The Implications of Using Interactive Artifacts to Bridge the Divide Between Audience and Stage in a Conventional Hall Setting

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Figure 1. Audience controlling the backdrop with the installation *In Case of Emotion*. (Photography by Mads Hobye).

Introduction

Within theatre settings like the Royal Danish Theatre,1 there is a tradition for a divide between the audience and the performing stage in which the audience rarely physically or verbally interrupt or affect the performance on stage. Similarly, breaking the fourth wall in the sense of the performers engaging with the audience is typically considered a special "trick" that is only to be used occasionally. The "conventional divide" should, thus, be understood as a context similar to the Royal Danish Theatre consisting of a conventional "passive" spectatorship hall setting in which the performances are played out (hereby simply referred to as "the divide"). Sarah Bay-Cheng, et al. define the conventional theatre set-up as "…putting the audience in the dark in front of a brightly lit stage…"2 We have explored how using interactive physical artifacts can give the audience

the ability to either change or sense the performance in alternative ways, and still preserve the conventional divide. Through the three experiments, we see three distinct implications that are at play and need to be taken into consideration in the design process.

This paper offers a practice-led source on the incorporation of interactive media into conventional "passive" spectatorship configurations such as theatre, opera, ballet, and concerts. Through our collaborative design experiments, we have explored the implications of bridging the divide between audience and stage through interactive digital artifacts. We look at three different experiments done over a period of five years (2013-2018) in collaboration with the Royal Danish Theatre as an exploration of possible ways to intermediate this divide through a layer of interactive technology. The types of performances tested range from plays, dance performances, to classical concerts. Two have been tested at actual live performances with up to 500 participants. The first two experiments were tried on classical concerts, and the last experiment worked with ballet dancers in a series of workshops. Our curiosity has been to explore ways that technology can be used to create actively engaging participants in the performances while maintaining the format of the conventional divide.

We take a cross-sectional look of the experiments to gain more generally applicable insights into the opportunities and pitfalls that are at play and point to three thematic implications: *context expectations*, *the level of audience control*, and *embodied experience*. The three implications are related; the embodied experience of interacting with technological artifacts relates to whether the object affects the meaning-making in the specific context and in relation to the specific art form. The knowledge contribution in this paper, thus, stems from a practice-led design research process in which the different experiments have continuously informed and solidified the overarching research framing and contribution. In the following, we will ground this approach using Research through Design based annotated portfolios.

Practice-led Design Research Exploration as Knowledge Contributions

In this paper, we chose to base our discussion around three different preliminary experiments. The primary intention of the experiments was to explore new ways of mediating the interaction between the divide. The intentions behind the experiments were

not to create "production-ready" solutions, instead their role was to (gently) challenge and push the boundaries between the divide, to open up new possibilities through technical solutions and to open up discussions of what should be considered preferred (e.g. see speculative perspectives on design as a way to explore preferable futures[3]) interactions with a wide range of stakeholders (lightning designers, ballet dancers, choreographers, etc.). Similarly, this is what Bill Buxton[4] would consider the sketching phase of user experience design. In this phase, the artifact is meant to provoke and evoke new understandings, more than seeking to reach a perfect fit. This perspective helps us shed light on the implications that are at play. For this reason, the focus of this paper is on the initial experiments with the three different artifacts and not the more polished versions at later stages.[5]

We position the work within what is commonly known as Research through Design.[6] [7] The concept of "Research *through* Art and Design" stems from Christopher Frayling[8] in which he maps out different approaches to Art and Design research. Researching *through* design in development-work is, in his words, "less straightforward, but still identifiable and visible." [9] For him, it can be "[..] customising a piece of technology to do something no one had considered before, and communicating the results."[10] Working with experiments as design examples is a practice-based form of knowledge production in which there is an ongoing dialogue between the overarching frame and the different experiments. The experiments inform and challenge immediate perspectives and framings. This methodological approach to Research through Design is also known as Programmatic Design Research.[11] [12] [13] [14]

One recurring discussion within research through design (and Programmatic approaches to Design) is what should be considered a knowledge contribution[15] [16] and what format such contribution should be presented in. The scholars referenced above collectively argue to both consider rich descriptions of the artifacts, the design process, and the overarching reflection as a knowledge contribution as a whole. This becomes a matter of packaging the "takeaways"[17] in such a way that they are available for use by other designers and researchers. Bill Gaver and John Bowers introduce one such solution to packaging in the form of annotated portfolios.[18] They propose annotated portfolios for communicating design research with a practice-led approach because:

> [Annotated portfolios...]… maintain the particularity of individual examples, while articulating the ideas and issues that join and differentiate them. Juxtaposing designs with annotations supports appreciation of the conceptual dimensions of designs on the one hand, and, by yoking them to particular design manifestations, grounds and specifies theoretical concepts on the other.[19]

What this means is that by having a collection (as a portfolio) of designs similar to traditional art portfolios, one is able to juxtapose the design examples to give breadth as well as depth and motivate comparative discussion. What is important to emphasize, is the role of the portfolio as a set of designs (or experiments) with either overlapping similarities or with conscious differences curated in such a way that they create a basis for a larger discussion around a specific framing. For Gaver and Bowers, annotations are meant as a written meta layer on the actual designs to inform about the role in the portfolio and/or how the different designs relate to each other.

With our intention of discussing possible ways of mediating interaction based on practice-led experimentation, we find annotated portfolios operate as generative artifacts to present our work within the written format of a journal article. Concretely, we use the annotated portfolio to present the different experiments and to map out different implications (annotations) that are at play. Based on the identified implications from the experiments, we open up a broader discussion on the strategies for future performances.

Bridging the Gap Between Stage and Audience

An increasing amount of research has been done around audience participation, audience engagement, and co-creation. From categorizing audience engagement to studies of the experience of engaging and participating. [20] [21] [22] [23] [24] Within the domain of the conventional divide of a stage and an audience, interactive technology can often be experienced as invasive novelties. Traditionally the Royal Danish Theatres' hall setting holds many norms and traditions telling the audience to act quietly, respectfully, and collectively as a group. This atmosphere and pervasive culture can make for a challenging setting for new digitally augmented explorations when certain interaction design parameters are not met. Ana Dias and Patricia Jorge[25] point to a paradox where even though interaction and participation seem connected to spontaneous experiencing of emotions, technical mediation can introduce distance and detachment.

With reference to Ervin Goffman, Mads Hobye[26] points to how an audience's behavior is dependent on the space they 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. Where Hobye[27] refers to public settings as the scene to create social playfulness through distortions of situated norms, the Royal Danish Theatres hall setting is bound by rituals and traditions.

The symphony concert has been described by Christopher Small as operating simultaneously on two levels. The first level is the experience level, including the actual music, emotions, and communication. The second level is the ritual level, which considers the concert as an event within a society, involving a particular group at a particular time and place.[28] The ritual and the tradition of the genre is part of the challenge of intermediating between the stage space and the audience: the discrepancy between a seated audience passively experiencing immersion of the art form, and the potentially invasive interaction through digital augmentation. Andy Lavender argues for a shift in performance making from *mise en scène* (the arrangement of the stage) to *mise en événement* (the arrangement of the event) to *mise en sensibilité* (the arrangement of feeling).[29] He states:

> This all makes for a reengagement with meaning in and around theatre and performance; a change to our understanding of registers of performing and what it is to be an 'actor'; likewise a new set of possibilities for spectatorship, increasingly drawing on participatory models of engagement, and privileging sensory experience.[30]

Lavender argues that performance theory has thoroughly treated the overall mainstays of theatre and performance--mediation, performing, and spectating[31]-- as primary functions of interest, going further, we zoom in and focus on the meaning-making of the interactive objects inserted into performance events. The meaning-making of interactive objects follows Small's point that experience and ritual operate simultaneously, and Lavenders' argument of a shift in performance towards the arrangement of feeling and privilege of sensory experience; that embodied experience and context expectation are closely related.

Portfolio: Three Experiments with Interactive Artifacts in a Hall Setting Performance

In the following, we present the three design experiments executed at the Royal Danish Theatre. Subsequently, we offer a reflection of the implications of incorporating interactive artifacts into a hall setting performance to bridge the divide between audience and stage. Reflections on the implications are presented as three thematic headlines in the next section.

In Case of Emotions was tested at a concert held at the Royal Danish Theatre's old stage, featuring the Royal Danish Orchestra during a Music2Go concert with up to 500 participants. During the concert, the audience could influence the light in the concert hall by using their mobile phones (see figure 2). It is an interactive system in which the audience can influence the color of the light in the concert hall on a projection screen placed behind the musicians. The audience can choose between blue, yellow, and red to express their mood during the concert. In this paper, we describe the first experiment done with the *In case of Emotions* as a concept (see credits for more details).

Personal Light was used at a Music2Go brass concert at the Royal Danish Opera House with 300+ people in the audience. The members of the audience were each given a little lamp with the instruction only to use it when indicated by personnel placed in the aisles during a limited time of the concert. The concept is centered around three elements: a screen, lanterns, and the interaction object, which consisted of a little lamp. With the interaction object, the audience could trigger color behavior on a big projection screen behind the musicians (see figure 3). Turning on the lamp created colored bubbles of air (a reference to the airflow of playing brass instruments) on the screen. The interactive system is based on camera detection; when a lamp turns on, bubbles of air are triggered at the screen mapped to the position of each audience member's seat in the hall with the intention to create a personal output.

Case #1: In Case of Emotion

Figure 2. Audience members choose colours with their mobile phone (Photography by Peter Løvschall).
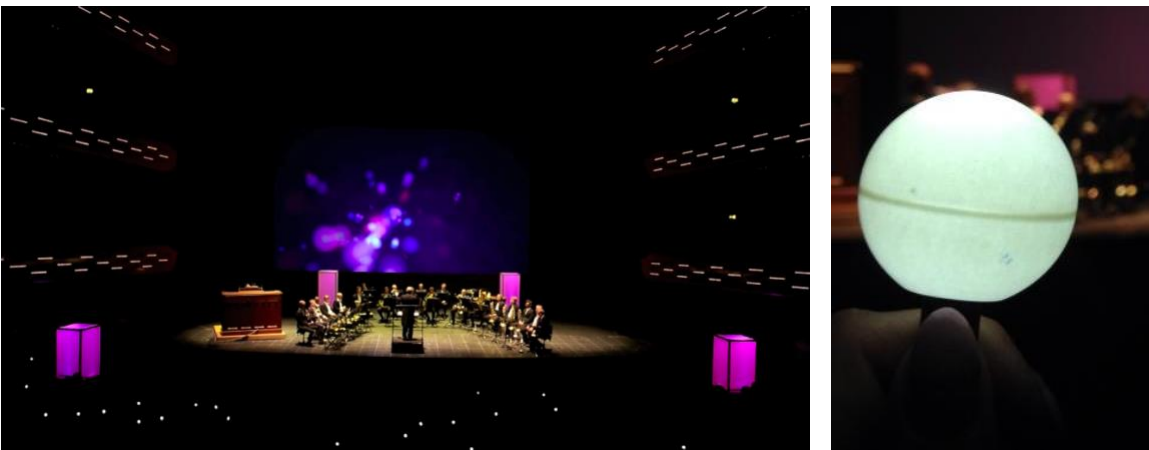
Case #2: Personal Light

Figure 3. Audience members trigger bubbles on the screen. (Photography from Ranten & Jensen[32]).
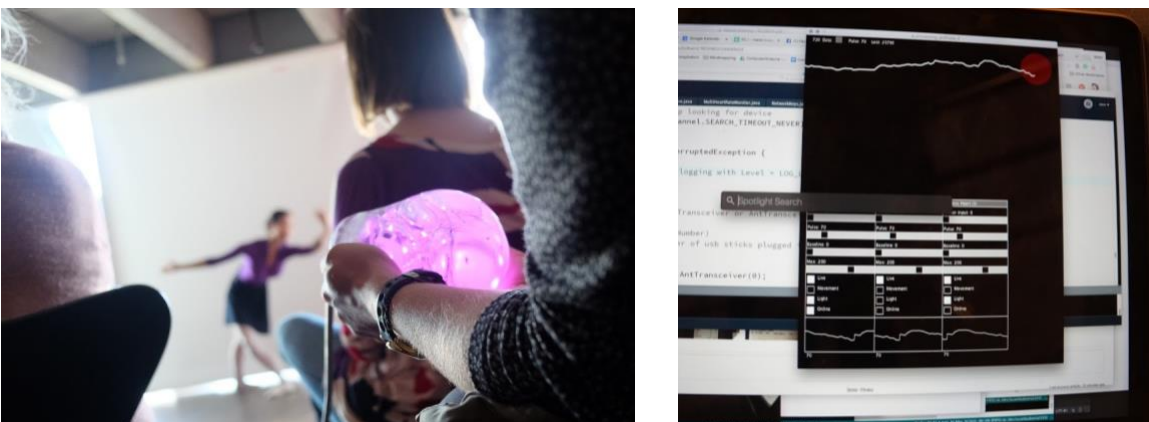
Case #3: Mediated Pulse

Figure 4. The glass heart vibrates with the dancers' pulse (Photography by Mads Hobye).

Mediated Pulse was developed and tested at a series of workshops held at the Royal Danish Theatre with the contemporary ballet company Corpus as part of the research project "A Suitcase of Methods."[33] The workshops explored a specific paradox between perceived perfection and the struggle behind it. Specifically, we wanted to share the (normally hidden) pulse of the ballet dancer with the audience. Thus, giving the audience an alternative way of perceiving and empathizing with the artists' as the dancer experiences the physical and mental demands of dance.

The object in the *Mediated Pulse* project is made of hand-blown glass with computational behavior. The glass is formed in an abstract organ-like shape with embedded copper wires as a vein and multiple layers of diffused glass. Internally it consists of a microcontroller, a vibration motor, and an individually addressable pixel light RGB strip (see figure 4). By attaching a wireless pulse sensor to the ballet dancers, it is possible to map a representation of the heart rate. To track the pulse, the glass heart vibrates in sync with the recorded pulse and activates a red expressive animation in the light strip as a representation of blood running through the veins. The glass heart, which is vibrating in sync with the dancer's pulse is then given to one audience member at a time for them to hold and thus sense the dancer's pulse during the performance.

Annotations: The Implications of Incorporating Interactive Artifacts into a Hall Setting Performance

The annotations (see figure 5) serve as a basis for a structured way to discuss the incorporation of interactive artifacts to bridge the divide between an audience and a stage. The annotations cover three thematic implications in relation to interactive artifact*: context expectations*, *the level of audience control*, and *embodied experience*. We based our reflections on multiple qualitative information gathering strategies. First and foremost, during the experiment the audience was observed to understand how they interacted with the artifacts, where they placed their focus, and to what extent they used the artifacts throughout the performances. In the case of *Personal Light,* we conducted interviews with a focus group of selected audience members.[34] With *In Case of Emotions,* we observed their use of the interactive object during the performance. With *Mediated Pulse*, we had a more iterative approach where experiments were mixed with ongoing conversations from

both performers and the audience. We did a workshop in which we iterated between experimenting and having a conversation about the current experiment (we did 5-6 iterations). Further, we did a stakeholder presentation with feedback from the audience afterward.
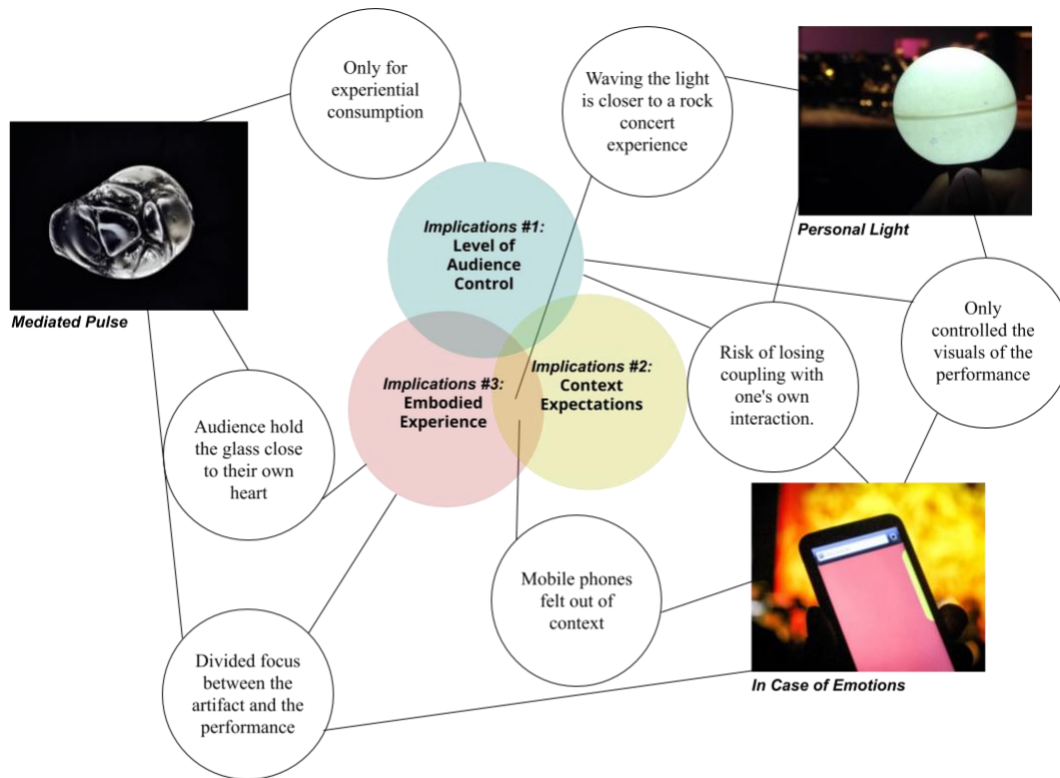

Figure 5. The annotated Portfolio of the three design examples. The annotations (colored circles) show the implications: *Context Expectations*, *Embodied Experience*, and *Level of Audience Control*. The white circles illustrate the different nuances that are at play in the three implications. Thus, showing how distinctive experiments have overlapping challenges.

Implications #1: Context Expectations

The contextual expectation of this type of hall setting is that the audience stays seated, quiet, and does not move around. In our experiments, we tried to either embed or play with the contextual expectations[35] in different ways:

- *Mediated Pulse:* The peculiar glass heart had the least out-of-place character. It is highly aesthetic in its appearance, and one could argue that the fragile yet powerful glass heart complemented the fragile yet strong ballet dancer. However, the

question of the object's relationship to the actual performance it still left open. For example, what would be the integrated story behind the object? Besides this, it is our impression that it integrated relatively well into the performance setting, because of it being the least recognizable object from an everyday context, and because the object's artistic qualities seem to support an aesthetic experience.

- *In case of emotion:* The conventional role of smartphones as digital communication devices did not integrate well into the classical music setting. The choice of smartphones was merely a matter of available technology than an actual interest in the devices as artifacts in themselves.

- *Personal Light:* The little lamp was designed to relate to the embodied experience of swaying back and forth while listening to music, but it was still a foreign object in the conventional hall setting. The interaction and the motion would have matched better in a concert hall setting.

What can be seen with all three experiments, is that they all struggle with finding a contextual fit both within their role in the performance and within the role of the overall hall setting. This is essentially a question of what role they should have. Whether they should blend into the setting as an embedded (as in naturally expected) artifact or if they should be disruptive (as in being an out of place element). This dilemma is an underlying theme with all the experiment and most of the problems we highlight in this section and the implications point towards this discussion. In general, distorting situated norms by adding an *out-of-context* element (thus creating a disruptive object) can be a tool to create curiosity among the participants (see e.g. Tieben, Bekker, and Schouten). [36] Using this mode of curiosity building was one way we intended to play with the overall setting (see e.g. Hobye.)[37]

In the case of *Mediated Pulse,* the concept plays with the audience member's contextual norms within the ballet tradition and thus disrupting their expectations. The high pulse of a ballet dancer is usually a hidden factor. By amplifying the pulse expressed in the glass heart, the act of "watching" a ballet is made a potentially strong tangible experience despite the consequence of breaking the illusion of the effortless movements of the dancer. In the project, audiences gained access to a personal, physical reaction to the movement of

the performer and the physicality of the performance. One of the questions we identified was how this form of interaction affects the overall audience experience of this art form.

A consequence of playing with contextually disruptive objects is that higher social awareness is created. As Peter Dalsgaard & Lone Hansen[38] argue, when one designs for interactive experiences, the audience become spectators and performers simultaneously. They point to three different user actions: performing, perceiving, and interacting. They state:

> The user is consciously or subconsciously always performing in front of imagined or real others when she interacts with the system in public space. She puts herself on the line and becomes a performer of her own perception. Implicitly, an interactive system becomes the stage for not only the user's perception of the system but for her perception of her own act of performing in and with the system.[39]

This is especially at play with both *In Case of Emotion* and *Personal Light.* Both experiments challenge the traditionally "passive" role of the audience, where the spectators usually primarily relate to what is happening to the stage through visual and auditory reception. In the experiments, they gained an ability to affect it through interactive objects. This shifts their role (and thus the contextual expectations) to being co-performers.

One major implication to consider with inviting the audience to co-perform is when and for how long they should interact. With *In Case of Emotions,* the concept of indicating emotions through three colors could not match the duration of the full concert. Building on the experiences from *In Case of Emotion*, the ambition with *Personal Light* was to "reserve interaction for dramaturgical significant moments."[40] This was communicated to the audience at the entrance (when handing out the lamps), but a notable amount of audience members started before the interaction part of the music began. Some because they missed the information about when to use it, others because they got confused by seeing other people using the light objects. This confusion or unplanned use indicates that introductions to the use of technological objects should be treated with careful attention to when and how to use the objects.

Implications #2: Level of Audience Control

As shown in the previous examples, interaction with technology can turn the audience from passive spectators to active co-creative participants. But, instead of the

notion of either active or passive, the three design examples serve as examples of different types of interactions between stage and audience. Put simply, they can be summarized like this:

- *Mediated Pulse*. Here the audience can *only* experience the heart, but it has no way to actually impact what is happening on stage. Further, only one or two members of the audience can experience it at a time due to the fact of only having one artifact (heart) to send around. Consequently, this becomes a signal delivered in one direction: From stage to audience in a "one to one" (1-1) relationship.

- *In Case of Emotions*. The audience had control over the light, but only through the sum of all the input delivered from those using the artifacts. Further, the audience did not affect the actual musical performance in any tangible way. They "only" changed the color pattern displayed behind the musicians. Although this presumably affected the way the audience perceived the music, the control is unidirectional, this time from the audience to the stage; many mobile phones to one general light output: a from audience to stage in a "many to one" (*-1) relationship.

- *Personal Light*. The audience could add light effects with direct coupling, but without control of the musical expression (similarly to *In Case of Emotions*). The concrete control goes from the audience to the stage where many lamps create many bubbles; in a "many to many" (*-*) relationship. In practice this created a feedback loop between the visuals and the audience, but with presuambly little effect on the musicians and their performance.

With just the two interactive dimensions (direction of control and the many/one relations), we can see that the multiple potential experiments are missing. For example, the different modalities could be combined in other ways. The most complex scenario seems to be a two-way and many-to-many relationship, in which many performers on stage and many audience members interact with each other through an interactive medium. However, it is relevant to look at the implications and insights each case presented.

During *In Case of Emotions*, each member of the audience can choose a color, but there is no individual marker in the visuals as the output of the interaction is generated based on an average of the colors selected by the audience. There might be a personal reaction, however. Those that chose blue and got blue would have some overall level of satisfaction, most likely, while those that chose red, may be dissatisfied. This creates an uncertainty of actions (especially for the segment which did not get the color) and meaning-making. Similarly, *Personal Light* failed to create a tight coupling between action and meaning. Even though the system was built to make a visual output representative of the personal input ("many to many"), the interaction was confusing: a click on the lamp would create bubbles on the screen mapped to the position of the seating of the particular audience, but many kept holding their click button down which resulted in confusion as the output only happened once. Hence the implementation of the experiment resulted in an audience split between those who understood the way the object worked and those who had an experience where the object did not work.

Coupling between action and meaning is a recurring issue in interaction design. Hobye[41] addresses the issue of direct feedback and tight coupling to create meaning and appropriation. Dag Svanæs[42] addresses the embodied point to coupling: that the body should easily understand the action-reaction coupling. Paul Dourish[43] also points to the relationship between action and meaning: "While intentionality concerns the relationship between what is done and what is meant, coupling is concerned with how that relationship is maintained."[44] Hence coupling is about how the relationship between action and meaning is maintained when we interact with objects.

As opposed to the two former concepts, *Mediated Pulse* operates as a form of digital mediation from the stage to the audience. The "one to one" relationship raises the question if one object traveling the rows of the audience will be sufficient in a hall setting of many hundreds of people. Furthermore, as only one audience member can hold the heart at any given time, this individual may also become the center of attention for other audience members; thus, relating back to the previous discussion of the audience becoming performers. The heart may slightly shift the performance hierarchy and offer a bit of the spotlight to the person holding the heart - the individual, who for a moment, has a privileged connection to the artist. Besides, the focus of this project was not to turn the audience into

co-performers, but rather to support the connection and communication between the artists on stage and the audience in the auditorium. As mentioned earlier, when interaction is added to allow the audience member a new level of connection, they inevitably become a part of the performance, making the audience co-performers whether it is intended or not.

Astrid Breel (2015) states a similar point in her categorization of the different types of audience involvement – interaction, participation, co-creation, and co-execution – when she points to the three aesthetic elements of these forms of participation: "1) the interpersonal relationship between the performer and the audience, or between participants; 2) the physical, embodied experience of the participant; and 3) the creative contribution the participants make to the final performance." [45] In *Mediated Pulse,* the aim was thus to strengthen Breel's first form of participation through a mediated communication of the ballet dancer's pulse.

Our intention behind designing audience enabled interaction is to create some level of ownership and co-participation. Using a parallel layer to allow the audience to change the color setting or the background is a way to give the participants power to co-create with the performers on stage, however, looking at the three different cases, it is striking how little power is actually given. In all three cases, the audience does not have a say in the actual performance (e.g. the sound output). Is this enough for the audience to feel like they are given actual real power over the performance, or are we creating the illusion that they "can play along" so to speak? William Lewis makes a distinction between "tangible agency" and "affective agency" where affective agency is the embodied feeling of agency and tangible the measurable one.[46] Considering this, to what extent are we underestimating the audience's ability to call "bullshit" - or become disconnected because they quickly decode that their role is insignificant in the bigger picture. Ultimately, this is a question of whether controlling light to a piece of music or holding an artificial heart close to one's body is considered meaningful in the sense of the contextual expectations of the audience members.

Implications #3: Embodied Experience

In the three experiments of the portfolio, the interaction is built around an object; the mobile phone, a lamp, and a heart. Each different object creates various levels of embodied experience. Put simply:

- *Mediated Pulse*. The glass materiality, the weight, and the pulsating sensation allowed the object to convey an intimately haptic and personal experience in which it was common to see audience participants holding it close to their hearts. Their visual focus shifted between the object and the performance at first but settled to sensing through the hands while keeping visual attention on the stage.
- *In Case of Emotions*. The screen and touch-based interaction created a split focus between the phone and the stage. The lack of tangible feedback forced the participants to look down on the screen to change parameters, thus mentally disconnecting from what happened on the stage. E.g. Embodied disconnect - cognitive demanding.
- *Personal Light*. Waving the light in the air gave a bodily connectedness to the music, but created an out of context experience in the conventional hall setting and especially within the frame of classical music. E.g. Situated engagement.

Bay-Cheng et al. define key aspects of intermediate experience as: experiencer and embodiment. The experiencer is "the body as medium of perception" and a "haptic dimension of space." [47] Embodiment is defined as the ways the embodied experience of the self are "extended, hybridised and delimited through technology."[48] With reference to Breel's [49] notion of the second aesthetic elements in participation, the physical embodied experience of the participant, and Lavender [50] who argues that sensory experience is privileged, we suggest that the embodied experience of interacting with technological artifacts – besides relating a physical embodied and sensory experience – also relates to whether the object affects the meaning-making in the specific context and to the specific art form.

The sensory, haptic, and embodiment of holding a heart or a lung in your hands can have a relation to the art form and could be explored further through material exploration. Whether the heart is a foreign object in the setting or becomes an integrated part of the performance greatly depends on the visual aesthetics of the heart compared to the overall aesthetics of the performance. The lamp was designed to support an embodied way of enjoying the music through the interaction of swaying back and forth. This ideas was inspired by the common act of holding a lighter and swaying to the beat as seen during a

ballade at a rock concert. The use of the lamp formed a dynamic changing ocean of light, visible for the musicians when they look into the audience. Hence, the embodied experience relates to basic phenomenology as it is both the actual embodied experience (the bodily movement of listening to music) and also to the meaning-making of the object as it makes sense in relation to the art form. And, as emphasized by Bay-Cheng et al. embodied experience such as "... intermediality in performance is, indeed, very much a matter of redefining our senses and resensibilising our perception through bodily encounters with (digital) technologies."[51] The important issue we identified, in our experiments, is the need to materialize the use of digital technology as objects that make sense in relation to the embodied experience, the art form, and the context. In other words, objects that support the communication and experience of what is happening on stage without disrupting the overarching context.

Strategies for Future Performances

The three experiments are all examples of stage performances modeled around passive spectatorship that attempt to incorporate interactive artifacts but didn't fully succeed in integrating the artifacts in a manner without negatively impacting the overall experience of the audience members. Through these experiments, we have discussed three thematic implications: context expectations, the level of audience control, and embodied experience. It is clear that within a hall setting with a conventional passive spectatorship setup, dividing audience and artist, it is important to be aware that even simple changes in the relationship between the artists on stage and the audience can be challenging. We suggest two strategies to integrate interactive artifacts in a more holistic manner. Ultimately, it is a matter of whether to custom design for a particular production or to design integrated artifacts as part of a specific context.

Custom Design Mediated Experiences for a Particular Production

Throughout the experiments, it became clear just how invasive even the simplest little experiment is in a divided performance context. From a technical perspective, multiple specialized personnel across the overall production team neeed to be involved including lighting and stage designers. From an experience design perspective, performers, musicians, instructors, directors, etc. needed to contribute input. When e.g. using mobile

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phones, we needed to get a formal acceptance to deviate from the cultural norms of turning off the phone during events from the leading management.

Where Breel 52 makes a distinction between participatory processes and outcomes – whether the audience is part of the creative process or the artist construct the experience and the audience is needed to execute the work – we suggest working with the institution, drawing on the participatory design tradition where collaboration with stakeholders in the process is a main focus in the design process. This is especially relevant when the object will have a disruptive role in which the contextual expectations are challenged. It is hard for us to imagine a situation where this could happen without it being an intentional part of a specific production. It should thus only be done if it is within the interest of all the stakeholders to do so. Therefore, we suggest the possibility to work across disciplines and stakeholders to custom design mediated experiences for a particular production. Digital augmentation as audience engagement in a hall setting with the traditional divide should be considered a mixed practice between performer, audience, and the institution.

The Possibility to Design Integrated Artifacts as a Part of the Context

In a theatrical event, countless elements are at play that we culturally expect as an integrated part of what it constitutes to participate. We often sit in soft chairs covered in velvet, and there is a small incline for each row of chairs as they move away from the stage. There may be small guiding lights at the end of each row showing the way out or indicating the row number. All of these elements are small iterations that have been developed over time and with specific variations for each theatre and their individual stages.

Through the experiments, we are left wondering if it would be possible to rethink interactive objects as an integrated part of the theatre setting itself? Instead of considering them novelties for a specific play. Would it be possible to design interactive objects that we would take for granted in the same way as the chair we sit in? Could we design non-invasive artifacts that can be used in different plays without larger interference with the overall experience? Could the heart be seen as an object that would even be expected to be shared during performances involving a high level of the pulse? Would the audience expect the mediated heart to float around during performances? Over time these artifacts will seem less and less invasive and more of an expected part of a theatre performance.

These were considerations implemented during the *Mediated Pulse* workshops. One consideration arose as a result of one specific workshop situation. During the workshop, we asked one of the ballet dances to perform an improvised choreography for the group. As he prepared his performance for us, he stood completely still, eyes closed, and focused in the middle of the room facing us - his audience. His body was stationary, but to our surprise, his pulse was racing, and the glass heart was vibrating and lighting up, telling us that something was going on. There was a physical response to the situation, which we wouldn't normally be able to perceive. Whether it was a result of nerves or his mental preparation for the choreography influencing his heart rate, we don't know. But the blinking heart told us that something intense was going on during the preparation for this artistic expression.

This piece of information leaves us with the question of how a mediated heart or other artifacts may communicate other aspects of a performance experience. We are in many ways far away from answering this question and completely understanding this potential. However, one initial step could be to start using the heart before performances as a way for people to sense the pulse out in the foyer as the dancers were preparing. Thus, creating a mediated connection to the dancers as they prepare their performance.

Conclusion

With a focus on the implications of bridging the divide between audience and stage through interactive digital artifacts, we have offered a practice-led perspective through our three experiments and offer central implications to integrate digital artifacts: context expectations, the level of audience control, and embodied experience. Finally, we have proposed two strategies to consider when integrating interactive artifacts in a holistic manner using a collaborative design process as a mixed practice between designer, performer, and the theatre to develop interactive artifacts that are fully integrated into the performance. The two proposed strategies are 1) to work across disciplines and stakeholders to custom design mediated experiences for a particular production, and 2) the possibility to think in terms of designing artifacts that can be integrated into different plays without larger interference with the overall experience. We need to continuously explore and understand the creative and aesthetic potential for incorporating interactive technology

into hall setting performances and acknowledge the process as a mixed practice between designers/developers, performers, audience, and the theatre/institutions.

Acknowledgements

Mediated Pulse is developed by Mads Hobye, Nina Gram, and Maja Fagerberg Ranten and done in collaboration with the Royal Danish Theatre. The glass form development emerged as a part of Dynamic Transparencies with Henrik Svarrer Larsen, Peter Kuchinke, and Mads Hobye. Blown by Bjørn Friborg. It has been tested internally with smaller audiences in workshop-like settings in 2017-2018 with the ballet dancers from the contemporary dance company "Corpus."

1 The Royal Danish Theatre is the Danish national performing art institution. The theatre was founded in 1748, and today it has three venues at its disposal: The Royal Danish Playhouse, The Royal Danish Opera, and the Old Stage. The Royal Danish Theatre consists of four art forms: ballet, opera, drama and orchestral music. In the previous season The Royal Danish Theatre had 875 performances.

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5 *In Case of Emotions* and *Mediated Pulse* (which are discussed in the portfolio) evolved beyond what is presented in the paper. *In Case of Emotions* has evolved into a concept called Opus Lux (see credits for more details), which has been tried in other settings and setups with more successful integration. Similarly, *Mediated Pulse* was tested in settings with a less formal divide.

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