

## **Interactive Art, Performance and Scientific Research into Corporeal Empathy**

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### **ABSTRACT**

*This paper presents the evaluation of a design research project that combines artistic practice and academic theory to demonstrate how problem-based learning (PBL) can bridge the gap between those fields. “Researching Empathy Through Staged Performance” was a master’s thesis project in the field of interaction design and consisted of an artistic performance titled “My Body, Your Room.” The live performance functioned as a site for conducting scientific research into corporeal empathy. The project investigates how embodied methodologies that combine dance performance and interactive technologies can strengthen empathic relationships between the audience, performer and the environment. “My Body, Your Room” was developed at the Design School Kolding (Denmark), and utilised cross-disciplinary theories, concepts and methods from interaction design, performance studies and neuroscience. The working methodology drew on artistic approaches and scientific research methods such as quantitative and qualitative analysis, including video documentation, ethnography, surveys and interviews.*

**Key Words:** PBL, Art and Science, Artistic and Academic Methodologies, Art and Technology, Interactive Art, Design Research, Interaction Design, Empathy, Interdisciplinary, Cross-disciplinary.

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## INTRODUCTION

This article evaluates the combination of artistic practice and scientific research in a project conducted at the Design School Kolding. The project was comprised of two parts: an artistic performance and an empirical study of corporal empathy between performers and audiences (Da Silva, 2015). I first introduce the motivation to utilize an artistic project as a research tool in interaction design, and then outline the goals of the project and describe how the performance came to function as a method for scientific research within a Problem Based Learning (PBL) framework. The motivation for conducting an academic research project through artistic practice was informed by previous training in PBL (I previously completed an undergraduate degree in Art and Technology from Aalborg University). I also have professional dance and theatre training, and throughout my university education I worked professionally in live performances. It was therefore natural and intuitive for me to introduce academic knowledge and methods into an artistic framework. Pursuing artistic practice concurrently with academic studies has opened my performance practice up to possibilities for combining artistic and academic methodologies. I deliberately chose to work with PBL methods in the development of “My Body, Your Room” in order to bridge the gap between these two approaches.

The main goal of the design research project was to conduct experimental research in an academic framework utilizing live performance to study human interactions and responses. Audiences and guest performers participated in the research: their inputs were used to re-think the design of the performance and enhance the empathic relationship between the audience and performer. This research took into consideration the aesthetics of communication in a performance setting as well as neurological approaches for building and enhancing human empathy. The working methodology drew on artistic approaches and scientific research methods such as quantitative and qualitative analysis. The analysis involved each element of the artwork, such as the volume and quality of sound, the intensity and behavior of lighting cues, and the organization of space and the choreography.

The goal of “My Body, Your Room” was to create and strengthen the empathic relationship between audience and performer by combining elements of a live dance performance and interactive art installation. Research in cognitive neuroscience has shown that the human mirror neuron system can be retrained through sensory motor experience (Shaughnessy, 2012 p. 47). Empathy refers to the cognitive and emotional processes that bind people together in various relationships that permit the sharing of experiences as well as an understanding of others (Eslinger, 1998; in Reynolds, 2012 p. 125). Empathy is the ability that humans have to understand and share the experiences and feelings of another person. When loved ones say “I feel your pain,” it is not just a figure of speech; they actually do feel pain as observed through

neural pain representations in their own brains (Riess, 2013). Empathy is central to human development: neurological studies suggest that students who are disengaged are more likely to drop out of school, while marriages without empathy are more likely to fail. The same studies suggest that patients who do not feel cared about have longer recovery times and poor immune function. Evidence supports the physiological benefits of empathic relationships, including better immune function, shorter post-surgery hospital stays, fewer asthma attacks, stronger placebo response, and shorter duration of colds (Riess, 2013). However, face-to-face interactions are increasingly mediated by smart phones, computers and other technological devices. When people come together in shared physical spaces, they often divide their attention between people who are physically present and electronic devices. In contemporary societies where people interact increasingly through devices, it is possible that that people will develop more intimate relationships to objects than to other human beings (Riess, 2013). A decline in empathy changes the way humans relate to one another. One example is the trend in cyber bullying: it is often easier to cause pain when humans do not directly observe the effects in others. Face-to-face human interaction is very important in our lives. The look in the eyes, the tone of voice and the body expressions affect the way humans perceive one another and are essential for meaningful conversation and bonding. However, if lost, empathy can be recovered or re-learned (Riess, 2013). Artists and designers concerned about the decline of empathy in the contemporary world can address this issue by facilitating experiences that promote social, empathic relationships.

***From Artistic Practice to Scientific Research – From “My Body, Your Room” to “Researching Empathy Through Staged Performance”***

The performance and installation “My Body, Your Room” began as an intuitive artwork, and later became a tool for scientific research. The term ‘intuitive’ here means the process of creating an artwork without prior research of a theme or conceptual design, where design research and abstract representations precede the realization of the art work. There were no brainstorming, explorative prototypes or sketches before the realization of the first version of the artwork “My Body, Your Room”: the work was generated by the artist from a basic project description, followed by the physical realization of the artwork and initial public showing. Intuition refers to the ability to understand something instinctively, without the need for conscious reasoning. Intuition is a method commonly used in artistic practice: many artists initiate artworks without much planning or previous intellectual consideration. Artists draw on intuition and inspiration as working methods, where inspiration is understood as the mental stimulation to do something creative. “My Body, Your Room” was designed for an arts festival, which solicited the artwork based on a brief project description. The artwork consisted of an audio-visual interactive art installation combined with a live, solo dance performance, where biometric signals from the body of the performer controlled the sound and the light effects in the room in real time. Using wearable technologies, the artist would transform the room into a networked space, where the performer’s heartbeat and breath would be amplified and create strong empathic bonds between the audience, the performer and the surrounding space. As an

artist, I was inspired by a desire to strengthen the audience-performer bonds through the use of digital technologies, such as sensors and actuators.

After the first performance of “My Body, Your Room” and obtaining informal feedback from audiences, I became curious about the potential of this artwork and possibilities for improvement. My aim to explore this work further coincided with the completion of my master’s thesis at the Design School Kolding (DK). The shift to an academic context gave rise to new questions, for example, how to turn a finished artwork into an academic design research? (The work had been developed and presented prior to the academic study). Another question was whether this artwork was “designerly” enough to be considered design research. Finally, I wondered which academic theories would validate this type of research project. Empathy had not yet emerged as a core theme of the project: the focus on empathy came about only after the analysis of potential themes and theories related to the artwork. Scientific theories and academic research methods were applied to both shape and validate the goals of this project. The PBL learning method further supported this academic inquiry.

One of the initial challenges was to define the multiple roles and responsibilities I had as the artist/performer separately from my role as researcher. It was necessary to define and understand each role, as the project expanded from an intuitive artistic practice into the field of scientific research. As the artist, I was responsible for the conceptual idea and realization of the artwork. As the performer, I was engaged in the physical act of training and performing in front of an audience. As a researcher, I was responsible for the research design, data collection and analytical framework. Each of these roles could be outsourced and simultaneously performed by a group of people, but being the only group member, I needed to shift among those roles according to each action. It was also relevant to define the artistic practice and the academic research to understand better each phase of this project. (See Figure 1)

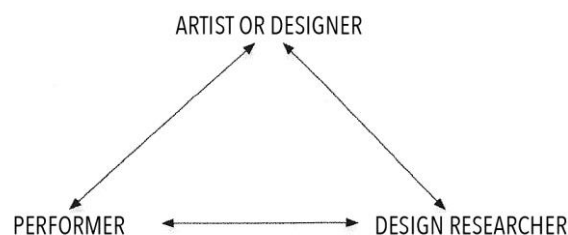


Figure 1: Model of potential roles in this project:

Performer (artistic practice): does the act of performing in front of an audience.

Artist or designer (artist practice): responsible for the concept development and realization of the artwork.

Researcher (academic research): applies the scientific theories and academic methods, analyzes the work and presents the outcomes.

The academic research methods and theories applied to this project served to organize, explore and analyze the phases of the project and the practical (experiments) and theoretical (written) works. The different aspects of the artwork, such as the space, sound, light and the performance were investigated and analyzed in order to find out how each aspect contributed to the audience experience. The types of communication and the levels of aesthetic interaction were considered and discussed in the completed master's thesis titled "Researching Empathy Through Staged Performance" (Da Silva, 2015). Empirical research can turn even very exploratory design into a research object (Koskinen, Zimmerman, Binder, Redström, and Wensveen, 2011). For design research, the experimental design is the result of designerly engagement with a possible form that can be appreciated and evaluated as design, or alternately as a deliberate attempt to question what users expect from the design (Brandt & Binder, 2007). In this project, design research was a way to formalize the involvement of the participants (guest performers and audiences) in the research outcome as well as in the re-design of the artwork. The outside participation helped me to rethink and better understand the potential of my artistic practice.

### **EDUCATIONAL METHODS AND CONCEPTS - PROBLEM-BASED LEARNING (PBL), PROJECT-BASED LEARNING AND DESIGN PROBLEM**

The 'Student Handbook of Academic Policies and Procedures' at the Design School Kolding states:

Based on artistic concepts, the design programme develops the student's capacity for aesthetics, innovative design and problem solving skills through approaches which alternate between concrete, materials-based projects and abstract theoretical assignments – approaches which qualify the students for positions where they have to solve concrete and theoretical as well as abstract design problems.

Developing a student's capacity for problem solving skills and solving concrete, theoretical, and abstract design problems are key principles for PBL. The concept of problem-orientation is strikingly similar to the definition of PBL, a learning method based on the principal of using problems as a starting point for learning (Barrows, 1984, cited in Kolmos, Fink, and Krogh, 2004 p.10). While the term 'problem-based' or PBL is not mentioned in the Student Handbook (nor was it referred to by professors and instructors at the school), the educational practice that utilizes project-based (or project-oriented) models for learning and research is well-documented. Furthermore, elsewhere in the Student Handbook it is written that "the programme encompasses Disciplines of methodology and theory; Project-oriented disciplines; Disciplines of communication and dissemination", which together reinforce the design school's emphasis on project-based educational models. Within the Danish context, it is important that PBL be understood as a combination of a problem-based and a project-organized approach (Kolmos et al, 2004). Even though the terms 'problem-based' or PBL are unfamiliar to many of the students

at Design School Kolding, students are accustomed to working with the concepts of ‘design problem’ and ‘project-oriented’ approaches, which correspond to the concepts of ‘problem-based’ and ‘project-based’ at Aalborg University. At Design School Kolding, all student projects begin with the articulation of a design problem by the students, and the learning is organized around the problems through research and experiments. A problem is the starting point for the learning process in PBL, as well as at Design School Kolding where students are required to define a ‘problem statement’ or ‘design problem’ in each synopsis of their projects. One might ask, “What is a design problem?” ~ Design School Kolding defines it thus:

The problem statement must be a distinctly formulated question. It must define the problem the student wants to solve from a user and a design professional standpoint, and it must be sufficiently specific as to appear realistic within the time frame of the project.

The definition of ‘problem’ in PBL is more complex and open for discussion, as a problem can be of many types, from a concrete, realistic problem to a theoretical problem. Problems also vary widely across professional areas and academic disciplines. Many PBL theorists have discussed the concept of problem and arrived at different definitions. Palle Qvist collected several definitions of problem. The most broad definition Qvist finds is the following: “Problem is a documented or argued anomaly, paradox, contrast or contradiction” [sic] (Qvist, 2004 p. 88). One should must consider that defining a problem in a design context at a design school is unique and cannot be synonymous or interchangeable with how problems are defined across academic disciplines or at other research universities.

### **COMBINING METHODS AND ASKING QUESTIONS - CONDUCTING DESIGN RESEARCH THROUGH ARTISTIC PRACTICE**

The Design School Kolding establishes the project-based learning as its educational method and requests students to define a problem statement or research question to initiate their research process. Students are required to write synopses of their projects, which need to be approved by the teacher and advisor before they can commence with their projects. Often the design methods are specific enough to help the students define what direction their process should take and the types of outcomes for the problem solving. The choice of methods, as well as the research question, is responsibility of the student, who has been introduced to a range of research methods. For my master’s thesis, I chose to combine two design research methods under the heading of project-based learning. The “Experimental Design Research” by Brandt and Binder (2007) and “Design Research Through Practice” by Koskinen et al. (2011) were the two academic methods that I drew on. The reason for combining these two is that they are complementary: Brandt and Binder (2007) emphasize the concepts of ‘Question, Program, and Experiment’ in experimental design research, while Koskinen et al. (2011) emphasize the concepts of ‘Lab, Field, and Showroom’, which are closely related to the physical design spaces

where designers work. On one hand, Koskinen offers a larger overview and a broader perspective on design research by defining areas of actuation of the designer, while Brandt and Binder's concepts speak more specifically to my project because they focus on experimental design research. Brandt and Binder also created a diagram that was easy to relate to my project: their method is based on the similarities of works by other experimental design researchers, through a collaborative workshop they made together. The core concepts of 'question', 'program' and 'experiment' helped me to define the phases of my research process. According to their concept definitions, the question (research questions) guides academic inquiry by exploring, while the program frames and contextualizes the experiment by proposing e.g. to stimulate creativity through the employment of particular methods and tools (Brandt & Binder 2007). The experiment is the interaction between the user and the research object. Their method, for being a circular method (see Figure 3.1), makes it possible to start the design research process from any phase of the project, from the experiment or from the question. The experiment can help the evaluation of what is to be expected from the design object. The experiment might involve user participation, surveys or questionnaires. Empirical research has the potential to turn even very explorative design into the research object (Koskinen et al., 2011), and designers increasingly engage their own capabilities as designers in research (Brandt and Binder 2007). To use a tested method based on the similarities found in previous works might reduce mistakes and offer new ideas for the types of outcomes that can be expected. Other designers let their research take shape from technological research, where completed design works are tested and evaluated as prototypical instances of a larger programmatic approach (Brandt & Binder 2007). To put a completed work in trial already suggests a question or some kind of explorative thoughts or inquiry: the researcher is already finding their position in the design process. Not having an initial question, the researcher starts their process with an empirical experiment around the object to be studied. The research object, for Koskinen et al., is the experiment object for Brandt and Binder. These two methods complement each other, while sometimes using different terms to describe the same concept. Design researchers do not want to make finished design for its own sake; they understand the design experiment as a means to explore a possible program. One way or another, the experiment produces knowledge about the research object and this knowledge is utilized to improve the research object and provide the user with an improved user experience. Design practice may involve research and design research may involve design (Brandt & Binder 2007). Design practice occurs when explorative design research brings new knowledge about the research object and its user, as well as the interaction between these two observed during the experiment.

The following diagram by Brandt and Binder shows the relation between the concepts of question, program and experiment, and the circularity of the method. A research project might start with the formulation of a broad research question, but a promising provisional experiment may allow for a more programmatic approach to emerge that could eventually shape a specific research question.

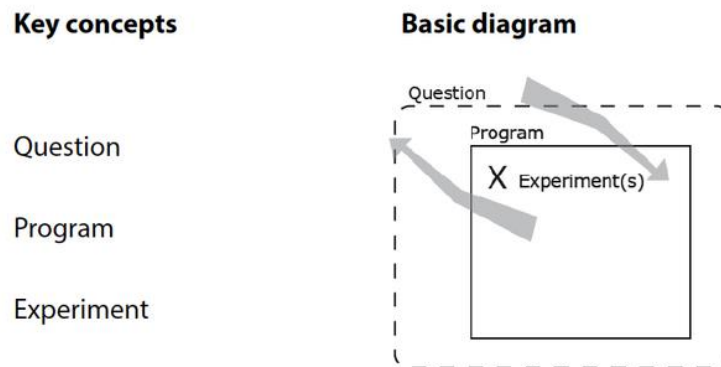


Figure 2: Experimental design research diagram by Brandt and Binder

Figure 2 illustrates the relation between program, questions and experiments in design research driven by designerly experiments. The research question guides the inquiry by exploring e.g. a concept like performativity, while frames and contextualizes the designerly experiment by proposing the possible (e.g. to stimulate creativity through the employment of particular methods and tools).

Kristina Niedderer illustrated in 2004 another representation of the experimental design methodology proposed by Brandt and Binder after participating in a collaborative workshop. Niedderer illustrated process (Figure 3) to show the relation between academic research and design practice. Here, it is possible to anticipate the types of outcomes that may occur from the different phases of this process. From the ‘design practice’ towards the ‘academic research’, the outcome consists of data or evidence. This data can then be used to define a research question or generate new questions during the academic research phase, as well as confirming possible evidence or generating new ones. The experiment on the first diagram (Figure 2) is renamed as ‘design practice’ on Niedderer’s diagram (Figure 3), where design practice is located where the experiment happens and defined as that which generates data or evidence. Academic research, on this diagram, generates knowledge and leads the researcher to a new design practice, another experiment, while keeping the circularity of the first diagram. The program is the intermediary phase between the question and the experiment where knowledge and data are generated.



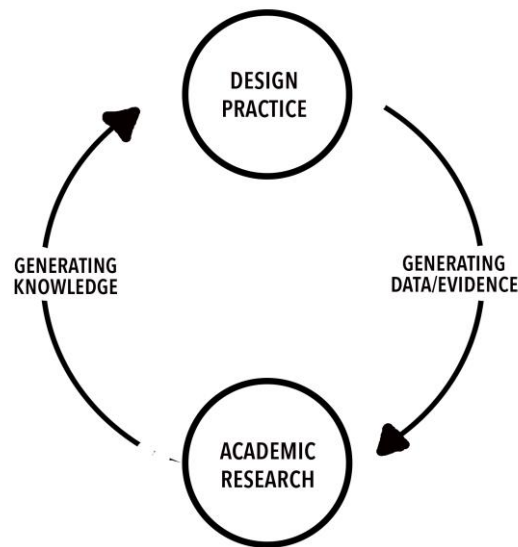


Figure 3: Experimental Design Research Method

Koskinen helps define research areas through the concepts of laboratory (lab), field, and showroom. The laboratory is a controlled area, where the researcher manipulates the object of interest in order to learn how people interact to it; ideally after the researcher has generated a hypothesis. A hypothesis is an explanation based on theory; it is researchers' best guess about how the function works before they do a study (Koskinen, 2011). Field researchers do not bring the research object to the lab, rather they go out to the natural settings where the research object is regularly used or observed. Field research has stronger ties to ethnographic approaches than empirical studies. Showroom researchers are more concerned with creating critical design and art. Recent work has explored biotechnology, robotics and nanotechnology. By building on science, critical design can look at the distant future rather than technology, which has a far shorter future horizon (Koskinen et al., 2011).

### **FROM THEORY TO PRACTICE – EMPATHY IN MEDICINE, EMPATHY IN ART**

This section explains how empathy became the main research theme, and introduces a novel approach for studying methods to enhance empathic relationships in live performance. After the first public performance of “My Body, Your Room”, I solicited informal feedback from audiences about their experiences and responses. Many said the use of technology made them feel more connected to the performer during the performance. The words ‘empathic’ or ‘empathy’ were not used by any of the study participants in those initial feedback sessions. Audiences responses indicated a strong bond between them and the performer:

“The performance was fragile in some way, so I was cheering for him at all time, but I don’t know why.”

“The performer breathing and pulse were so strong. It was a very emotional performance for me.”

I became interested in understanding the relationship between empathy and audience’s emotional reactions to an aesthetic experience. I found evidence that having access to some physiological data can actually enhance empathic relationships among people. I was inspired by Helen Riess’ discussion of “The Power of Empathy” (2013). Riess, a psychiatrist at Harvard Medical School, describes an experiment where a doctor and patient were attached to a heart rate monitor through a skin conductance sensor in order to find out if their physiological tracers would match up over time. Using measurements of heart rate and skin conductance, studies suggest that patients and doctor are highly reactive to one another and produce varying physiological responses that are either in concordance or discordance. The highest correlation between affect intensity and degree of skin conductance activity (Riess, 2010). The same experiment was repeated with twenty doctor-patient pairs. Riess (2013) says that the experiment changed her life, because she began to regard physiological data displayed on a computer in new ways: there exists the potential for doctor’s to observe useful information about the patient’s problem and that might positively impact treatment.

I found similarities between the doctor-patient experiences described by Riess and the experience performer-audience in the performance “My Body, Your Room” described above on this section. The following illustrations (Figures 4.1 to 4.4) aim to compare and explain the similarities between the two different situations and point out where the gains in the level of empathy might be had.

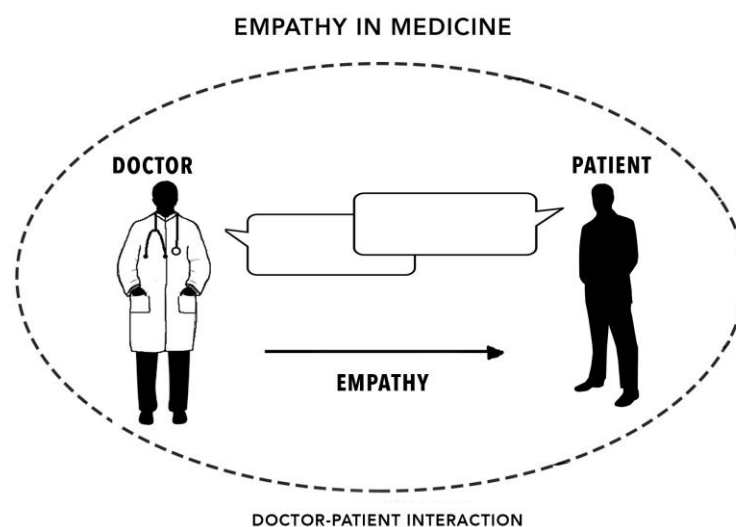


Figure 4.1.: Empathy in medicine without the physiological data displayed on the electronic device – LOW EMPATHY

Figure 4.1 illustrates a traditional doctor-patient meeting situation, in which the patient tells the doctor what he/she is feeling and the doctor tries to understand and to find relevant information to the patient the best possible treatment. In this example, the doctor empathizes with the patient, but in comparison to the next example (Figure 4.2), the level of empathy is lower. In Riess' example, the patient appeared calm and sounded confident to doctor, who only later found out that the patient was suffering from anxiety. This discovery of patient's anxiety was discovered through the use of sensors and physiological data displayed on an electronic device.

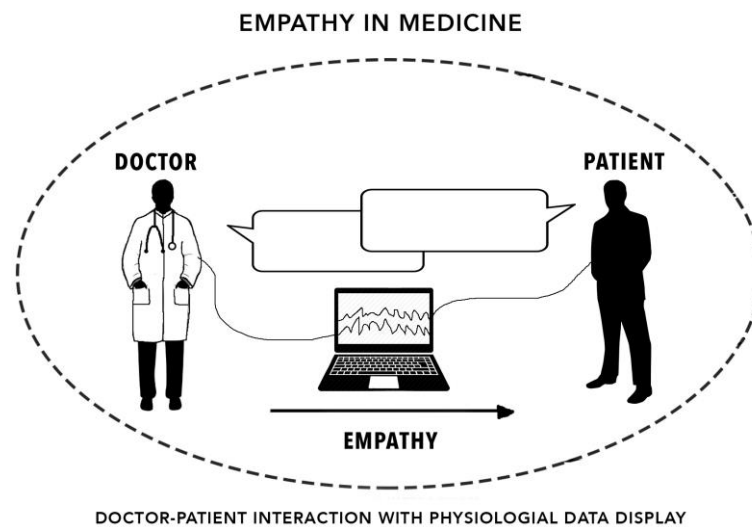


Figure 4.2: Empathy in medicine with the physiological data displayed on the electronic device – HIGH EMPATHY

Figure 4.2 represents the doctor-patient experiment, where the doctor repeats the same procedure as in (4.1), but here the doctor and patient are attached to a skin conductance sensor that displays whether or not the two are in synch with their physiological responses. Only after doing this experiment, the doctor became aware of the signs of anxiety disorder the patient had, but were not decipherable through their previous conversations. The physiological visual data on the display brought to the doctor information that made her more empathic toward the patient and helped the doctor to treat the patient better. This experience also helped the doctor to understand that some physiological aspects and patient behavior are not always legible. The help of the electronic devices in this setting can benefit the medical experience for both doctors and patients.

Applying this line of reasoning to performance, Figure 4.3 represents a traditional solo dance performance where the performer dances in front of an audience. The sources of light and sound in this performance come from electronic devices placed in the room. The light and the sound are pre-programmed to provide the performer and audience with the relevant atmosphere and

ideal viewing conditions. These devices are not interactive<sup>1</sup> and therefore are not represented on this illustration. In this setting, the sound and light do not correspond to any aspect of the live performance or the embodiment of the performer.

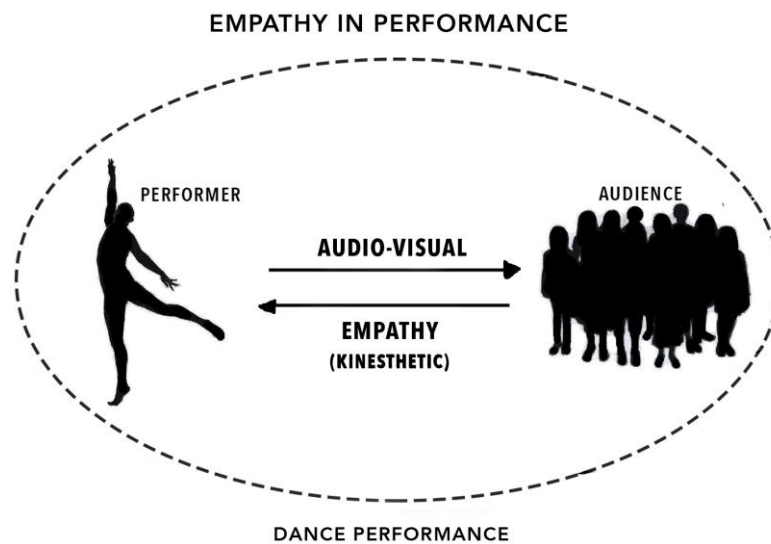


Figure 4.3: Empathy in staged performance without the interactive art installation – LOW EMPATHY (?)

In 4.3, the performer dances for the audience and expects to establish an empathic relationship with the audience through narrative and choreographic devices. There are no ways to measure empathy levels in this setting, but given the similarities with the doctor-patient relationship represented with the Figure 4.1, we could speculate that the level of empathy would be lower when compared with an audience with access to visual representations of physiological data, as in the doctor-patient example (Figure 4.2).

<sup>1</sup> The term 'real-time interactive' means to be responsive to the person (the performer in this context) in moment he is acting (performing).

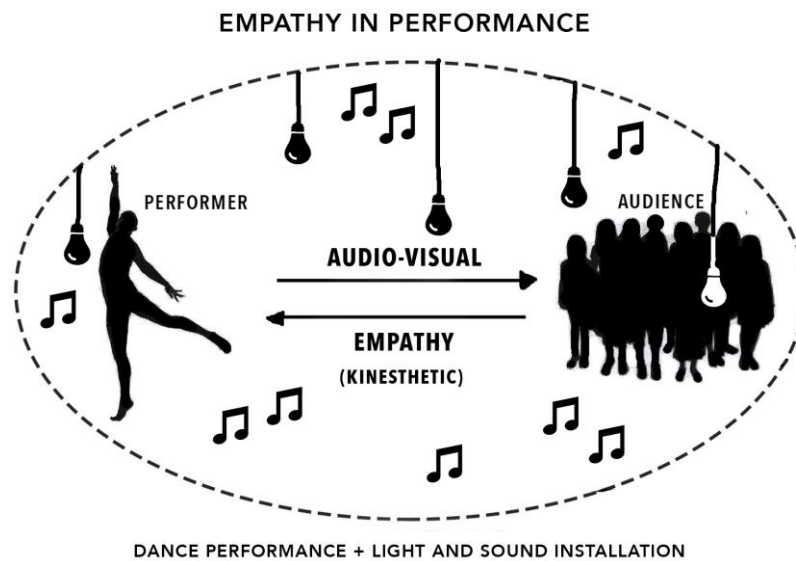


Figure 4.4: Empathy in performance with the interactive art installation – HIGH EMPATHY (?)

Figure 4.4 represents the performer-audience experience within the artwork “My Body, Your Room.” In this situation, the performer uses a heart rate sensor and a wireless microphone attached to his body. The lighting cues and the soundtrack react and in some cases correspond to the performer’s increasing heart rate and complete the audio-visual atmosphere of the performance. The sound of the dancer’s breath and heartbeat, which are amplified and played back, fill the room. The lights blink in concert with the performer’s heart rate. This combination of sounds and the light blinking creates audio-visual data that reflects the evolving physiological dimensions of the performer. Different from the doctor-patient experience, only the performer uses sensors here. Therefore, concordance of physiological responses for performer-audience pairs is impossible to see in this set up. Both the performer and the audience experience the audio-visual responses from the performer. In the doctor-patient experience (Figure 4.2), their physiological visual data were displayed on a computer, while in the performance set up (Figure 4.4) the entire room becomes the audio-visual representation of the performer’s physiological responses. In Riess’ experiments, visual data made the doctor more empathic toward the patient. My hypothesis was that the aesthetic experience of audio-visual data controlled by the physiological inputs from the live performer would make the audience more empathic toward the performer.

Comparing the experimental setup of doctor-patient trials and my own performer-audience investigations invite some similarities in terms of settings and in effects. Both cases are

instances of both human-human interaction (HHI)<sup>2</sup> and human-computer interaction (HCI)<sup>3</sup>. In the first doctor-patient example, (Figure 4.1) there is only the human-human interaction, as is true for the first example of the performer-audience (Figure 4.3). In the second example, the doctor-patient (Figure 4.2) and the performer-audience (Figure 4.4), both constitute human-human interaction and human-computer interaction. Considering the second example of the doctor-patient experience (Figure 4.2), in which the HCI strengthens the empathic relationship between doctor and patient, we can deduce that in the second instance, the HCI will strengthen the empathic relationship between the audience and the performer.

## RESULTS OF THE EXPERIMENTS

The research experiment happened in a field context<sup>4</sup> as part of the Sol Festival<sup>5</sup> in northern Denmark. Six performances of “My Body, Your Room” occurred over six days during the festival (20<sup>th</sup> through 28<sup>th</sup> March 2015). Each performance lasted approximately twenty-five minutes. I performed for four of the six performances, while two guest performers were invited and performed one time each. The guest performers were interviewed following the performances about their experience. From the audience, 140 study participants answered questionnaires from all six shows. The questionnaires consisted of a paper-based survey with 35 multiple choice questions using a five point Likert scale ranging from “Totally disagree” to “Totally agree”, and two open-ended questions.

The main research question centers on using technological interfaces to enhance empathic relationships in artistic settings. Combining artistic and academic methodologies led to other interesting findings and knowledge: one of the most challenging issues was devising a tool for measuring empathy in an artistic context. Theoretically, one could set up a control condition for comparison, but this was not possible given the performance context. Furthermore, measuring empathy levels using self-reporting can be difficult. In the existing literature, scientific approaches (such as those by Riess) served as a guideline for my artistic practice and research design in parallel with the performer-audience in order to approach how to study empathy. Although there are fundamental differences in contexts and dynamics, the comparison between doctor/patient and performer/audience relation to empathy was productive for thinking how to introduce sensing technologies to enhance or promote empathy. However, whereas neuroscience can use sensors on both doctor and patient, this method is difficult in a live performance context. Therefore, I chose to use more subjective measurements of empathy (self-reporting). As there was no control group, it was not possible to conduct a comparison of audience members for “My Body, Your Room.” The empirical approach used questionnaires and from the audience and guest performers. The results indicate that the technological aspects of the

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<sup>2</sup> Human-human interaction (HHI) is when a person interacts with another person and one affects the experience of the other.

<sup>3</sup> Human-computer interaction (HCI) is when a person interacts with a computer system and one affects the other.

<sup>4</sup> The term ‘field’ here is the one of Koskinen (mentioned in the section 2.1 of this thesis) and it means the experiment happened in its natural setting, not in a lab.

<sup>5</sup> Sol Festival is a light festival that happens in the city of Aalborg, Denmark. <http://solfestival.dk>

artwork enhance the experience of both the performer and the audience, but by how much is impossible to say. In interviews, the guest performers indicated that they were affected by augmented sensing tools, which enhanced their physiological self-awareness as performers. The experience for the guest performers was a cyclical system: the artists feed the installation and are in turn fed by it. The performance was not entirely pre-determined, but rather supported the creative expression and elaboration of real time emotions and physical effort, augmented by the technological tools. Audiences could relate to those emotions and react to them empathically. Throughout the performance, the audience could see each other: this was an important feature of the circular seating and staging. Everyone in this performance setting was either directly or indirectly interacting with others. While live dance performance alone is able to establish empathic relationships, this research explored the potential of technological tools and design solutions to enhance empathy between people in artistic contexts.

## CONCLUSION

The Design School Kolding is a problem-based and project-based educational institution, where PBL principles similar to those used at Aalborg University are employed. Both institutions use a combination of problem-based and project-organized approaches, where the problem is a starting point for the learning process. In design school, the definition of a problem is more specific, while the diverse faculties and fields of study at the university allow for more diverse approaches to different types of problems. “Researching Empathy Through Staged Performance” is an instance of a problem-based and project-based approach to learning and academic research. The project combined artistic practice with academic methods, and involved cross-disciplinary studies and scientific theories. Academic methods helped inform the artistic practice, and vice-versa. Through an empirical approach, the work explored the challenges and potential of working between the fields of art and design, artistic research and academic research. Whereas artistic practice can be intuitive and explorative, design practice requires methods to ensure the functionality of the design product, and scientific research requires robust methods that are not always suited for artistic settings. The PBL environment facilitated the research design process and supported the complexity of the empirical study. The PBL environment is conducive to working with cross-disciplinary approaches within an academic framework, while focusing on the main question related to art, technology and design.

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