarium performance is
stimulated directly by the dialogue between artists and audience as each performance is shaped and controlled by the actions of the participants choosing to interact. By walking up to and touching the window in front of the performers the audiences touch manipulates both the sound of the music and the visuals projected behind the performers. (Taylor et al., 2011a).

 [...] the system's interactivity allows audience members to transition from passive spectators to active participants and enables them to enter into a dialogue with the live performers who improvisationally adapt their musical performance in response to participant contributions. (Taylor et al., 2011a, p. 1118)

Furthermore, Humanaquarium is interesting in terms of their design process and methodological considerations. Taylor et al. position their work as practiced-based research and stress how they work interdisciplinary regarding background and practice: they act in a double role as both creators and researchers. As creators in terms of participating as musicians, literally embodied during the performance, and as researchers during evaluation and revision of the system design (Taylor et al., 211a).

They call the method designing from within, and build on traditions acknowledging the designers embodied experience with the material, and stress the importance of being in the field through performance iterations, where they can react to participants on-the-fly as practice in-the-wild (Taylor et al., 2011b).
Figure 7: Humanaquarium

Extracts
Dinner at Luciérnaga represents an attempt to make a more complex interaction between audience and stage, and Humanaquarium is an example of a project where the audience get to actively become co-creators of the project. Both are examples where the interaction becomes a dialogue between audience and performers, in different ways; Humanqaurium as an intimate close dialogue, Dinner at Luciérnaga in a broader scope. They also, to a great extend, show how the art can open up for integrating the interactive elements as solid parts of the performance. Furthermore they represent examples of merging the artistic intention with audience experience. Humanaquarium additionally stress the importance of working in-the-wild, and include the reactions from participants in the iterations of their performance. Where they act as performers themselves, we intend to include both audience experience and artistic intention in our exploration of interaction in the domain of classical music.
3. Project frame

In this chapter we introduce the frame of our design project. The frame illustrate some of the most important methodological and theoretical considerations, we have used to navigate the design process. The frame model below is a product of our process, and is an important part of understanding how we see the challenge of designing for mass interaction.

The chapter also reflects how our work has been inspired by programmatic design research thinking.

It started out as the question, how to design for mass interaction, and throughout the process the frame has been expanded and reformulated, and has thus been used as an anchor point in the design process in relation to all of our explorative actions. Whenever we have gained new insight during the project period, these have been analysed in relation to, and placed within the project frame.

The frame is divided into four parts: Project focus, Process ideal, Main analytical frame, and Design dogmas.
Frame part 1: Project focus

This part contains what has been established throughout the introduction of this thesis. It represents the thread that binds the work presented here together. From an interest and curiosity on why large-scale interaction seems to always fail, to an idea build into our project about needing to understand interactivity in this setting as something supporting the performance. Along side that, a design research objective of understanding if, and how, mass interaction can be created and understood as a dialogue between artistic intention and audience experience in the domain of classical concerts.
Small (1987) describes the symphony concert as operating simultaneously on two levels: the experience including the actual music, the communication, and emotions and the ritual level considering the concert as an event within the society, at a particular time and place, involving a particular group.

The domain of the classical concert hall combined with interaction calls for the theme: From an immersive passive (listening to music) individual experience to a shared active one (interaction).

We are interested in the experience side of the concert. The ritual and the tradition of the genre we see as part of the challenge: the apparent discrepancy between a seated audience passively experiencing immersion while listening, and the disruptive interaction. Furthermore we see that the experience, the rituals and tradition are inseparable.

**Frame part 2: Process ideal**

This part of the frame represent how we approach the design process as a collaboration between music and design. We consider it a need to collaborate with artists in order to design interaction as a dialogue between artistic intention and audience experience.
Holland et al. (2013) gives an overview of the discipline, themes, and issues of music and HCI. They acknowledge instruments as part of a larger socio-cultural system, also including performers, composers, repertoires, and audience, and state that music interaction is intimately bound up to the practices of the music community. This view of including the practice of music is of special interest to our focus, as well as the overall opinion that music interaction, instruments etc. are part of a larger socio-cultural system.

By acknowledging the need to work with musicians and by including the music practice, we add a new layer to the field of HCI, otherwise dominated by a focus on the audience. We add the more holistic way of thinking including space and time, as well as all the actors.
Frame part 3: Main analytical frame
Here we introduce the key concepts of our analytical part of the frame. These are all guidelines to how we understand and view the domain in relation to the research focus. These are conceptualizations of how we think the design domain can be understood and analysed.

**Individual and shared**
With this model we articulate the main analytical frame, to explore the balance between individual and shared experience.

![Diagram of Individual & shared](image)

Figure 11: Illustration from the frame part 3, Model of the balance between individual and shared experience
The act of attending a concert, and the activity of listening to music is to a great extent both a personal and a social experience. In order to create an interactive musical experience in a concert setting it is important for the design to be based on insights into what happens when people experience music in this way. These insights on dynamics and restraints can help inform the design process.

One specific consideration this model communicates is how we see audience interaction in relation to the terms Co-creation and Participation. We place co-creation at the individual end of a scale, since we wish to emphasize the understanding and importance of creative exploration, which we see as something highly individual, in relation to mass interaction, though still possible in a shared context. Participation is placed under shared to show the importance and quality for the audience to experience being drawn into the concert through means of active participation. Knowing, of course, that this also exists in both ends of the scale we find this the most interesting in relation to collaboration, supporting the audiences feeling of sharing an experience.
Immersion, Action and Artistic intention

This model illustrate insights on experience and interaction: that immersion and action are interrelated with the artistic intention. The continuous immersive experience is of great importance, which is why the action (interaction) must support the musical intention. In order to accomplish this, the artistic intention, the tradition, and the quality of the music is likewise related to the action and immersion.

We are interested in understanding the embodied experience of listening, playing and interacting. We are focusing on both the listening experience as being an embodied experience, the embodied experience of playing music, and what happens when the experience becomes an interactive collaboration. We see this involving both music as sound media, the interaction artefacts, and human-to-human social interaction.

McDermott et al. (2013) state that perception and action are
inextricably linked. They address the issue of transparent technology stating that a skilled musician becomes one with his/her instrument, and in the hands of an experienced musician, technology should be transparent and give a feeling of non-mediation. Further they articulate the issue of engagement and flow, that flow-like activities like music are characterised by being an appropriate level of difficulty, not too difficult nor too easy.

**Interaction cycle**
The model show our view on the existing relationship between audience experience, music, and musicians playing. We are inspired by the full cycle in the interaction of playing and listening: that (brass) musicians generate sound from air by using their body, to the actual music, to the audience experience, and how the audience’s experience and their reaction (physical and embodied) again feed into the way the musicians play. Our view on the listening and playing, acknowledge interaction as more than a one-way interaction, but rather as a dialogical relationship where audience and musicians influence each other.
As a conductor he tries to reach the point where he thinks in feelings: “sound and feelings are connected”. Additionally he states that the boundaries between playing and listening disappear when playing, like singing: “when you use your voice you feel cohesion, you get involved.”
Describing music as nonverbal - as something you cannot understand rationally but you can get a physical reaction to - he touches upon the individual embodied experience of listening to music. He underlines this by stating that the more you need to analyse, the more it blocks your experience: “In order to make room for the experience you must remove all disturbing elements.” He further states that you need to make the audience feel safe and sometimes the experience can be better if you involve them or inform them about the context. Additionally he describes the existing relationship between audience and musicians as “one big cohesive aura.” Even as a conductor with his back against the audience he feels the audience.

Frame part 4: Design dogmas
The Design dogmas are our guidelines for doing design in the domain of the classical concert set in the auditorium, and have been used as resources for guiding design decisions. They are also an expression of some of the key qualities thought into our design. Furthermore the dogmas will serve as a basis for reviewing the provisional takeaways by the end of the project.

Theoretically we are inspired by Hobyes (2014) aspects and insights. His work is centered on designing for Homo Explorens, and the insights are based on experiments done over a period of ten years, from which he has distilled a set of design aspects, that can lead to social exploration. We find great inspiration in these insights and aspects as addition and enlargement of our dogmas.


Create a frame for interaction
This dogma relates to the need to give the audience security. This further relates to the theoretical term *stage fright* (Taylor et al. 2011b). Interaction must be done through a defined action space, and the audience needs hints of the (interaction) context.

Part of this dogma stem from our interview with Pedersen. As a conductor and leader of different ensembles he has been involved in different ways of engaging the audience in the concert. He states that “*What we do is art [the classical concert] so if the concert is a potluck - there has to be agreed rules of the game.*” Relating this to his earlier statement about making room for experience, and making the
audience safe, this has a clear connection to our dogma, that interaction must be done through a defined action space.

Hobye (2014) articulates a similar aspect: \textit{Create space for negotiation of meaning and appropriation}. Hobye stresses how it is up to the participant to find their own appropriation of the experience themselves within the space of negotiation, where meaning is constructed collaboratively as negotiations in situated contexts.

Another related aspect from Hobye: \textit{Create a frame for performative interactions}. Here Hobye addresses performative awareness on two levels: the participants basic awareness of their own actions and how they are interpreted by other participants, and the level where the participants actively chose to shape the meaning of the interaction based on own desires and through dialogue with other participants.

\textbf{Create an abstract experience}

Abstract experiences make room for more free interpretation which will create new meaning.

This part was supported by our case study around Music2Go 3, where our audience focus group argued that the abstract parts of the visuals of the concert allowed them to create their own interpretation as opposed to the more concrete ones.

\textbf{Spread information}

This dogma is related to the latter dogma, \textit{create an abstract experience} and from our belief that interaction should be considered from the point of the audience as well as the musicians. This relates both to the experience as well as the technical part of the interaction as data being more than a binary input/output, but rather should be considered as complexity in the data flow, allowing the participant to continuously explore the interaction/experience. Hence the aspect Hobye (2014) calls \textit{Create exploration through internal complexity}. Hobye refers to Reeves et al. (2005) how internal workings with
complex nonlinear states makes it possible to expand the interaction space to rich explorations the participants can engage with.

**Balance interaction**

This is meant as simple consideration, that dogmas are not meant to be absolute, but rather an ongoing balance to consider like easy and hard, concrete and abstract. Hobye (2014) addresses this balance among other aspects and insights underlining the balance between easy and hard and meaning making: *Create multilayered interaction space while keeping tight coupling.* As well as the term *sweet spot,* described as the sweet spot between predictability and chaos that sparks curiosity.
4. Methodology

We position our work as research through design. As we consider design practice an essential part of design knowledge production. Our method is based on explorative work of a design space through interweaved processes of design practice and reflection.

We consider it a need to collaborate with artists, include the artistic intention, and respect the integrity of the music, in combination with the traditional audience inclusion in order to design an experience combining interaction and classical music. Interaction should support the experience of the performance, not be a superficial layer.

We consider an interaction experience during a live performance, as a whole, that you cannot break into parts, and this includes technology, audience, the music, the musicians, as well as time and place into our design space.

Programmatic research

Methodologically our approach is inspired by programmatic research (Redström 2011, Brandt et al. 2011) and Löwgren et al.s (2013) proposition of the hermeneutic loop to programmatic research.

Redströms (2011) notion of programmatic research is described as a dialectic relationship between program and experiment, here programs act as a frame and foundation for carrying out a series of design experiments and interventions (Brandt et al. 2011). The research process unfolds over time, as program and experiments influence, challenge, and transform each other (Redström 2011).

Where Redstöm focuses on the relationship between program and experiments as being dialectic, Löwgren et al. describe programmatic
research as being holistic and consider it a hermeneutical dynamic process:

First, we find the nature of the work to be more holistic – a hermeneutical dynamic process of ‘doing the program’ rather than a dialectic of program and experiments. This also implies that we locate knowledge contributions in the program as a whole, rather than in experiment outcomes. (Löwgren et al., 2013, p. 84)

In Löwgren et al.’s optic the nature of a program engages in praxis with a view towards explorative action, where participants engage in design activities to learn and examine possibilities. They describe the core of the ongoing work on the program as a hermeneutical dynamic in their model, *A model of programmatic design research*, a hermeneutical dynamic between the two parts *engagements* (design interventions and constructive actions) and *optics* (the whole - the way of seeing and thinking). Furthermore they stress the provisional ongoing act of framing the program and that the program change over time (Löwgren et al., 2013).

We will in a similar way work with various engagements through explorative action in a hermeneutical dynamic between our actions and our optics. It should be stressed that our use of the term programmatic research is merely inspirational as a full programmatic research would require a much bigger and time consuming scope.

Our frame represents the optics of how we see and think about our problem domain. Our frame (described in the previous chapter) serves as a navigation tool for understanding the design domain and how we position ourselves. It can be seen in a hermeneutical dynamic relationship - an organic whole - with all the engagements we do through constructive actions and design interventions.
Our engagements are various actions from our design process to understand the domain, as well as our experiments and collaborative work towards the concept for the concert and the following analysis of the empirical material.

We divide the procedural steps of our process into three chapters: *The design process*, *The concert*, and *Debriefing the concert*.

*The design Process* is divided into six sections: *Collaboration activities, Case: Music2Go 3, Ideation, Experiments, The concept, and Production*. These phases represent the overall process and all the actions and interventions.

Leading up to the design process we did initial work of framing our optics based on paper experiments to outline insights from previous work, theory, and related work. To get deeper into the playing and listening experience and as an insight into the genre, we have worked with mapping relations between theory and related work, as well as our interview with Pedersen.

*Collaboration activities* is a review of all the types of collaborative activities we have done throughout the process, how we have worked with our stakeholders and what kind of strength and weaknesses came out of this.

The case study was *Music2Go 3* where we attended rehearsals, talked to musicians and met stakeholders from the RDT. Furthermore we followed the design team from the design schools’ work with the visuals and the concept to get an understanding of the domain and the future collaboration. Additionally we attended the concert *Music2Go 3* and did a focus group interview with our invited audience groups.
*Ideation, Experiments, The concept, and Production* are all centered on actions leading to the concert: Music2Go 4.

In our ideation phase we have been iteratively exploring the design space through different brainstorming, mapping, and detailing sessions. Through that, we started opening up the design space, and slowly narrowing it down by grouping ideas into themes, detailing the relevant ones and evaluating them. Krippendorff (2006) explains this as:

> [...] a systematic expansion of the space of possibilities, followed by an informed reduction of that space to arguable proposals for artifacts that promise to bring forth desirable futures for particular communities or prevent undesirable ones from occurring. (Krippendorff, 2006, p. 265)

This process is presented in *The design process* chapter, where the design decisions and arguments are validated through the process. Our way of doing this is closely related to Krippendorff’s way of explaining validation as a process entailing showing alternatives considered, and paths examined in the design space (Krippendorff, 2006, p. 266). We explain the different themes (paths) and through *insights* show how the design is grounded in those.

During our ideation process we combined lab work with field work and collaborative meetings and design sessions. We have had sessions exploring technical and material possibilities, performed and tested by ourselves setting up bodystorming and Wizard of Oz style sessions for each other to ideate and elaborate on ideas. We have done on-site experiments and production *in-the-wild*, at the Opera, to test technical and material solutions in the actual room. By bringing prototypes and mock-ups for meetings and design sessions, we illustrated ideas and tested concepts with our collaborators.
All of these actions result in testing a concept at the scheduled classical concert at the RDT Opera House. The concert served as test and field exploration and was followed by a debriefing based on our own observations and follow up interviews with audience members as well as musicians.

Our inspirational use of programmatic research has been a big strength throughout the process and the project; constantly building and reframing our optics (our framework) while doing our design engagements. Our framework has been an anchor point and a way to manifest our standing ground internally and externally. Internally as a way to shape and form our way of approaching the collaboration through the process ideal as a frame in the ideation and building phase, and externally as a way to manifest our standing ground to all of our stakeholders and collaborators.

**Interviews**

All of our interviews are conducted in Danish and translated into English from notes and sound files recorded. All of our raw empirical data can be retrieved upon request.

Our focus groups are a selection representing different types of audience members, based on their relationship to classical music. We have a group of six people attending both Music2Go 3 and 4, and additionally four only attending Music2Go 4.

The group attending both concerts includes two women (70 and 73 years old) with a close relationship to classical music as well as frequent concerts goers. Additionally four young people (24-33 years old, one male, three females), three of them with no previous relationship to classical music, and one with performing experience and a close relationship to classical music.
The additional four consists of two women (40 and 26 years old) engaged with music on a professional level; a voice coach and a student reviewer of new experimental music and sound-art, and two female students (24 and 27 years old); one with a close relationship to classical music, one without.

All of our interviews are based on conversational interviews guiding the interviewees through semi-structured questions. The interviews after Music2Go 4 are furthermore based on a prompted recall approach: a video stimulated-recall approach that enables opportunities of deeper interrogation and offers visual evidence of actions (Price & Jewitt, 2012, p. 2910), as we showed them selected video clips from the concert and asked them to comment on their memory of the experience.

Collaboration
As put forward in our frame, we have approached the design work as a collaboration. By stating that in order to design interaction that works in a big scale, we have to design with the aim of improving the experience of attending a live concert, not merely making it more interactive. The latter is what we see happening in a lot of the existing examples that have inspired the making of this thesis. The collaboration is based on our insights from our frame: that we wish to focus on collaboration with the artists and the personnel of the RDT as a means of integrating the interactive format with the artistic intention and practice. This has been a clear outspoken wish from our side and has been pointed out at initial meetings with our stakeholders: that we believe it is important to build the collaboration on a mutual understanding of integrating design practice with the artistic side.
A case with four different stakeholders, including two big organizations (RDT and the design school), is obviously a complex matter, everybody have both a shared and an individual agenda. An important part of our work has been navigating the complexity by infrastructuring (Hillgren, Seravalli & Emilson, 2011), and trying to use and nurture each others competences by treating stakeholders as experts in their respective domain:

Briefly, when a designer aims to create a collaborative process with stakeholders representing multiple constituencies, treating these stakeholders as experts in their respective domains, it is obvious that (a) mutual learning and collateral action need to replace traditional notions of designers studying people’s practices and then transforming their insights genius-style into appropriate artifacts, and that (b) when it comes to decision-making power and “final say”, agonistic processes of ongoing constructive conflict are more likely than discrete-time notions of clients acceptance-testing final delivery products. (Löwgren & Reimer, 2013, p. 97)

Validation issues

The validation of the thesis is triangulated: field site validation through live testing at the concert and empirical results from debriefing interviews and our own observations. We use theory and literature to support our points, and we will reason and compare with existing concepts of related work as well as analytical validation.

One of the reasons for working with validation of the design triangulated, and on different levels, is to secure different aspects and issues regarding collaboration, scalability, and live production.

The nature of designing for a bigger live performance, done in collaboration with two big organisations poses interesting challenges to the process of validating the design. One challenge is connected to
stakeholders having different agendas in the collaboration. Both the
the RDT and the design school are big organisations that have
internally complex structures affecting their ways and abilities of
engaging in a collaboration. Especially the RDT who represents the
classical music, and all the conventions and traditions that follows.
The issue here is the risk of a clash between our research focus and
their production focus.
Regarding validation through our engagements in the collaboration
process immediate validation from stakeholders can turn into
concrete design decisions.

Another important issue regarding validation, is the one of scalability.
Since we are focusing on mass interaction it seems inaccurate to only
test something in small scale. We have been on site and tried to test
as much as possible in the actual setting, but due to time restraints
and other productions at the Opera House, we have not had endless
time in the auditorium of the Opera. To make up for that, we have
combined being on site in the field with additional testing throughout
the process making small scale experiments through bodystorming
and Wizard of Oz style tests based on our own embodied experience.

This relate to validation on a different scale - on a micro level - where
all of our engagements related to experiments and construction
likewise have been part of our validation. From Schöns (1987) point
of view through conversation with the material, we have done
reflection in action every step of the way, as well as through general
findings from material exploration as part of our validation.

We address the issue of scalability through an attempt to work
closely with our collaboration partners in the project, and by
sketching and prototyping in-the-wild. Hobye (2014) and Taylor et al.
(2011b) describe prototyping in-the-wild as the ability to do live
tweaking of a design on site. This way, it is possible to respond to
how audience and participants respond to the design, in the live setting, making lab style activities part of the field testing. The notion of lab and field is is described by Koskinen et al. (2008).

In Lab, the construction of knowledge functions as in the natural sciences through a series of carefully constructed experiments. Field advances knowledge just as rigorously, but in another way, through methodologically sophisticated field studies (Koskinen et al. 2008, p. 55).

By merging the two, and bringing the lab to the field, the field becomes the lab where tweaking and modifications can be made:

This way of tweaking deviates from traditional field testing in the sense of the field becoming a lab in itself where significant modifications to the prototype could be made. (Hoby, 2014, p. 82)

Specifically we merge lab and field in our tests on site at the Opera, we bring prototypes to meetings with the design school, working both with organizers, musicians and stage technicians, attending rehearsals and live productions.

The last noteworthy issue relating to validation is related to the nature of the design task being for a live performance. The live concert is a onetime event, not being repeated, it only exists in a short timeframe. The challenge is therefore how to evaluate design ideas during the process.

A live performance is an experience where many different elements help shape the whole experience: the musicians, the location, time of day, audience expectations and so forth. First and foremost we find it important to acknowledge that a design process designing for a live event like this has a lot of uncertainties in terms of having good grounds to forecast how the concert will be experienced and
interpreted by the audience. This lies in the very nature of performing and attending live art. This is also one of the reasons why we find it interesting to combine design practice with artistic practice. We see a great potential for mutual learning, both regarding collaboration and the two fields getting inspired by each others practice and way of thinking.

We address part of the issue, of liveness by using the Music2Go 3 concert as a research case, as it has a lot of consistent elements with Music2Go 4. By following the design process and the concert we used this fieldwork research to establish a baseline of understanding the challenges in the design of Music2Go 4. Besides following of the process, we used the Music2Go 3 concert to investigate possibilities by observing and interviewing audience members experiencing the concert.

Our use of triangulated validation means that our results will stem from different levels of contribution: the concept tested at the Music2Go 4, the empirical data, our process and work with materials, analytical reason and reflection, as well as our collaborative process.

**Knowledge contribution**

The expected knowledge gained from the project is of generative and suggestive nature. Though the concept reflects our frame and research curiosity: how can mass interaction support the concert experience in a way that interactivity become a dialogue between artistic intention and audience experience. It will not represent the only way to design for interaction within classical music. Rather, it will be provisional takeaways reflecting the loop of our engagements and actions.

Furthermore the specific concept and the event will be part of a
broader repertoire and possible function as inspiration for the design community and other cultural institutions.

Löwgren et al. (2013) consider artifacts as an important aspect of takeaways from programmatic design research. Partly since concrete examples are raw materials of how repertoire elements are appropriated, and partly since artifacts and other engagements form parts of the hermeneutic process in the program.
5. The design process

In this chapter we explain and outline our design process. It is divided into six sections: Collaboration activities, Case: Music2Go 3, Ideation, Experiments, The concept, and Production, representing the six main types of activities covering the process.

The design, and how it came to be, will be explained throughout this chapter, and the actual description of the concert will be the following: Chapter, The concert. An important foundation for understanding both chapters is that it was given in advance that projection visuals would be developed, made by the design school, performed live by the VJ.

Collaboration activities

Here we explain how we have carried out the design activities relating to the process of designing in a collaboration with both the design team from the design school, and the ways we have tried to include the musical practice into our design process, through the collaboration with the RDT.

Our collaborative activities have consisted of four types of activities: Design meetings at the design school, Design meetings at the Opera with musicians, organizers, and technicians, Play sessions with the VJ, and Hands on at the Opera.

Design meetings at the design school

We have had numerous meetings at the design school. Early in the process we followed their work with Music2Go 3, primarily by attending internal presentations and design discussions, to get to know their way of working, both regarding their design practice (visual communication) and how they collaborated with the RDT.
After Music2Go 3, the meetings were focussed on presenting our ideas and concepts for Music2Go 4, generating ideas together, and presenting progress in the work to each other.

Figure 15: Pictures from design meeting at the design school

These meetings were one of the most important places for us to navigate the shared design process. Throughout the process we worked closely with the design school, though less when we entered the final production stage before the Music2Go 4 concert. It was highly inspirational to work with people from another discipline of design, but a challenge getting the very different ways of structuring the work aligned. Where the design school seems to have a more individualistic and linear way of working, we work more iterative and entangled in all parts of a design project. The main challenge about this was that it made it very hard to stay on a common track, and ensure the overall consistency and quality of the whole experience.
Design meetings at the Opera with musicians, organizers, and technicians

We have had two ideation meetings with representatives from the brass section, the design school, and organizers and technicians from the theatre. Furthermore we attended rehearsals where we presented ideas and concept to the whole brass section, as well as production meetings with organizers and technicians.

Figure 16: Pictures of meeting with musicians

At the ideation meetings with representatives from the brass section, we got insights from the musicians into their perception of the different music pieces and what it feels like to play a brass instrument, which served as the basis of a shared theme that got developed. Details from this will be elaborated in the Ideation section of this chapter.
These meetings were an important forum for establishing contact to both organizers, musicians, and technicians. The RDT has a very distinct structure and hierarchy, and the Music2Go concerts have little priority within the RDT, which made it very important to have good contacts to create an *infrastructuring* process respecting their internal structures, resulting in a great deal of goodwill from everybody at the RDT.

The biggest and most crucial challenge was accessing the musicians. It was hard, almost impossible, to get any time with them specifically focused on this project, since they are personally cut off from the planning processes in the house, and their time schedules are planned a long time in advance.

**Play sessions with the VJ**

In the later part of the project, when the conceptual frame was almost in place, we had a few sessions with the visual artist. We were going to run the technical live setup with him during the concert, and there were a lot of important connections between our work and his, both technically and creatively, which were sorted out during these sessions. Partly as result of a good collaboration process with him, some of the elements produced by us, were run by him in the final stages, which turned out to be a challenge when it came to flexibility in tweaking the design in the last steps where all parts finally were tried out together.

The VJ had another significant role in the project, integrating the musical practice and intention into the project. This was possible since he is a trained classical percussionist. His competences and knowledge from both the classical world, as well as visual art, became an important combination of qualities. Especially as it turned out that the musicians were almost unreachable. He knew a lot of the musicians at The Royal Danish Orchestra, and had a deeper understanding of the classical music, he was able to give input on
things outside of our, as well as the design teams, area of competencies.

**Hands on at the Opera**

With the help of the RDT personnel we have been using the Opera as a base for executing the approach of prototyping *in-the-wild*. We have been testing, tweaking, planning and researching possibilities, all of which were beneficial doing while being located at the Opera, making everything connectable in a big infrastructuring process. Being on the spot, instead of trying to arrange meetings, was also the best way of getting a minimum of time with musicians; we could sneak in time with them during breaks in their busy day. Also, the design school and the Opera are located next to each other, so being there made practicalities easier.

Due to our scalability issue: that it does not make much sense to make small scale tests, we have spend a lot of time in the auditorium of the Opera, making technical and material tests, often with the technical personnel helping us navigate the possibilities of the house. Important elements from this will be further described in the *Production* section of this chapter.

**Case: Music2Go 3**

The Music2Go 3 concert with The Royal Danish Orchestras percussion group, was played in full length without breaks and consisted of seven percussion pieces. As the Music2Go concerts differ from the regular Royal Danish Orchestra program by being smaller, one off events, they are squeezed in between the big productions at the RDT, leaving little time for practicalities, resources, and accessibility to musicians.
As mentioned, we used the Music2Go 3 concert as a research case as it has consistent elements with Music2Go 4: it is within the experimental format Music2Go at the RDT, the design team is making the visuals, and the visual artist performing it live is the same for both projects.

More specifically, we have followed the process by attending design meetings and presentations at the design school and attending a number of rehearsals with the musicians before the concert. Further, on the day of the concert, we helped out with preparations, as well as observed the event as audience members. For this concert we also assembled our focus group that we invited to experience the concert and take part in a follow up interview about their experience just after the concert.
The concept of the Music2Go 3 concert was based on a structure dividing the concert into the three sections: before, during, and after.

Before the concert the audience could participate in activities at stations in the foyer. They could try out percussion instruments supervised by students from the music conservatory, and participate in generating video recordings that would be used live in the visuals for the concert. The video recordings was done from three basic modes: a close up of the face of an audience member generating a sound with the mouth, a close up of a finger snap, and a close up of feet stamping.
These shots were used live by the VJ together with a mix of pre-recorded visuals, and visuals reacting to the sounds of the music. The VJs role was furthermore to make connections between the visuals and the music, which were enabled by his musical training and skills. During certain pieces and parts of the concert, his role would be to make direct coupling between the rhythm of the music and the visuals, including the part using the video material created with audience members beforehand.

The focus on after the concert was not about extending the experience, but debriefing audience through informal talk and questionnaires, sent out to people participating.
Focus group interview
After the concert we gathered our focus group for a post concert interview about their experience.

The overall experience was that there was a lack of coherence in the different visual parts of the concert. There was overall agreement that the more abstract parts were better compared to the photorealistic concrete videos of people from the foyer and musicians playing.

The abstract video allowed the audience to create their own interpretation, whereas the concrete ones functioned as disturbing elements to the music. As stated by one from the focus group audience: “What is shown [on the screen] becomes my music experience - but I like to create my own pictures” (Ayla). As a critique of the visuals being too concrete and loaded with meaning. Another said: “The visual played a major role in contributing to my experience. I was clearly influenced by the different themes that you got on the screen, which contributed to my fantasies and associations” (Ulla).

One touched upon the issue of whether the musicians had a say in how the visuals were created: “I like visuals - they create the mood for the music, I hope the musicians have a say!” (Kristian). A general notion was that the visuals should link to the music and specifically connect to the fact that it was a percussion concert. They also liked when the visuals underlined the rhythm and followed the beat, and, vice versa, got distracted when it seemed out of rhythm.

In relation to our stated approach of including the music practice, it is interesting to see how the audience also expects and prefers representation of, and a strong link to, the music and musicians. This shows that this is something that matters to the audience, and can be worked with concretely from the audience experience perspective.
The link between participation in the activities *before* and the live concert got a mixed review. It started a discussion about modern *selfie* culture, whether it is a cheap popular trick to involve people by showing their faces in an otherwise difficult genre. At the same time participation was seen as a teaser, an anticipation about something to come. Which in return can be either fulfilled or you get disappointed that your face doesn't appear on the screen. Or spend the whole concert nervous that it does: “*I am happy it wasn’t my face - my shoes were plenty provoking for me*” (Karin).

Another stated: “*The fact that we participated in the foyer, contributed to an increased concentration: a fun motivational input to an experience - regardless of whether you yourself are a part of it*” (Ulla). From a design perspective, it is interesting how strongly what happens before can influence the audience experience of the concert.

This supports our idea behind the design dogma: *Create a frame for interaction*, to create a good and secure frame for the interaction experience. It shows the importance of thinking about how to situate interaction in the concert. It is an example of the *stage fright* issue that additionally can be related to Hobyes (2014) aspect: *Create social playfulness through distortions of situated norms*: how playing with boundaries of social norms can open for the possibility of collaboratively re-negotiating a shared experience.

The co-creation type of participation that went on in the foyer, got interpreted both as overshadowing the intended experience of audience participation and as a positive and interesting experience, as well as a motivational input.
Our experience
Our experiences and insights from the Music2Go 3 project and concert was partly an individual experience of being in the audience and partly considerations about the collaboration, technical issues, and what parts to reuse for Music2Go 4.

The experience of being in the audience was somewhat similar to the focus groups overall critique. We experienced a lack of cohesion between the different visual parts, and preferred the abstract ones. The stations in the foyer were poorly supervised and the workflow from the pictures to the live concert could be upgraded.

Regarding collaboration, the communication between the VJ and the students producing the visuals, seemed to be bad. Which was a reminder to have clear workflow agreements and deadlines. Furthermore the collaboration between the musicians and the design team was of special interest to us. The musicians are interested in collaborating but in practice it is hard as their rehearsal schedules are very short and few, furthermore they are very concentrated in the rehearsal room and it seems hard to work around.

One very interesting part of the collaboration was, as mentioned, the role of the VJ, and how he became a link between the world of the musicians and the design team. One of his old colleagues in the Royal Danish Orchestra, Mathias Friis-Hansen, joined design sessions with the intention of writing a piece for interaction. The idea was that he would use video-clips from the foyer generating sounds in the music piece live, but due to time restraints, technical issues, and artistic intentions the piece was not written, instead an old composition of Friis-Hansen was used and the sound generated by the VJ was cancelled.
Ideation

We have had several rounds of sketching and ideating. Clustering different areas of focus interests into themes. The main influential themes will be elaborated below: Abstract installation, Bridging the gap, Sensing music, Passive interaction, and DIY kit.

All steps of the ideation process have contributed with new insights and understandings to develop the frame, which has been revisited ongoing. All themes presented therefore revolve around our frame and our considerations about mass interaction not just being a one way experience. It is a circle of actions influencing each other.

Figure 20: Illustration of theme clusters

Abstract Installation

One cluster of ideas was based around making an abstract installation physically in the room. For instance a spatial object visualising breath, pulse or vibration, following the musicians body generating sound. Or as a representation of the audience reaction to the music.
The idea stem from our dogmas: *Create abstract interaction*, and *Spread information*. By making the physical form of the interaction abstract, the audience would be free to explore and create their own meaning. Furthermore to make the interaction between audience, music, and musicians more than a binary input/output feedback, but rather as *internal complexity* as a way to open up for exploration:

> Our interest lies in designing artifacts that create a space for exploration. This requires us to leave behind ideals of transparency and usability that are dominant when more utilitarian purposes are at play. (Hobye, 2014, p. 16)

From the ideation within this cluster we found that it is important, not to simplify representation of output, eg. visual representation of interaction in an installation, to allow individual, exploration and meaning making.

**Insights:** | Spread information | Allow individual meaning making | Create free interpretation of meaning with abstract interaction |

**Bridging the gap**

Bridging the gap is the idea to connect the apparent physical gap between musicians and audience, stage and seating area of the auditorium. It can be viewed an extension of *abstract installation*. The main idea is to get the music closer to the audience by locating its representation in the audience space, and reverse to get the audience interaction represented in the musicians space.

A key point here is the aim to breach the fourth wall, or experienced gap between audience and musicians, which seems highly present in a big auditorium, by physically connecting the audience space with the stage.
Here the idea of music and interaction meeting each as an element in the visualisation occurred. The idea to create a space where the audience can experience and interpret the music and interaction as parts of a whole, by both being represented in a shared visual space.

**Insights:** | Break the fourth wall by physically connecting audience space with the stage |

**Sensing music**
Another cluster is Sensing music: an attempt to understand and capture moments of internal focus, or the core of the music listening experience, through a focus on moments where music can be felt. Not only as sound, but feelings like being surrounded by sound, generating bodily reactions like the small hair on ones arm rise, or physically *feeling* sound as vibration through a piece of wood or the vibrations from a big speaker system.

![Sensing music](image)

**Figure 21: Moodboard illustrating sensing music**

Listening and sensing music is an individual embodied experience. This means the design has to be open and flexible in the sense that people should be able to use it in a way that suits them, and not as a
restricting listening experience. This theme contributed to a focus on the embodied act of listening to music, and a focus on making a physical interaction that supports the music listening experience.

**Insights:** | The listening is individual | Listening as embodied experience | Physical interaction should support the listening experience |

### Passive interaction

The theme revolves around a number of ideas where interaction is seen as a more passive thing. Interaction is interpreted as a way of framing the experience as a passive thing, rather than a physical action. An example of this is monitoring the audience in different ways, using the data to influence the concert, as an attempt to make the concert dynamically fit the audience experience. Part of this idea is to respect personal boundaries by making the interaction either without the audiences’ knowledge or as something they can chose to do.

Another angle of passive interaction is to generate visual material from the stage and create close ups amplifying the musicians' techniques (e.g., blowing air into the instrument). Or generate visual material using close up video of audience reactions to the music. Combining this with elements from abstract installation, the projection space could have a physical form, e.g., projections on a huge modelled mannequin head on the stage showing expressions of audience reactions or musicians playing.

**Insights:** | Interaction can be passive | Interaction as a way of framing an experience | Respect personal boundaries by making interaction a choice |
DIY kit
The DIY\textsuperscript{2} kit is a cluster of ideas where the audience can transform their program into an artefact. The core idea is based on making a coherent experience, a narrative in combining events \textit{before} with \textit{during} the performance. To allow the audience to be freely creative, by focusing on co-creating the experience, rather than merely participation.

Figure 22: Presentation material describing this theme, made for a design meeting at the design school

A concrete idea could be that the program folds into a lantern, a small poetic paper lamp. The kit would consist of foldable paper and a little whistle with a led: when the audience blow air into the lantern it lit up. This would create a beautiful field of colors, where the members of the audience are free to interpret individually, some will blow the whistle in line with the rhythm of the music, and others might get a new listening experience from using their own breath in relation to the music.

\textbf{Insights:} | The audience forming an ocean of light as an addition of the physical room | Relate action to the listening experience | Allow

\textsuperscript{2} Do It Yourself
the audience to be freely creative | Create a narrative cohesion of the experience of attending a performance |

**Choosing a theme**

The filtering process of the concepts and different clusters of themes was done through an iterative exploration of the design space, mapping, detailing and narrowing down ideas by considering alternatives, evaluating and comparing design decisions.

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**Figure 23: Picture from sketching session**

In relation to the hermeneutical addition to programmatic research it is hard to separate the pieces. Some decisions are affected by pragmatic choices from the collaboration as well as by reflections in relation to materials, our frame, and our own experience and intuition.
One example is the DIY kit, this cluster helped to see limitations of what it is reasonable to ask the audience to do during a concert. The concrete idea of folding or building something seem to draw too much attention away from the musical experience. Whereas the idea of creating cohesion in the experience stayed with us throughout the process as well as the image of the audience forming an ocean of light.

Another example of the filtering process is that part of the passive interaction cluster started out as a cluster of screen based interaction. Based on the given fact that the design team from the design school would make visual material as video, we created ideas on how the audience could participate in the creation of music or visuals for the concert. The ideas were similar to the concept of Music2Go 3 and rejected because of the empirical data from our interviews regarding issues of stage fright and the preference towards abstract representation of visual material and breaking immersion.

Furthermore as a reaction to our ideation process, the idea of reserving the interaction to restricted moments occurred. It seemed that regardless of the type of idea we created, it was impossible to imagine one that would last throughout a full concert. Thus, we came up with the idea to limit the interaction to restricted dramaturgical moments during the concert.

Towards a shared theme
In parallel with, and as a result of, our own ideation phase, we did concept development with the RDT and the design school. Part of the final shared concept is based on aspects from Music2Go 3; the use of visuals and the focus on before activities, and partly on our first Music2Go 4 meeting at the RDT with musicians and organisers. At that meeting we established ideas about how to collaborate emphasising the importance of joining forces and get inputs from, and access to, the musicians. Furthermore, we got insights from one
of the musicians about the musical programme; how the Carl Nielsen piece relates to Nielsens childhood at the colorful countryside of Funen (a Danish island). And what the brass experience entails, both regarding the playing and the listening experience: how brass members use their voice and breath to generate music.

This lead to a shared thematic focus on *music and color*. Based on historical tradition where colors and music is connected, formulated by many different contributors (eg. Newton and Goethe). And the *air flow* narrative based on the physicality of playing a brass instrument.

![Figure 24: Session at the design school](image)

In addition to the shared theme, the core of the concept *during* the concert in the auditorium is created based on the concept-theme *From Physical to Virtual.*
From Physical to Virtual is meant as a mean to connect the different elements in the auditorium; the screen, the music, the audience and the musicians. Following the cycle of interaction: how musicians play and generate music, to the audience listening and affecting the musicians way of playing, we wanted to create a cycle from physical to virtual and from virtual to physical. A transition from the physical world with bodily interaction and physical objects into the virtual world of the screen, and a transition from the virtual world to the physical, represented by the music.
Experiments

This section is a description of our lab experiments working with digital material exploring concept ideas, and aspects of interaction. The experiments are primarily tested by ourselves as experiences felt on our own bodies and used as mock ups and prototypes brought to design meetings and collaboration activities to demonstrate our ideas. Moreover they represent the development of the concept through digital sketching using tools like Arduino\(^3\), and Processing\(^4\) to make rapid digital prototypes.

The balloon experiment

Figure 28: Picture from the balloon experiment

The balloon experiment stems from the theme *From Physical to Virtual*. We worked with the idea of making an abstract

\(^3\) Hardware prototyping platform
\(^4\) Programming language made for visual artists
representation physically in the room. A scenario could be balloons hanging in clusters over the audience. The color and rhythm of the light in the balloons would change based on the music intensity and audience movement and create an abstract visualisation which feeded into the virtual world of the visual projections.

We made a simulation of the concert stage to test the experience of having abstract light representation connected to the music in the room. We connected controllable light to balloons while playing the Nielsen piece, and by connecting the balloons directly to a speaker we tested what it would feel like if the light followed the rhythm and pitch of the music.

**Insights:** Connecting the music to a physical light object had a great effect, though it was hard to imagine a possible relation between a group of audience members relating to the same balloon, representing their interactions. This seemed inevitable since it would be impossible technically to make something with one dynamically changing physical object for each audience member. Further it also seemed impossible within the physical restrictions of the concert hall.

**The mirror effect experiment**
The mirror effect experiment is based on the idea to mirror the audience on the big projection screen. The idea stem from our focus area on the balance between individual experience and shared, combined with the theme *From Physical to Virtual.*

Similar to the kit idea from our ideation session the audience would each get an object - eg. a feather. If members of the audience make a gesture with the feather it turns into something on the virtual mirror representation on the screen.
The aim of the experiment was to play with the balance between generalised input and direct one-to-one input where each audience member can see themselves and the reaction to their gesture.

For this experiment we held a feather while listening to the music, exploring the embodied feeling of the interaction. We made software prototypes with dynamic and detailed simulations of graphics interaction effects and output from gesture, and we worked with audience detection. The specific example seen on the picture below is a visual representation of the sky filled with stars, where the audience could be a twinkling star when waving with a feather illuminated by a LED light.

![Figure 29: Picture from the mirror effect experiment](image)

**Insight:** We found that it is hard to make Wizard of Oz style tests on an experience level, due to the scalability issue of being hundreds of audience members doing this together. Though we found that there
was a good connection in the experience of being an audience member with holding a light generating stars on the screen. As experience it was hard to make meaning of the feather gesture in relation to the many stars.

**The lantern experiment**
The lantern experiment is based on the insights from the *Balloon experiment*, replacing the lights in the balloon with a DMX lamp\(^5\), to ensure working with materials close to what we most likely would end up using, and materials easy to scale up for a big stage use. We constructed a mockup of a lantern out of wood and parchment paper to spread the light of the lamp. For this we made a software setup to control the lamp.

![Image of lantern experiment](image)

**Figure 30: Picture from the lantern experiment**

\(^5\) Lamp with a standardised control protocol, used in stage light equipment.
It was tested as experience with a setup playing different videos while the lamb was controlled to match music and videos. One video showed colors of impressionistic paintings moving fluently over time, another video had colored dots moving over the screen resembling the music score as different voices in the music.

**Insights:** Connection between colors in the video, created a good meaningful cohesion, affecting the light in the room, and making meaning of the music. When the light from the lantern matched colors in the video it highlighted certain colors. In the video with the dots, the light from the lamp emphasised a color and thereby the interpretation of an instrument.

**Combining the lantern and the mirror experiment**
In this experiment we combined the lantern and star insights from the mirror experiment. The overall idea was to create a cycle from the music to the lantern and onto the screen, and from the audience interaction to the screen.

![Figure 31: Our work station during the lantern and mirror experiment](image)
We wanted to make a more coherent experience and selected a ten minutes part of the Nielsen symphony with good mood transitions in the music that we analysed in terms of intensity and visual expression. We found a collection of videos that we could control through a VJ'ing software, where it is easy to sample and change the graphic expression. We tested and experimented with creating connection between the visual expression in the video, the lantern light, the intensity of music, and how that could turn into an interaction session where the participant is holding a LED that is represented as stars on the screen.

Figure 32: Picture from the lantern and mirror experiment

**Insights:** Again we found that there was a good connection between video and lantern, also when mixing between the two modes; flow intensity of the music, and a color mood mode following the visual expression. Further we were able to make good transition between the intensity in the music, the colorful videos, and the more quiet
pieces with stars. There was also a good connection between LEDs and stars but no relation to the music. And still we found it hard to determine interaction and scalability.

Figure 33: Picture from the lantern and mirror experiment
The feather session

In the feather session we created a feather with a LED, a battery, and a button to function as an individual interaction tool with the aim to investigate different modes of individual interaction.

The feather could indicate a mode from passive to active interaction. It lit's on, or the audience can lit it on, and they can control something on the screen with it. Different actions tested were dimming, turn on and off, movement, and touch. The output could either be generalised (shared) output or one where each audience member is represented individually as feathers. The core of this experiment was that the feather (like the lantern) is part of the cycle from physical to virtual. It became a physical representation of the music.

Furthermore the feather session showed the big impact the visuals play, and how the relationship and meaning between the color of the interaction object is of great importance. Another insight was how the embodied experience of waving the feather, became part of
experiencing the music. It had a clear reference to the act of conducting. Here the affordance of the feather, the balance of weight and aerodynamic resistance, made the waving experience feel natural compared to other more solid materials we tested.

**Insights:** From this experiment we started questioning and imagining how the experience would be from the musician side, a mood image through the LED lights or a physical representation of the music.

![Figure 35: Picture from the feather session](image)

**Concept**

The concept description is based on our intentions of how the different elements were intended to work in relation to each other. The concept is centered on the visuals on the *screen* representing the music through colors, supplemented with big *lanterns* spreading the colors from the screen to the physical space of the whole room. At a
limited time during the Nielsen piece the audience can trigger color behaviour of the visual elements through an interaction object.

![Figure 36: Sketch of the setup during the concert](image)

The setup builds on the idea of supporting a space where the audience can interpret the music, express themselves creatively in relation to it, and support the musicians and audience ability to feel in touch with each other. The audience and musicians each influence the concert, and are influenced by each other. This makes room for individual meaning making from both sides, while experiencing the event from each their point of view.

**The screen**
The screen is the visual meeting point of the music represented by color graphics and the audience interaction. The visuals have two main themes: interpreting the music as colors by relating music to
color, and the physicality of playing a brass instrument represented as an air flow narrative.

**The lanterns**
The lanterns are a concrete way of bridging the experienced gap between audience (seating area) and musicians (stage). They relate to the music through the screen, and become a physicalization of the virtual world, by mirroring the screen colors, spreading them into the whole room creating the possibility of a spatial experience for both audience and musicians.

**Interaction object**
Audience members each get a small light device at the entrance, to the auditorium, after the break. By turning on and off their light they can trigger color particles on the screen. Here the flow goes from physical to virtual and is meant as supporting an embodied way of enjoying the music through the interaction. The audience also form a dynamic changing ocean of light, visible for musicians and audience when they overlook the audience seating area. Further by changing the color of the screen graphics (through the interaction object) the audience indirectly change the color of the lanterns, located close to both musicians and audience.

The idea is that the audience is free to choose for themselves how they want to act during this part of the piece, and through that interpret the music and live concert experience based on a more embodied experience. The output of the interaction is dynamic behaviour of the visual elements represented as particles on the screen. Each audience member interacting should get the feeling of being represented in the visuals, and through that participate in creating a shared experience and interpretation of the concert, visuals and music together.
This part of the interaction is limited to the second part of the Nielsen piece, based on our insight from the ideation phase that interaction should be reserved to restricted moments, as the action could not last throughout a whole concert.

<table>
<thead>
<tr>
<th>Nielsen</th>
<th>Allegro espansivo</th>
<th>Andante pastorale</th>
<th>Allegretto un poco</th>
<th>Finale: Allegro</th>
</tr>
</thead>
<tbody>
<tr>
<td>The screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>The lanterns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction object</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 37: Model of the different elements during the Carl Nielsen Piece**

**Production**

After the feather session, and a description of the concept, our experiments took a turn towards production. Our work was still done in an explorative manner, but there was a shift in the conceptualisation. In combination with meetings and concept sessions with the design school and the RDT, our experiments so far, had formed a shared understanding of a concept. We started to work towards the concept of the concert, still exploring different possibilities, but with a clear idea about the concept.

The approach in this stage of the process was of a more linear nature, we worked for a long time on each element separately, and finally combined all the pieces together at the general rehearsal.

During this period we experienced many challenges regarding scalability issues when designing for a live event. First of all, it was hard to get a realistic expectation of how the experience would be,
how the audience would react, and what specific output their interaction would generate, regardless of the fact that we made various tests. Secondly, because of how the RDT is organised around concert productions, we only had one shot to try out and combine all the parts, at the general rehearsal the day before the concert.

In this part of the process it is clear how both technical issues, time restraints by the nature of the live event, and the collaborative process have impacted the final form of the tested concept. It is especially important for the reader to understand how this resulted in some of the conceptual thoughts presented in the frame and in this chapter, are not present in the final design. This will be accounted for in the next section, and touched upon in the end of the thesis: *In conclusion.*

Below is the part of the process, where we combined both technical and material experiments with construction, programming, making and testing *in-the-wild*. Besides carrying important information further grounding the final tested concept, this is also an example of how we, with Schöns (1987) words, continued the reflective conversation with the material. Both regarding physical materiality, and also viewing the design process as our material.

**The digital part of design and construction**

In this section we will explain the process of finalizing and making the concept. It is divided in a digital and a physical part. This is not a hard distinction that represents of the process was carried out, but a way to group the activities.

**Interaction tracking**

We needed a solution to track the interacting of the individual member of the audience, and brought a web camera and different
light sources to the auditorium of the Opera to make initial tests of tracking in the actual environment. As a continuation of this we also did test sessions during rehearsals and during a live Opera performance, to test different light settings and determine how much the ambient light from the concert, could be expected to affect our ability to track the light of the audience interaction objects. These tests and the simultaneous work on programming the tracking software, lasted throughout the production phase until the general rehearsal.

Figure 38: Picture from a light test during rehearsals

Many of the tested light sources were not strong enough, so we needed to work either with stronger light sources or better diffusion of the light. It was impossible to precisely determine how the tracking softwares reliability would be influenced by the changes in light conditions made by the projection and stagelight. This would have demanded a realistic real size test, with audience, stagelight, and
interaction objects, which was not possible due to other productions in the house, and the issue of gathering 200 volunteers. As a consequence of that we had to make sure the light sources used for the interaction objects were much stronger than needed.

**Designing a computer infrastructure**

All of our programming was partly build on the basis of our first experiments, and done in parallel with new insights and production development. We decided to gather the different elements for controlling the lanterns in relation to the videos, and receiving input from our tracking software, in a MaxMSP⁶ patch (program), on the VJs computer. This made for the most robust technical setup, being able to run as much as possible from one computer. Our tracking software was the only part running remotely from the VJ, this was due to restrictions in physically placing the tracking camera in relation to the computer using it. The tracking software was sending output to the VJs computer from ours, over a closed network.

Because of the crucial link between our work with interaction and lanterns and his role in running the whole set up, our play-sessions were partly used testing and integrating the setup with his computer. This meant that, we were never able to make realistic technical tests of the lanterns scaled up to right complexity size, before the general rehearsal.

**Interaction visuals**

The visuals for the interaction were designed as part of our play-sessions with the VJ. Due to collaboration and communication misunderstandings with the design school and unforeseen complexity in the design task, these were sadly under prioritized in terms of experience testing. Further, the fact that the whole setup was running on the VJ’s computer, made it difficult for us to make

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⁶ Visual programming language for music and multimedia programming.
adjustments in the final stage. We realized how critical it can be when working towards a complex live event, to ensure coherence between those who have the ability to act, and their agendas with the project. The mentioned challenges resulted in a design of the interaction visuals that did not live up to our conceptual ideas of clear representation of interaction and music in the shared visual space.

![Figure 39: Screenshot from the particle generator](image)

**The physical part of design and construction**
In the following section we will explain the process of making the physical part of design and construction.

**Design and making of interaction object**
The idea of using a feather as the interaction object did not make it through the collaboration process. Which is why the feather is not part of the work shown here with finalizing the design of the interaction object. This work was part of a material exploration, trying to find the right combination of materials, encapsulating both our intentions of an embodied experience relating to the music listening, and the different materials’ ability to light and diffuse in a
way living up to the trackings’ technical requirements. The feather from the previous experiments had a more embodied natural movement to it, that we had a hard time replacing with other materials. We found a round sphere shaped objects with a smooth surface, both worked as a reference to the particle, and best meet the technical requirements.

![Figure 40: Pictures of prototyping different interaction objects](image)

After selecting a little flashlight with the least noisy button and the function that you needed to push it to turn it on, we worked with different solutions to cover and coat the flashlights. We tried covering them with fabric, with paint, and with rubber, and ended up using the easy non-smelly and sound absorbing heat shrink.

![Figure 41: Finalizing the object: flashlights with heat shrink](image)
We drilled a little hole in ping pong balls and glued them to the flashlights covered in heat shrink. We made 200 objects in total. As a last thing a little instruction note was added to the object, aiming at communicating the purpose and use of the object, which was handed out with a short verbal explanation. The text on the note said: "Turn on your light, express yourself through colors and become a part of the music’s color screen" (translated from Danish).

Figure 42: Finalizing the object
Design and making of the interaction lanterns

After several meetings with the RDT and their head of light technician, we started constructing the lanterns. As it was not possible to mount anything directly above the audience, we ended up placing two lanterns by the musicians close to the screen and two on the edge of the stage in the empty orchestra pit. We explored different shapes and materials, and ended up constructing four rectangular boxes, covered in canvas, which had the right diffusion effect on the light, and also met the requirements of the RDT.

The boxes each had three DMX lamps controlled by an Arduino microcontroller, which technically was an upscaled version of the setup in the lantern and mirror experiment, described in the Experiment section. Like the other elements it was impossible to test these on stage in a proper scale before the general rehearsal.

Figure 43: Picture from the process of constructing the lanterns
Assembling the design
As already mentioned the general rehearsal, the day before the concert, was the first time when all the different elements of the project were put together. The main reasons for this, was because of the RDTs structuring of time and resources, but more importantly because of the design collaboration. During the production part of the process there were design meetings, but little material was shared, which made it hard to keep an overview.

Furthermore the general rehearsal was not played in full length, but was done more as a music rehearsal with many stops and repetitions. In addition hereto, the design school cancelled attending the music rehearsals the final week and handed in their visual work (the videos) at the general rehearsal. This meant that we did not get to see the lamps and the visuals play out together. Besides the unfortunate conditions for making a coherent assembly of the different elements, there were a few main insights to push forward here.

When testing the interaction at the general rehearsal, though only tested with a few people, it was impossible to find yourself in the particle graphics generated. Further none of the visuals we saw seemed to really interpret the color and music relation. They had a lot of colors, but the way colors were presented and used seemed sketchy and without connection to the music. And additionally there was a delay in the reaction of the lanterns, that we only first experienced when things was put together in its right scale.
Figure 44: Picture from the control room during the general rehearsal, and finalizing the lanterns at the Opera
6. The concert

Music2Go 4 took place at The RDT Opera House the 11th of May 2014 at 3 pm. The concert was played by the brass section of The Royal Danish Orchestra, and introduced with the title: *A Bundle of Brass*. With visual design, concept, interaction in the auditorium, VJ and programming.

Approximately 250 tickets were sold, with the addition of invited guests giving a total of around 300 people in the auditorium. The musical program was four different pieces by four Danish composers.

**Arriving at the Opera House**

![Figure 45: Music2Go 4, the foyer](image)

All the audience members were invited to come one hour before the concert to participate in activities in the foyer. These were put together like a small exhibition area in the foyer, blending hands-on
activities with instruments and sound with more explanatory elements where people could read and explore the overall theme of the concert. This was all part of allowing audience members to explore the theme around sound and color, the embodied experience of playing a brass instrument, and getting introduced to the way they could interact during the concert.

**Trying instruments**

![Image of people trying instruments](image)

*Figure 46: Music2Go 4, trying instruments*

Two of the activities were to try out brass instruments.

One was a table with trumpets and trombones where audience members could try out and feel on one’s own body what it feels like playing the instruments. The trombones were test instruments made in hard plastic, adding yet a colorful element to the color and music theme.
The other instrument activity was a setup with a screen and a microphone where people could play into the microphone and a visualisation of circles with different colors would respond. Each color represented a frequency area. The circle of that color would move up and down when notes in that frequency area were played.

Meeting musicians

Figure 47: Music2Go 4, trying instruments

Figure 48: Music2Go 4, meeting musicians
In the foyer some of the musicians that were about to perform at the concert were present. They showed off their instruments and were available for curious souls to ask them about their instrument, techniques or just casual conversation. They also helped instructing people how to try the test instruments, showing them how to blow into the mouthpiece the right way, and demonstrated the sound to color visualisation installation.

**Color and sound theory**

![Image of color and sound theory](image_url)

*Figure 49: Music2Go 4, color and sound at the activities in the foyer*
There were two informative installations focusing on introducing the audience to the historical perspective on the relation between color and sound. One being a poster board with theoretical information about color and sound, and with samples from the design process for the visuals. The other was a computer with an application where one could explore two different color wheels. One representing Newton’s color theory, the other representing Alexander Scriabin’s. By clicking on a color, a brass instrument playing the corresponding note was played through headphones.

Preparing for interaction

Figure 50: Music2Go 4, the interaction object at the activities in the foyer

The last activity in the foyer was a presentation of the interaction objects going to be used during the concert, and showing examples of the graphical representation that the interaction would be triggering in the concert. Here the interested members of the audience were briefed shortly on what would be going on for the interaction part of
the concert. The actual handing out of the objects took place later during the break.

**The concert - part 1**

Entering the auditorium the audience was met by the empty stage with chairs set up for the musicians. Four lanterns were lit to a dimming alluring level on stage. Two placed in the back of the stage and two on the edge of the empty orchestra pit almost within touching range of the audience, opening the room and physically connecting the stage and the audience space.

The concert began as expected in terms of a classical concert with the orchestra entering the stage, followed by applause from the audience, then the conductor entering, followed by applause, and the musicians stood up to honour the conductor, sat down again and then the concert was ready to begin.

The first part of the concert was the three musical pieces: *Festklänge for brass and organ* by J. P. E. Hartmann, *Doing!* by Per Nørgaard and *Interference* by Kim Helweg.

The first piece was written as the opening piece for an event celebrating the 400 years anniversary of the university, originally held and played at Vor Frue Kirke, 1879, in Copenhagen. Here the graphics were simple minimalistic pipe systems with color flowing through them representing the airstream through the instrument pipes becoming music.

During this piece the lantern lamps slowly started reacting in the climax moments, when color filled the screen, as the lantern was following the colors on the screen changing intensity in a fluent transition.
Figure 51: Music2Go 4, during the Hartmann piece

The second piece, Doing!, was in three parts (*I'll do it, You can’t do that, and It’s done*). The whole piece is written in 1968 and is an interpretation of the Beatles song *You can’t do that*. Compared to the Hartmann piece this one was more experimental. The first part with various themes replacing each other, the visuals were dark with color particles moving upwards from below the screen, as two bubbles in water flowing in two streams, here the speed of the streams changed at various points in the music. The second part, played with high intensity, the visuals here were a big circular disc with color particles entering from the outside. The last part was more calm and atmospheric. Here the visuals were similar to the second, but particles entering the disc while the disc slowly moving away, like a spaceship into the black universe.
Throughout this piece the lanterns became more active than with the first one. When a lot of particles filled the screen they would light up, and dim again when only few particles were present. When the speed of the particles flow were high, the colors of the lanterns would change more rapidly, due to faster color change on the screen.

The last piece before the break was Interference in the two parts: Adagio-Allegro and Scherzo-Finale. In the beginning the piece had various layers of voices and themes floating into each other, after a while replaced by more abrupt sections. Towards the end the music entered parts with a more jazzy feel, where a percussionist played a small jazz drum kit setup. There were no visuals for the entire piece, and during the piece the lanterns were dimmed down without changing.
Intermission

After the Helweg piece there was a 20 minutes break. Besides stretching legs and socializing, audience members could still visit the stations.

Upon re-entering the concert hall, the members of the audience were each handed the little light object for interacting to use during the last part of the concert.
Each object had a little note with a text encouraging people to interact: *Turn on your light, express yourself through colors and become a part of the music's color screen.* They were handed out with a short verbal explanation, that they could be used as free play at a given time during the concert: when signaled by employees standing in the aisle in each side.

**The concert - part 2**

The whole second part of the concert were Carl Nielsen’s *Symphony no. 3 'Espansiva' for brass and organ.* It is divided into four parts: *Allegro espansivo, Andante pastorale, Allegretto un poco,* and *Finale Allegro.* The second part, *Andante pastorale,* being the one where the audience could interact with the light object they were given.
The music is grand and with long themes weaving in and out of each other. The first part is very energetic, the second more quiet, the third part is changing between quiet passages and energetic ones, with different themes in the music being highlighted, and at last the grand finale of the whole piece.

**Carl Nielsen - part 1, 3, 4**

With the exception of the second part with the interaction, the visuals are best described as very abstract flows of color replacing each other. Most of the time rapidly going from color to color. During the entire Nielsen piece there were longer parts without visuals, the screen would be momentarily black and after a little time become visible again. There were three such *blackouts* during part 1. During part 3 and 4, these blackouts were shorter but more frequent.

Figure 55: Music2Go 4, blackout during the concert
Figure 56: Music2Go 4, during the Nielsen piece
During part 1 of the Nielsen piece some people started playing with the light object. They played with the objects with no feedback, since the technical setup, was that it would only work and give feedback during part 2 of the piece.

![Figure 57: Music2Go 4, during part 1 of the Nielsen piece](image)

**Carl Nielsen part 2**

As the audience clapped, two ticket employees walked down the aisles, held up their object and turned on the light as the music started again. The audience immediately followed the action and turned on their light creating an ocean of light spread all over the auditorium, and spawning particles onto the screen.

The screen had started out black as the lanterns changed to default color. And the colors from the particles triggered by the audience to the screen resulted in the lanterns fast changing colors.

Whenever a new light was lit, or someone flashed it, a new particle would appear, with a slight delay. The particle would spawn from a
location on the screen corresponding to the seated position of the audience member triggering the light. From there it moved fast into a cloud of particles, and disappeared again after a few seconds.

Figure 58: Particles spawn onto the screen

Figure 59: Music2Go 4, interaction part during the Nielsen piece
In the beginning, the main part of the audience kept the lights lit up, and some waved them to the music. About one third through the interaction part the employees in the aisle, started to flash their lights, and the main part of the audience reacted by imitating the action and started flashing the lights too. The crowd became a flickering ocean of light, leaving the screen often occupied with loads of particles.

During the last four minutes of the approximately nine minutes long interaction part, the level of activity in the audience became smaller, though still on a level significant enough to be seen and create changes in the overall graphics as well as the changing color of the lanterns. In total the audience triggered 3299 new particles in the graphics during part 2 of the Carl Nielsen piece.
Figure 61: Music2Go 4, Interaction part during the Nielsen piece
Figure 62: Music2Go 4, Interaction part during the Nielsen piece
Leaving

In the final part of the Nielsen piece the abstract flows of color from the visuals replaced each other faster and faster as the lantern followed the rapid color changes in a rhythmical way. After applause and encores the audience left the auditorium.
7. Debriefing the concert

This chapter is our empirical evaluation of the field testing. Here we will put forward our own experiences and observations as well as data from our debrief interviews with audience members, and reactions from musicians. The chapter is divided into sections representing the different elements of the concert: General picture, The theme, The visuals, The lanterns, The interaction, and The whole. In the interaction part we will touch thematic issues from our frame: state of immersion, individual vs. shared, setting the scene, and interaction as a dialogue.

The debriefing sessions are primarily based on interviews with our focus group of ten selected members of the audience, and also informal conversations with musicians after the concert. The audience interviews were conducted two days after the concert, the musician conversations took place shortly after the concert, when musicians and other personnel were gathered to socialize and debrief.

**General picture**

The general picture, from our own point of view, was that the lanterns worked as intended and thus had the effect of connecting stage and audience, whereas the interaction part created confusion as people could not understand and recognize themselves in the interaction. One reason being that the pace of the graphics was too fast, and did not fit the intention of people being able to recognize themselves. Another part was due to the instruction on the lamp, as well as the physical presence and instruction from the employees holding the light in the aisles of the auditorium to indicate when the interaction would work. It resulted in people following the action of
the authority instead of the verbally encouraged free play. A few people did however explore free play, for instance a group of five people clustering their light to one big light.

The overall extraction from the audience interviews is, that people were confused about the overall theme, seeking meaning in the presented thematic theory about the relation between color and music in the foyer with the visual part of the concert.

Regarding the interaction part, the biggest issue was not recognising oneself in the graphics generated, which let to different outcomes and actions; some used movement to seek meaning, and others explored unanticipated ways to become visible, and others simply gave up.

Our audience interviews revealed that there was a big difference in the experience dependent on the position of the audience in the auditorium. There seemed to have been more noise and disturbance in the back during the interaction part, whereas people in the front had a more poetic experience, and some the feeling of togetherness. The same, though reverse, applies to the lanterns: the lanterns were experienced more embracing as connecting audience and stage for the audience seated in the back who had the full view of the four lamps - whereas for people seated in the front, they did not play as big a role.

**The theme**

The general experience of the audience was the feeling of lack of cohesion between the introduced theme and theory in the foyer and the experience in the auditorium. Many were searching for meaning in relation to what they met in the foyer:
I had to give up trying to understand the notes in relation to the colors that were shown [in the foyer]. (Kristian)

In my opinion; when you put up an information board, then you have to be able to recognize it, like when you walk around at Louisiana [a Danish museum of modern art] and you are told that the avant-garde artists liked red and black. You actually see it in the art. This didn’t happen here. When it is not understandable to the audience, keep it as your own inspiration. (Sandra)

For me it would have been interesting if I could connect the notes to the colors - now everything is yellow because the notes are high or blue since low - if I could get that logical transition from the visuals to the foyer [...] But it wasn’t clear enough. (Ayla)

When you encourage the audience to take the time to get involved in a theme, you give them an expectation to have an aha experience in the experience to come. And when that is not fulfilled it becomes a big distraction. It can even make the audience feel like they are not clever enough: “[about the poster info boards in the foyer] You quickly get the feeling that this doesn’t speak to me, that I am not clever enough to understand it, and it’s probably for someone else.” (Kristian)

Other point to the fact that the whole theorising in the foyer made them analytical during the concert, which prevented them from interpreting freely and just experience:

Maybe we knew too much before we went in [to the auditorium]. (Helle Rose)

The confusing information from the foyer [...] you bring it with you in the experience instead of getting absorbed in pure aesthetics. (Karin)
The visuals

**Intention:** The screen was meant to be the visual meeting point of the music represented by color and interaction. The visuals has two main themes. Interpreting the music as colors by relating music to color, and the physicality of playing a brass instrument; the air flow narrative.

The lack of cohesion between the visuals and the theme, meant that the audience didn’t see a connection between the music and the visuals: “The visuals should support the music but they did the reverse!” (Karin)

Another general thing was that the empty black parts in the visuals made the audience think that there were technical breakdowns: “The part where nothing was on [...] did the technique break down?” (Ulla).

In the interviews after Music2Go 3, our focus group preferred abstract visuals as opposed to figuratively and recognisable things. This time the opinions were more diverse and we got a lot of different reactions to the visuals. For instance the first part, during the Hartmann piece where pipes were meant to illustrate the airflow of the musicians playing. Only one commented on the relation to the theme here, about the visuals for the Hartmann piece: “[...] classical lines, it suited the brass music nicely, pipes with air, that was what I got from it.” (Kristian). Other commented that it had an 80’s computer game association to it, including one of the musicians who found it to be unsuitable for the ceremonious and serious Hartmann. Another saw a sewer system, and yet another a meaningful labyrinth with relation to the music: “The labyrinth worked really well - the music finds its way and bends and the road becomes deeper when there is music.” (Helle Rose).
Others simply didn’t like the visuals: “The visuals took the concert away from me” (Ida). “[The visuals] reminded me of a Windows screensaver, and that just got a bit too graphically sharp cut [for me].” (Sofie).

**The lanterns**

**Intention:** The intention with the lanterns was to make them relate to the music through the screen and become a physicalization of the virtual world, spreading the colors of the screen into the room creating the possibility of a spatial interpretation for both audience and musicians.

The general picture is that the lanterns worked as intended, they connected the stage and the audience, and the audience had a feeling that they followed the music. They were a consistent element making room for being immersed in the experience without having to use negative energy on figuring them out.

I liked their expression, I thought they were a bit… I got a bit calm, or it was a softer kind of expression […] than what went on up on the screen. (Sofie)

This time [compared to Music2Go 3] there were more - you didn't feel that split [of elements] there were more cohesion between stage and audience and the back screen part […] instead of three separate elements - it became a more fluent thing. (Karin)

The best was actually the last piece with the screen when big color surfaces appear and follow the music and those boxes […]. Here you didn’t need to use your brain to try to interpret (Helle Rose).

Furthermore the audience found individual interpretations of what the lantern meant and what their role was. They were part of the
explanation when the audiences experience momentarily merged into a complementary understanding between the different elements:

The colors are connected all the way up and down! (Ayla)

[...] they also activate the room, and create both cohesion and activity. (Karin)

They concretized - there were boxes! You can touch them. Their form is different, more solid compared to music and colors, and yet they were mystical in a wonderful poetic way. (Ulla)

[...] they added life to the room, the screen sometimes shut down, but the boxes were there the whole time and were a constant further dimension of the visual. (Ayla)

The art and the material in negotiation! (Ulla)

One saw a narrative in the use of the lanterns:

It was very cool the way the boxes were used symbolically - the narrative of the boxes. In the beginning I didn’t even notice them [...] they started out quite neutral and then during the Carl Nielsen piece they became more and more apparent and started changing and we saw green and blue where we only saw white and yellow and pink in the beginning. I really liked that they did exactly what I have requested - they helped interpret the music! (Karin)

As mentioned in the beginning of the chapter the experience of the lanterns were different in the front rows than when seated in the back. An audience member seated on the second row did not notice them much, and another did not think they had any effect:

Well, I think the boxes were a little disturbing somehow. Because a lot of the things going on up on the big screen was more alluring, and changed speed a lot, but then there were these four boxes that
weren’t somehow big enough, some places they kind of disappeared. I don’t really think they had any effect. (Marie)

The interaction

**Intention:** The intention was that the audience is free to choose for themselves how they want to act during this part of the piece, and through that interpret the music and live concert experience based on a more embodied experience. The output of the interaction is dynamic behaviour of the visual elements represented as particles on the screen. Each audience member interacting should get the feeling of being represented in the visuals, and through that participate in creating a shared experience and interpretation of the concert, visuals and music together.

The overall picture of the interaction part is that it was very confusing. A notable amount of audience members started before the interaction part of the music began. Some because they missed information on when to use it, others because they got confused by seeing other people using the light objects early on. Everybody in the interviews found it hard, or impossible to get concrete feedback on how their actions impacted the visuals. This made it hard to make meaning of their own actions, and resulted in various attempts to search for meaning with the object:

> I waved intensely with it. There had to be a reaction - but there wasn’t any! (Karin)

> Is that me there? You tried to create patterns and find yourself - but I couldn’t find myself and I started thinking actively what is going on. [...] Sometimes it made sense, oh, many are clicking and there is a lot of bubbles, but then it didn’t again. (Ayla)

> Also because there is movement in the screen, in the dots, that quickly provides the association to what you are doing yourself, and then it
comes rather quickly - then it has to be movement I’m doing, because there are movements up there. That’s how I felt. (Marie)

State of immersion

Another general thing was that the interaction broke the immersive experience of listening to music for most people. The lack of feedback highly affected people’s ability to enjoy the experience of listening to the music, and interacting with the concert: “It was not clear enough. I think that if you should be able to surrender to a concert like this you need to understand it easily and intuitively. I didn’t get it. I had to think actively.” (Ida).

Some found that they didn’t really listen to the music during this part, since they used their mental focus on interpreting the interaction. There were a lot of different experiences of how this happened. Besides the lack of feedback, the most general source to this, was the misinterpretation of the ticket employees holding up a light to indicate that the interaction was on. Instead of just using the light signal, as an indicator of when it was time for free play, many followed and repeated the specific behavior of the employees holding the light. Others, on the contrary, wondered why people only followed the employees, and yet another felt she was free to chose when to start:

I pretty much let myself be guided [...] because we had been given this thing [...] I waited for a signal for when do I start and lit it. (Sofie)

It was obvious that they [other audience members] kept an eye on him [ticket employee] - so when he turned it on they did too. (Ulla) Is the sign that it should be intuitive - the sign is when I feel like participating? I feel like it now [...]I light, therefore I am! (Sandra)

Besides this more general source for breaking the state of immersion there were a lot of different aspects and opinions. One found that the
pace of the interaction and the music could fit together: “In relation to the music - if we transfer the flashing to bubbles - the flashing fits the music, and you can do it rhythmically.” (Nana). Whereas another felt drawn into other peoples rhythm in a disturbing way: “The music became background. I was drawn into other peoples rhythms, and that was very confusing. I was keeping an eye on what everybody was doing and that took dimensions of the music away from me.” (Ida).

Another interviewee had a momentary experience of cohesion and immersion, but at the same time points out how disruptive it can be when that is not the case: “Sometimes it goes hand in hand into a higher cohesion level - especially when we pushed the button and the visual came out to the audience. [...] But when it doesn’t work you just watch and interpret when you should be in flow [...] and when you get to be a part of it yourself it gets to a higher level!” (Sandra).

Individual and shared
As to be expected the audience had a lot of different experiences and reflections on the interaction in the concert. As just mentioned, some liked flashing the light in relation to the music others found it more fitting for them to sway back and forth with the object. “I liked flashing it, I felt if I was just holding it, it would be very static, and statue of liberty like.” (Sandra). And another replied: “I liked swaying with it, but I like that you could participate even if you don’t dare swaying with it.” (Nana).

During this interview it spawned a whole conversation about the role of anonymity. One wishing it to be more individualized so everybody could see it was her, the other wanting to be able to remain anonymous. Though both agreed that anonymity is important. They also both mentioned other experiences, one where having to write text was an unappealing personal element to her, the other mentioned a theatre experience where the audience voted on
questions, which gave an unpleasant feeling when she realized that they could announce who answered what: “Being anonymous is nice [...] Big difference to being held up on your own opinion [...], but when contributing with a color I wouldn’t mind beeing seen. But perhaps to get everybody to join you have to be able to hide within the group, and be part of the whole.” (Nana).

There were a clear conscious about the audience making the experience together. Some became more aware of other audience members than they normally would, and others speculated on how the visuals were an expression of a group effort or an expression of some kind of average: “I felt that if everybody among us had our ping pong balls lit up, we were combined in a community - one big organism combined.” (Sandra).

Setting the scene
The interaction sets the scene and transforms the behavior of the audience. The interaction encouraged a behavior very disturbing for some and liberating in relation to the perceived stiff genre to others: “I thought that was wonderful [about the fact that the audience was clapping in between the pieces] [...] I think the audience was completely different this Sunday - they were more alive [...] like bringing in the more foreign lively - like an Opera in Italy - where people are standing up and shouting” (Karin). And another stated: “Was annoyed about the clicking sound and the people giggling and talking next to me, finally I asked some people to be quiet!” (Kristian).

As mentioned it seems like the disruptive behavior were experienced quite different dependent on where in the crowd the audience were seated. From the interviews people in the front did not seem to experience disturbance to the same extend as people in the back. Yet the genre and the auditorium still sets the scene for the limit of the behavior: “We are cautious - it wasn’t mayhem - maybe because of the
setting. Nobody shouted: why isn’t it working or is there a glitch? [...] Next to my friend a woman was sitting like this [holding up her program as a cover to indicate the light was bothering her]. In pop culture people would have said to her: relax!” (Nana).

In relation to the norms of the classical concert domain, people became conscious about breaking the norms: “You were a little shy about sitting with a lamp - that is not common to do at The Royal Danish Theatre or The Opera, but we insisted, also in despite, and then I forgot and enjoyed sitting with this lamp and just follow the rhythm.” (Ulla).

**Interaction as a dialogue**

There is great difference in how our test audience find the interaction must have influenced the musicians. To understand and interpret the bigger picture you need to understand your own actions, so when the audience do not see the loop of activities they do not have anything to grab onto when trying to figure out the point of interacting, this affects the way they connect their own actions to the action of the musicians and vice versa.

The few from our audience group who have performed on a stage themselves, talk about energy and feeling the audience. One find the interaction part must have been disturbing for the musicians: “As a musician I get frustrated when people don’t listen [...] It was a fragile moment in the music and it could have been nice if people quietly had done this.” (Karin). But then changes her mind when she sees the video of the interaction: “Wow, it is effectful on the screen - it is really beautiful - I didn’t experience that in the room at all!” (Karin).

Maybe the musicians actually see this as a big homage, that it is beautiful for them to see the audience making a lighter concert for them. But as audience I was thinking it was disrespectful [...] but from the view of the musicians: wow, what a tribute! (Ida)
Yet another issue raised was the energy of the musicians on a more general level, commenting on the importance of being present on a stage: “I felt like some of them were doing Sunday work! [...] He [about a specific musician] was sitting like this [hunching her back] and was distant looking, sending out the thousand yard stare. [...] Others were more present. [...] In that sense it doesn’t matter if we have lamps or not [...] some are just better present on stage than others.” (Nana).
She also saw the whole circle of affects in retro perspective: *We flash with it and it get’s on the screen and out to the lamps and then they [the musicians] see what - that is awesome [...] But now I am rationalizing it in retro perspective.*” (Nana).

The musicians themselves didn’t see much, but did enjoy the light from the lamps forming an ocean. Further, some of them also enjoyed the colored light from the lanterns.

Many audience members related the act of moving with the interaction object to the conductor’s movements and also associated it with the audience turning on their lighter at a rock concert. One musician’s reaction after the concert was likewise that it was like a rock concert; how the second part of the Carl Nielsen piece could be the equivalent to the ballade at a rock concert where people hold up a lighter.

Some of the audience members connected the visual effect of their interaction to the musicians experience: “*The best thing was to turn around and see the whole. So here the musicians got a great experience from us sitting there [with the light]”. (Helle Rose). Others felt a new closer connection to the musicians and to each other:

> It was fun that you were allowed to clap and light up your lamp, and the musicians smiled and got feedback [about flashing with the light instead of clapping after the piece]. (Ulla)
In the end there was a direct applause contact- we waved with the lights and they [musicians] laughed. That was a different meeting than I have ever tried before in a classical concert. (Nana).

The whole
Many of our test persons report that they did not listen to the music during the interaction piece. They were too busy concentrating on the meaning of their action. A few gave up the meaning making, after a while, and enjoyed moving with the lamp to the music.

As a whole the function of the lanterns worked and took part in connecting the stage, screen and audience. A few of our audience test persons linked the whole circle; that the music is connected to the screen and when you interact the screen changes and that affects the lamps and the musicians might feel this.

Part of their revelation about the whole got revealed when revisiting the experience through the videos we showed them at the interview sessions. Here they could recollect part of their memory and also get to experience it in a more passive manner without using energy on trying to make sense of the interaction and connecting the theme to the visuals.

This shows how big an impact the wholeness of all elements have on an experience like this. It is hard to divide the different element into pieces as everything influence each other. The introduction in the foyer creates expectations about the experience to come. And the different elements in the auditorium is affecting audience, as well as affected by the audience behavior, which in turn creates new behavior.
In conclusion many of the issues pointed out by our audience group were part of our design intentions, partly those that succeeded and those that failed, experience wise.
8. In conclusion

Our curiosity about why large scale interactions seems to fail is still intact. We do not have a clear answer to the right way of designing for a dialogue between artistic intention and audience experience within the domain of the classical concert, but we have a lot of new insights and experiences from the work with this process.

We still consider it a need to include the artistic intention and collaborate with artists alongside the traditional HCI focus on the audience in order to design an interactive creative collaboration between artistic intention and audience experience. We also still believe that interaction should support the experience of a performance.

The cycle of playing and listening to music was considered. The musicians, the music, and the audience. We have tried to understand the genre and the classical music community in order to maintain the key intention behind the music and the concert.

The insight that mass interaction has to involve musicians as well as the audience, in a specific space and time, is part of a holistic world view that you cannot isolate the different parts and elements, but need to consider the whole. Even though we did not succeed in having a close collaboration with the musicians, this has still been our design intention as well as a big part of our design process; to consider the experience not just from the point of view of the audience, but also include musicians, conductor etc. in our considerations and collaboration.

We have made a concept based on these insights and considerations, and we have failed in testing and executing some of our intentions and succeeded in testing and executing others.
The domain has offered more than our initial assumptions about the discrepancy between the classical concerts quiet individual immersive nature and the seemingly disruptive interaction. It has affected the collaboration, as well as the experience of breaking the social norms the audience associated with the interaction, and the disruptive nature it resulted in.

**Takeaways**

In relation to programmatic research, we are merely presenting a snapshot from the middle of a dynamic process. As described by Löwgren et al. (2013) programs are ongoing rather than projects with a start and an end, but within the nature of academic publications there are periods of systematic reflection where you “view towards eliciting and communicating provisional insights and outcomes, thus contributing to the collaborative discourse that is academic knowledge production.” (Löwgren et al., 2013 p. 84-85).

This section is presenting our provisional takeaways. They are not meant as finalised results, but rather perspectives based and grounded in our findings from the two Music2Go events, our experiments and collaboration, as well as related work and theoretical studies.

The four takeaways we bring forth to the design space of mass interaction are:
**TAKEAWAYS**

- Reserve interaction for dramaturgical significant moments
- Breaking norms creates social playfulness and disruptive behaviour
- Create tight coupling between action and meaning
- Tie the stage to the whole space

Figure 63: The four takeaways

**Reserve interaction for dramaturgical significant moments**

This is based on the understanding that mass interaction is not either or - it can be reserved as climate moments in a performance.

This takeaway is partly build on the knowledge and experience from our ideation and experiment phase, as well as attending rehearsals with The Royal Danish Orchestra, where we have felt on our own body that active interaction could not last the whole concert. It also has roots in our knowledge about the domain: the music experience in the auditorium is related to an immersive passive state of mind.

We tried to make a significant moment in relation to the music during the Nielsen piece, choosing a passage in the music suitable for enjoying and listening to the music through the embodied action of movement. In relation to our empirical data from our focus group interviews, this action break with the immersive experience of listening. Mainly as seeking meaning in their own actions became a cognitive active state of mind. A few of them did however
momentarily forget to think and was enjoying swaying the objects to
the music.

This makes us ask the question of whether it is possible to actually do
interaction that supports the music experience, or whether active
participation always will be a conscious break with the immersive
state. Here it could be argued that the domain of classical music is
more sensitive towards interference and hence should be reserved to
restricted significant moments.

Relating to the term *stage fright* by Taylor et al. we intended to do
interaction through a defined action space, giving the audience hints
of the interaction context. This was partly attempted, but failed, in the
foyer before the concert and with the written and oral information
about the interaction object. Besides that, it was done by reserving
the interaction to a limited selected time during the concert. By
restricting the interaction to a limited time a more shared and clear
understanding of the rules of the game are defined, allowing the
audience to feel safe in the free play.

Even though this project failed at creating the intended frame around
the interaction, this takeaway is still grounded in its relations to
theory and our design process. Also the fact that the intention failed
showed another very important consideration verifying this. The
mass interaction context showed that there is a great risk of
disruptive behavior spreading between the audience group, which
makes it even more crucial to think about isolating the interaction.
We don’t see this as a way of only preventing a badly designed
interaction space from ruining the experience. Since the disruptive
behavior is something that spreads over time, we find it likely that
most mass interaction designers will have to think of ways to prevent
small acceptable disruptions to grow into bigger ones.
Breaking norms creates social playfulness and disruptive behavior

Our empirical data show that the interaction part changed the behavior of the audience. For some it was a disruptive experience, and for others it created momentarily social playfulness. In relation to our domain it shows how much space and situatedness affect the behavior of the audience. Breaking the norms is not meant as an ideal, but a consideration with two effects: it can create social playfulness and open minds towards new ways of experiencing music, but also create disruptive behavior.

Hobye (2014) touches the aspect of social playfulness in relation to distortions of situated norms: Create social playfulness through distortions of situated norms, and Create normative disruptions for social play.

Where Hobye’s insights and aspects point to the fact that distortion of norms can create social playfulness eg. at festivals and night clubs, our domain of the classical concert is more sensitive, the audience is not safe to explore free play due to traditions and norms of the domain. Additionally it seems the auditorium at a classical concert is more sensitive to distortion; many people doing and acting at the same time in an otherwise immersive and quiet domain can create a lot of disruption.

Hobye relates to Goffman (1966) when explaining how our behavior is dependent on the space we are situated in, and states that by playing with the boundaries of social norms in public settings, it is possible to trigger people to renegotiate shared experience collaboratively (Hobye, 2014, p. 17).

Our interviews show that people formed sub communities in the shared experience. The audience members who started the
interaction part early on, had an experience of unity within their little group being the ones who dared to break the norms, as well as the ones hushing them might have had a shared experience of being the ones who knew when to start. Forming sub communities was also seen in glimpses between audience members and musicians. Eg. the statement about a new meeting with the musicians as they used the object as means of appreciation, flashing with the lamps instead of clapping. Here parts of the audience renegotiate boundaries and social norms into a shared collaborative experience.
Hobyte (2014) further states that decoding appropriate conduct can become a moment of exploration. We saw this with the five audience members’ expressive use clustering their lights to form a unity when seeking meaning of their actions. As well the example of the audience member using the interaction tool as means of feedback, replacing applause.

Another example from a similar domain to ours is Dinner of Luciérnaga from our related work section. Tseng et al. (2012) refer to their empirical work how the audience was uncomfortable and confused when their iPhones made sounds: “However, members of the audience were confused and uncomfortable when the iPhones were turned on and the volume turned up at certain scenes even though the spectators were told this info.” (Tseng, et al, 2012, p. 556).
Also placed in the setting of the auditorium, breaking with the norm of sound from a phone can create insecurity and disruption as well as be a moment of exploration and social playfulness.

Richard Schechner (1971) point at another fact to keep in mind: neither audience nor performers are trained for participation. This can bring uncertainty to the improvisational nature of participation (Van Troyer, 2012). This is obviously both part of the nature of a live performance as well as an individual thing. As our interview data shows, some people like the uncertainty and get a kick out of
participating and see themselves represented in the performance whereas others would rather be part of a whole or not participate at all.

The balance between concrete information and free experience is likewise related to how breaking norms can either create social playfulness or be perceived as, or lead to, disruptive behavior. In the case of both Music2Go 3 and 4, the concrete information the audience got from the foyer became a hindrance for an immersive experience. It did not have the intended exciting playful effect. This was also the case with the interaction object; the note and the verbal information did not match the expected experience.

The lack of experienced connection between the music and the visuals similarly meant that meaning and action did not match the experience. The reason why the lanterns were better received might have been because they hit the *sweet spot* of the domain: the action was located closer to the passive immersive experience. The lanterns were not an active disruption, but a connection merging the different elements (interaction, visuals and music) into cohesion and sparked curiosity.

We tried to make the whole cycle of interaction, it was partly blocked by lack of immediate feedback in the interaction part, and partly fulfilled through the lanterns connecting the audience and the stage.

**Create tight coupling between action and meaning**
Based on our own ideation and findings from Music2Go 3; that the audience preferred abstract visualisation accompanying the concert, we assumed that an abstract experience would allow them to create their own free interpretation. This turned out to be more complex. There has to be a tight coupling between action and meaning before the audience can experience and interpret freely.
This is a really obvious, yet interesting, thing to balance. The act of doing something in the setting of the auditorium of a classical concert is almost a contrast to the passive immersive nature of listening to music. This means that the interaction with the object is different than adding visuals to a concert, the audience can still use cognitive brain activity on analysing the meaning of the visuals, but when you encourage the audience to actively join, you add the embodied action of eg. moving your hand to the music or sway back and forth.

Dourish stresses that “[...] embodiment is about the relationship between action and meaning.” (Dourish, 2001, p. 126). He explores the three aspects of meaning in the three headlines: ontology, intersubjectivity and intentionality. And state that the relevance of intentionality is how it provides “a route to understanding how the elements of an interactive system can take on meaning for users in the course of activity.” (Dourish, 2001, p. 138).

We did not make a clear intentionality with the interaction part of the Music2Go 4 concert: the relationship between the embodied action and meaning was not clear.

Dourish further addresses the next step: “While intentionality concerns the relationship between what is done and what is meant, coupling is concerned with how that relationship is maintained.” (Dourish, 2001, p.144). So once the relationship is tight between what is done and what is meant, how can it be maintained? One way we see this, further elaborated in the Future work section below, is by using a design strategy of gradually introducing the interaction.

Another aspect is all the actions we did not anticipate, how people appropriate technology in new ways and act through the technology regardless of meaning making: “The embodied interaction perspective
begins to illuminate not just how we act on technology, but how we act through it.” (Dourish, 2001, p. 154).

Hobye (2014) addresses the issue of direct feedback, action and meaning through the insights: Create exploration with rich real-time feedback, Create interfaces that guide the interaction, Create a multilayered interaction space while keeping tight coupling, and Create a space for negotiation of meaning and appropriation.

The need for immediate feedback is related to the balance between individual and shared. In order to get individual feedback on your actions, you need to understand the action. For some it would be a reward to recognize one’s own actions on the screen whereas others seek understanding in the audiences collaborative actions as a whole.

The issue of direct feedback and the coupling between action and meaning, are recurrent themes to balance in HCI and interaction design. Eg. Gaver et al. (2002) who address ambiguity as a resource for design. The audience should have an abstract experience and create own meaning - leaving room for ambiguity. Gavers position can be seen as an opposition to traditional HCI, where the user must know the clear meaning of the interface.

After all, the everyday world itself is inherently ambiguous: most things in it have multiple possible meanings. Allowing this ambiguity to be reflected in design has several advantages. Most importantly, it allows designers to engage users with issues without constraining how they respond. In addition, it allows the designer’s point of view to be expressed while enabling users of different sociocultural backgrounds to find their own interpretations. (Gaver et al. 2002, p. 233)

We see here that mass interaction, within this domain, have potential complex contradictions. The problem being combining working with
a big audience group, with a wish for abstract representations making room for individual exploration, and ensuring direct feedback.

On a practically communication level this is one of the biggest challenges in mass interaction. We obviously failed in creating a tight coupling between meaning and action: both in the informative communication leading up to the interaction as well as the systematic lack of direct feedback in the interface. Others have addressed this issue, and also connects it to the scalability issues of representing many individual contributions:

Individual contributions in an audience participation-based performance are often obscured by the large quantities of participants and it is often difficult, if not impossible, to represent every single contribution made from individual audience members [Weinberg, 2005]. (Van Troyer, 2012, p.142)

It is crucial that the audience understand the meaning of their action. This was obvious from our interviews regarding the interaction part in Music2Go 4: there has to be a tight coupling between meaning and action, an immediate feedback, otherwise the immersive state of mind is replaced by hard working cognitive thinking. Since the feedback was not immediate and understandable, the audience was not free to express themselves in free play.

**Tie the stage to the whole space**

This takeaway build on our theme and ideal about creating and acknowledging the dialogical relationship between audience and musicians. The use of the lanterns in the Music2Go 4 concert had the wished effect: it created cohesion between the different elements and connecting the stage to the whole space, making the gap between audience and musicians smaller.
This premise for making a dialogue setting where musicians and audience can feel connected is to include musicians and artistic intention in the process, this is not secluded to the process but also affect the live performance; the premise for the dialogue is that both parts are engaged.

The feeling of physical connection is a brilliant trick to make a cohesion and merge the gap between audience and musicians as the audience is often far away from the stage in mass interaction. The audience clearly needed something more to hold onto, also in terms of making sense of the whole experience. Despite that many of the interviewed were able to see ways the musicians were affected by their interaction, and some even started questioning who the experience is made for.

This relates to our ideal about collaborating with artists and to include artistic intention, which was hard to practice. This reason is closely related to working in the domain of classical music, how it blocks the opportunity to include the artists in the process. Practically we could not access the musicians more than a minimum of meetings and a few rehearsals. Part of the reason is due to tradition at the RDT, and part of it is due to their very busy schedule. We tried seeking expert knowledge outside of the institution, but in relation to the concert, the experience will not be extending the dialogical relationship unless the actual musicians on the stage are part of the dialogue, both live and during design process.

Artistic intention is not just about a verbal handover from musician to designer, but it is also an embodied expression during the live concert and it has to be grounded in a wish to engage with the audience: the audience needs to feel that the musicians want the dialogue too. Our experience with the musicians from The Royal Danish Orchestra was that they wanted this dialogue, but in order to get there, and feel
more ownership of the whole experience, they need to be active players in the design process.
These are the takeaways we leave for the design community. We can only hope that these will serve as a step on the way towards a bigger focus on mass interaction, and perhaps some day be helpful in formulating a program within this area. The final two parts of this chapter and thesis are devoted to reflecting upon our methodological approach and future work in this area.

**Quality of method**

In this section we will reflect on our use of methods, with a focus on our programmatic research inspired approach, and our methodological relevant experiences from integrating collaboration in our design process.

Our inspirational use of programmatic research has been a great resource for an explorative process based on an organic whole between our frame and all of our engagements.

Due to the short time frame of this project we are merely presenting a snapshot from the middle of a dynamic process. In relation to programmatic research we now have a richer frame and new questions arise. Though the scope of our work can not be considered a full program, this approach has proven effective in helping to unfold a design space, not previously addressed to any significant extent in current literature. This way of working has helped put together a lot of existing elements into a frame, from which we have found many interesting challenges and approaches that might grow into one or several design programs in the future.
The programmatic research approach became a way to manifest our optics in combination with our design actions. With the addition of the hermeneutical loop we have experienced how our framework and actions both affect, influence, and change each other, but also how everything is a whole that cannot be divided into parts. It has served as a common thread, keeping various different design activities (material exploration, experience testing, theoretical analysis etc.) in relation to each other. Furthermore our work with the framework has been a big strength both as a way to position our standing ground towards our collaborators and as a methodological tool in the design process; a shared program for designing for mass interaction.

When combining design practice with reflection and theory the programmatic research approach is a generous space where the interweaving of different approaches is a big part of the strength. This highly fits some of the challenges of designing for mass interaction. Because of the nature of big events and live production in general there are challenges with applying design and prototyping techniques from interaction design to live production. The time restraints and the more linear production setup poses hard challenges for a design tradition where iterative design thinking is the norm. Further a setup with many collaborators also serves as a big challenge for planning and executing a solid design process. We find that a programmatic way of thinking can contribute a bird’s eye view on the restrictions and possibilities and hereby help to make a frame with the potential of becoming an active guidance tool in the process.

What we have added to the design equation, compared to other interaction design projects, is a focus on the whole. Both regarding a methodological point of view as well as the specific ideal to include artistic intention, it is an addition to the otherwise dominant focus on results and on the user.
The term mass interaction contributes to interaction design by adding a new design perspective on highly complex design situations. This makes room for new ways of analysing and understanding the design situation, and hopefully leads to more whole concepts applied in mass interaction contexts in the future.

Regarding validation we have done triangulated validation: empirical results from interviews and observation, with theoretical support, related work and analytical validation. And on a micro level all of our engagements have likewise been part of our validation, doing reflections in iterations and through material exploration.

The final aspect of validation has been through our engagements in the collaboration process, where feedback and pragmatics relating to stakeholders turn into concrete design decisions. The collaboration has clearly been the most challenging part of this project. Infrastructuring the complexity and balancing all the stakeholders’ different agendas and ways of working. The two major organisations each have their established traditions, but also the VJ and we ourselves have very different ways of approaching a project, which challenged and affected our intention to do prototyping *in-the-wild*. In order to accommodate upscaling before the live event we moved crucial elements out of our direct control (to the VJ) which negatively affected our ability to tweak details in the field. However, the fact that we created a highly flexible design, meant that it was still possible to meet the unforeseen challenges that kept appearing in the process. This was what made it possible to hand over elements to be controlled by the VJ, and made sure our interaction tracking software was always flexible enough when new challenges occurred.

A very interesting aspect in relation to our collaboration is the clash between the apparent linear work towards a production that both
cultural institutions represent, and our iterative explorative way of working interweaved in both practice and reflection.

The more linear way of working, has introduced a higher risk and complexity in managing the project direction and ensuring a valuable knowledge outcome, compared to a process with many small iterations, where there are more potential occasions for shared evaluation and analysis during the project. At the same time, due to the nature of production, our process had a clear shift from explorative experiments to direct work towards productions, though still interweaved in the complexity of the scope of the collaborations rather non-linear nature.

In relation to the collaboration the programmatic research approach allowed us to be flexible and open and to navigate a complex collaboration, which was a great force in a big collaboration project. One of the downfalls with our inspirational programmatic way of working was that we did not share the program with our collaborators. The frame served as our optics, and as a way to manifest our optics it worked great, but it also highlighted the different agendas of the different stakeholders.

**Future work**

As to be expected when entering a new design domain (mass interaction), we have found many interesting areas relevant for further exploration. Perhaps even some that separately could be the foundation of a new design programme in the future. Some of these are elements we have touched upon in our theoretical and conceptual work, but did not get sufficient knowledge to validate the qualities of them.
Gradual interaction

One area of exploration worthy of continuation is the gradual introduction to interaction. Based on our mirror effect idea, and the design dogma of Balancing interaction, we see a promising approach in gradually introducing interaction. This could allow for a relation between input and output gradually becoming more abstract. We see that it might be possible to ensure tight coupling between meaning and action, and thereby create an abstract experience, with free space for individual exploration and meaning making. As with the related work example Dinner of Luciérnaga this could be done by starting with simple, and perhaps more binary, relations to the interaction and slowly increase the complexity level.

In our ideation process we found an interesting relation to early performance art as well as the genre Total Theatre where the traditional theatre setup is deconstructed and the traditional fourth wall between the stage and the audience is cancelled. We find these examples inspiring as tools to give the audience a narrative clue for an individual exploration, and gradually introduce complexity in the interaction.

Interacting directly with music

Another area we see promising, but also hard to practice, within the domain of classical music, is relating interaction directly to the music, as described in the related work chapter as The ideal.

One of the most obvious ways of attempting a dialogue between the audience and the musicians would be making a very direct link between audience action and music expression. During our studies of related work, this is the area we have found the most examples within. For instance the Glimmer example where the score is generated by audience interaction. Unfortunately, all of the examples we have found, with the exception of our ideal concept: The National
Mall, did not take the quality of the musical experience, and artistic intention, into consideration. Thus having the interaction merely being a layer, not supporting the musical experience.

The reason for this being difficult is partly that the classical music is not electronically amplified in the big concert halls, unlike most popular music genres, making it easier to manipulate through eg. digital sound manipulation. Besides this, the internal workings and traditions of institutions like the RDT, do not support opening the creative process and responsibility of the music production.

Though this seems like an obstacle for attempting new things, a lot of important insights into the genre and internal motives from the artists, are hidden in the artform. When attempting something like this project did, it is of utmost importance to embed these insights into a frame for the design, in order to challenge and support the genre in the right places, not ruining the experience more than supporting it and making it better.

A final challenging thought here could be that the only way to make interaction and classical music into a dialogical relationship between musician, artistic intention and audience experience might be to create the musical piece and interaction together from scratch, not by adding it as a layer on already existing music.

**Interaction space**
Through this project we have found a distinct challenge for mass interaction in framing the space in which the interaction occurs. This is especially sensitive when mass interaction is meant to support a musical experience, where disruption and conscious reflection can block the intended immersive experience. Our design dogma: Create a frame for interaction, very specifically relates to this, and was supported both by music experts, the concept evaluation, and
theoretical references. These seems to be obvious and crucial elements in designing mass interaction, with a focus on the whole experience, where many complex structures are at play.
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List of illustrations

**Figure 1 - Coded Narratives:**
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Figure 51, 54, 60, 61, 62 - by: RDT video.
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