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Integrating Academic and Artistic Methodologies within a PBL Environment

Falk Heinrich and Elizabeth Jochum *

INTRODUCTION

The combination of artistic practice with scientific inquiry has a long tradition that dates back to Ancient Greece. Despite a long and rich history, there are surprisingly few established models for combining academic and artistic methodologies in higher education. In the past decades, institutions of higher education have highlighted interdisciplinary efforts that bridge art and science. The ongoing interest in combining art with science can be seen in the numerous academic conferences (such as SIGGRAPH and ISEA) that bring together academics, artists and technologists working at the intersection of art, science and technology. The popularity of high-profile festivals and cultural summits such as SXSW (South by Southwest), Ars Electronica, and CYFEST are instrumental in raising awareness of the relevance of art and science collaborations for mainstream audiences. The STEAM (Science, Technology, Engineering, Arts and Math) movement, pioneered by Rhode Island School of Design, was an early effort to address interdisciplinary approaches by placing art and design at the center of STEM teaching in primary, secondary and tertiary education. Despite the widespread adoption of STEAM by universities and institutions of higher education, there is no clear methodology for how to approach the ever-emergent, always-becoming interdisciplinary field of art and science. This lack has implications for higher education and programs that will train the next generation of creative technologists and interdisciplinary researchers.

Stephen Jay Gould observed that although “the sciences and humanities, by the basic logics of their disparate enterprises, do different things, each equally essential to human wholeness,” both science and humanities can—and should—interact for the benefit of humans and societies, Gould, Stephen Jay (*The Hedgehog, The Fox, and the Magister’s Pox*. p. 5). Simply because they do different things, we need not consider science and humanities as separate enterprises. In this special issue, we echo Gould’s call for unity and expand it to include the arts. Specifically, we focus on the framework of artistic and academic methodologies as one possible avenue for discovering common ground and forging new alliances. Within the topic of art and

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* Falk Heinrich, Department of Communication and Psychology, Aalborg University, Denmark.
Email: falk@hum.aau.dk
Elizabeth Jochum, Department of Communication and Psychology, Aalborg University, Denmark.
Email: jochum@hum.aau.dk

science, subfields such as art and technology, bioart, interactive art, robotic art, and media art entail both methodological and epistemological shifts. In the post-digital, post-human, and Internet of Things era, artists frequently seek out exchange and collaboration with scientific partners. Scientists, too, incorporate artists or artistic dimensions into their methods and practices. Several high profile research institutions have adopted the artist-in-the-laboratory framework, including CERN, Ars Electronica Future Lab, Symbiotica, and HEXAGRAM Research Institute to name only a few. While the goals and logics of art and science are not necessarily aligned, there is mutual recognition within the academy to move beyond disciplinary boundaries to uncover new ways of working and arrive at fresh perspectives on research.

Recently, various educational programs have surfaced that aim to integrate artistic and academic methodologies. These educational programs take up the challenge of training students in both artistic and academic approaches with the hope that students trained in these practices will be more adept at navigating the world of research and industry, which increasingly require skills such as creativity, flexible thinking, collaboration and adaptability. On an epistemological level, this approach envisions the integration of concrete, affective, imaginary and abstract, model-driven reception, thinking and production. Problem-based learning (PBL) and research environments are particularly conducive to exploring the potential of artistic methods and integrating them into university pedagogy. This special issue focuses explicitly on novel pedagogical frameworks that combine artistic and academic methodologies within a PBL framework. We sought submissions from a broad range of disciplines across the arts, sciences, and humanities to understand how researchers and educators integrate artistic and academic methods especially – but not exclusively – within PBL environments. Bruun-Jespersen’s article makes clear that Aalborg University is one of the pioneers for PBL in higher education. At the same time, the range of submissions included in this issue speak to the frequency and relevance of project/problem-oriented learning in higher education worldwide. We are delighted to include submissions from Parsons Design, Stanford University and Kolding School of Design. Also, the broad range of subject fields included here also demonstrates that art and science research ventures are not limited to the visual arts, but extend to the fields of design, architecture and dance. Looking across these projects and their novel frameworks, some key questions emerge:

- How can we envision an integration of academic and artistic methods that fosters an innovative methodology?

- How are artistic and academic methodologies defined historically, and which perspectives and discourses support their integration?

- In what ways to artistic methodologies supplement, broaden, or work against the tenets of the PBL approach?

- Does PBL have a theoretical base through which we might conceptualize the integration of artistic and academic methodologies, for example, by allowing for different degrees or modes of integration?

- What are the challenges or trade-offs of combining artistic and academic methodologies? What is gained and what is lost when we move across disciplinary and formal boundaries?

- How can the integration of artistic and academic methods be realized in concrete teaching practices within an PBL environment?

Each of the essays in this special issue engage directly with these questions, and in doing so, help uncover points of convergence and connection, indicating paths forward that might lead to a substantive reshaping or rethinking of the role of the arts and artistic methods within an academic framework. The articles cover a wide range of subjects and fields, and it is interesting to see how they each approach the above questions from unique perspectives. It is also revealing to see what challenges are shared – from university to design schools to art programs. Each of the articles approach the possible integration of artistic and academic methods from within their own field of practice, either the educational field or the field of research. Line Bruun Jespersen reflects on the importance of problem formulation that can cater for artistic solution finding approaches. Connie Svabo and Michael Shanks elaborate on the term and practice of *scholartistery* (first coined by Lewis and Tulk) both in academic terms and as fiction. Alexsandro Da Silva's article approaches the topic from the perspective of a graduate student project conducting artistic research; he presents a novel project that demonstrates how a dance performance can be framed as an artistic research project within a PBL framework. Focusing on pedagogical practice, Ellen Pearlman examines the role of the instructor to facilitate collaborative team work in a new course on the emergent field of cyborg art. Isak Worre Foged presents a novel architectural design method he applied in several educational projects at Aalborg University that involve the strategic implementation of sequential primary generators. Falk Heinrich elaborates on the theoretical possibilities of the integration of academic and artistic methods by re-thinking of Koestler's concept of bisociation on the basis of an interdisciplinary workshop for students of two different programs.

One major theme that cuts across all of these contributions is the artistic problem: is there a need to define an (artistic) problem, or does problematization hinder the artistic unfolding of intuition and ideas? If the formulation of a problem is at the core of PBL, how should an artistic problem be formulated? Jespersen considers this question most directly from perspective of the Art and Technology bachelor curriculum at Aalborg University. How a problem is defined within the framework of PBL fundamentally shapes the possibilities for research outcomes. On the other hand, Pearlman observes that creative practice does not typically begin with a problem, but a 'messy situation.' Both authors' views on the nature and role of the artistic problem contrast with da Silva's understanding of creative/artistic practice as intuitive, and thus orthogonal to the problem-oriented nature of design practice. Foged makes a further distinction between problem-based and solution-driven procedures, but underlines the productive dependency between those two attitudes contending that architectural design processes are co-evolutionary process. However, Foged elaborates on the significance of primary generators (self-imposed, subjective value-judgments) that propel the design process. Foged sees these generators as integral to the creative-artistic aspect of design processes.

Another topic that emerges is the role that group work plays in integrating artistic and academic methodologies. Collaborative group work is a hallmark of PBL method, but the group dynamic plays out in myriad ways. Even the solo artistic research/performance project described in da Silva's essay utilises group dynamics by involving other performers into the research process. Pearlman offers another approach to group work: working within the same general theme, groups are each assigned a unique, defined problem. Jespersen also notes the advantage of group work, which affords opportunities for critical reflection-in-practice. Because students are required to communicate and collaborate in groups, they develop critical communication and reflection skills that require them to talk amongst each other about their work, discussing the results with their peers and supervisor. Heinrich uses the case of interdisciplinary group work to elaborate and concretize the workings of bisociation of artistic and academic matrices and codes, switching from Koestler's conception of individual creation to collaborative creation. Group work affords an iterative learning process, where students continually look back at the initial project proposal and reflect on their efforts through discussion, evaluation and contextualization, and also brings different matrices of thinking and perceiving into creative interplay.

Each of the contributions indicate the role and function of artistic methods as opening, freeing and sometimes disruptive to normative academic methodologies. Heinrich defines artistic approaches as fictionalizations or irrealisations of the problem at hand in order to allow for associations that do not explicitly follow academic reasoning and can therefore open up problem fields and postpone solution finding. Ultimately, this could lead to complex correlations between academic abstractions and associative-emotional experiences that widen the notion of knowledge. Svabo and Shanks explicitly single out the fictionalizing character of artistic methods by exemplifying their concept in form of a fictitious text about a guided exhibition tour. Here, they explain that artistic problem-based work does not necessarily start with a problem definition and its possible solutions, but with chosen pedagogical frameworks that support the "aesthetic, evocative, and imaginative" elaboration of the problem field. Pearlman reminds us that combining artistic and academic methods are not always seamless process: she discusses openly how students struggled with the sometimes "disruptive process of creative inquiry." The use of ANT is interesting here in light of how technological tools can facilitate and open up new spaces for integration: technology is both the subject of inquiry and also central to the process of integration.

Institutes of higher education that adopt flexible methods and approaches can introduce interdisciplinary thinking at the ground level of learning, teaching and research. The articles in this issue demonstrate how artistic methodologies can broaden the notion of knowledge and redefine pedagogical approaches across the fields of art, sciences and humanities. We can look within this special issue for approaches that reconsider dominant models in higher education and the introduction of flexible and durable strategies for bridging the art and science divide.

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Problem Orientation in Art and Technology

Line Marie Bruun Jespersen *

ABSTRACT

Art and Technology is an interdisciplinary art program at AAU that involves knowledge and methods ranging from the humanities, to engineering sciences. Art and Technology is a hybrid program that combines science and technology with the artistic imagination, and thus combines both artistic and academic methodologies. The main question this paper addresses is: "What is a problem in art?" The paper discusses what defines a problem as in the PBL Aalborg Model, in the field of Art and Technology, by analysing the problem formulations of the 2017 BA projects through Mogens Pahuus three types of problem orientation. The paper discusses the potentials and pitfalls of PBL in art and technology education.

THE PROBLEM IN PBL AND IN THE AALBORG MODEL OF PROBLEM-BASED LEARNING

The BA study programme Art and Technology is an interdisciplinary study program at Aalborg University (AAU). The study program involves knowledge, methods and theories related to both fine art as well as academic disciplines ranging from the humanities; visual studies, media studies and art history, to engineering sciences such as media technology. The myriad of theories and methods, relevant to the combined field of art and technology illustrates the hybrid nature and complexity of the study program as it combines science and technology with the artistic imagination, and thus combines both artistic and academic methodologies. In addition to the interdisciplinary and hybrid nature of the study program, the educational activities at AAU must be structured as Problem-Based Learning, as AAU has implemented the Aalborg Model for Problem-Based Learning as a pedagogical strategy in all parts of the university and as an institutional trademark.

* Line Marie Bruun Jespersen, Department of Communication and Psychology, Aalborg University, Denmark. Email: linebruun@hum.aau.dk

The purpose of the paper is to relate the cross-disciplinary study programme Art and Technology to the PBL pedagogy. The overarching question the paper is addressing is: What is a problem in Art and Technology, investigated through the following sub-questions:

- How does the Aalborg Model for PBL support learning in hybrid study programmes such as Art and Technology, and in what ways does the pedagogical model challenge the students and staff, working in the field?
- How can problem-based learning support learning a curriculum that includes an element of fine art?
- How can an art-and-technology problem be defined?

The papers contribution can be understood as part in an on-going discussion about art schools of the future. ELIA, European League of Institutes of the Arts, identify the main themes of the contemporary pedagogical discussions in relation to art education in this way: *”In recent years, the future of higher arts education has been hotly debated in publications, conferences and reflections. Art schools are changing, pedagogies are being reconsidered, the dominant models and ideals of higher arts education are subject to fundamental critique. This current crisis (if it is a crisis) creates a real or utopian space for new teaching standards, new ways of teaching art, new forms of belonging to a context, alternative institutional relationships, experimental projects, research, and new definitions of artistic success”.*

As a relatively young study programme that was established in 2008, Art and Technology is a result of precisely this kind of interest in new ways of teaching art. Historically higher art education in Denmark has been conducted in art academies and not in university settings. Higher art education has focused on fine art as a free and autonomous voice in culture, following the French “le Beaux Arts” tradition, based on a master and apprentice approach to learning and governed by other ideals and standards than the universities. In a Danish context, artistic practise as part of a university degree program is an example of such an ”alternative institutional relationship” as described by ELIA.

The main question: What is a problem in art and technology, is relevant in terms of pedagogical decision making, so the conditions for student learning become effective and optimal. But the paper has a double focus in relation to the definition of an “art-and-technology problem”: a pedagogical focus that deals with the identification of a problem field done by the teaching staff when planning the learning activities. The study regulation defines the overall organization of the curriculum and provides a framework for the coordinators of the semesters to operate within. The semester coordinators develop a more specific, thematic framework for the semester projects based on the study regulation, which is presented to the students.

Finally the students must identify a problem of interest and make their specific problem formulation, within said framework. The students´ respond to the problem field, in the form of their problem formulations for their project work. Examples of the student´s problem formulations are included as illustrations of what types of problems the projects of the education typically focus on.

PROBLEM-BASED PROJECT WORK IN ART AND TECHNOLOGY

The project work in the Art and Technology study programme must be executed under the overall framework of The Aalborg Model of Problem-Based Learning. The model consists of five main principles that are formulated as guiding principles for the whole university, so they are formulated in a way that leaves room for the different faculties and their scientific traditions to find the most suitable approach for the specific study. The five principles of the Aalborg Model for Problem-Based Learning are:

- *Project organisation creates the framework of problem-based learning*
- *Courses support the project work*
- *Cooperation is a driving force in problem-based project work: students work together in groups in the projects*
- *The problem-based project work of the groups must be exemplary*
- *The students are responsible for their own learning achievements*

The "rule" that the problem must be exemplary is significant in this context, as it is the only indication of what constitute a problem within the Aalborg Model. The exemplarity of the problem means that the knowledge the students acquire during the project, will be transferable to other situations the student will encounter in her or his future work life and that the knowledge and competences obtained from the project work, must be useful in other contexts too. This principle emphasizes the problem as a point of departure and the problems foundational position in the Aalborg Model. Since the problem is the basis of the learning process, it determines the direction of the project work and thereby also the learning. Therefor the nature and characteristics of the problem is important as well as the process that leads to the choice of the problem. A PBL-process begins with an identified problem, but the definition the problem depends on the scientific traditions and methods of the subjects that are studied and their scientific traditions. The definition of a relevant problem will always be up for discussion and negotiation. The world is in constant change and flux, so what is perceived as problems will also change, and be dependent on worldview and point of view. In this sense, the focus on a problem in the learning process means that the learning content is related to a wider context, which might be a very concrete societal context or a more principal theoretical or hypothetical context that needs investigation. In studies directly aimed at well-defined professions, such as law or medicine, the problem most often has the form of casework. Trine Schultz describes how casework is used to teach the legal method, from a legally dogmatic perspective in a social work study programme. She states that solving legal issues is ”not subject to the same freedom of choice as method and solution options”, while the definitions of problems in hybrid study programs such as art and technology are broader as it depends on which scientific traditions the project is unfolding within and leaves room for students to identify a problem within this larger “field”. Palle Quist presents various definitions of a problem at the different faculties at Aalborg University in his article “*Defining the Problem in Problem-Based Learning*” from 2004. Quist looks at the definitions that guides the PBL approach at the Humanities, Engineering and Natural Science and Social Science at Aalborg University, and finds significant variations. In social science, the problem is defined as an anomaly, which can be either a theoretical or a scientific problem. In engineering sciences a problem is ”*known and experienced as a conflict, a contrast, a need or a wish of those who are working with it*” and in the humanities a problem is a ”*phenomenon, which creates a curiosity or a qualified curiosity (wonder). The phenomenon can be an anomaly*.” What constitutes a problem in engineering sciences tend to favour problems which are closely connected to professional situations and experiences, so the problems reflect actual problems that make the practitioners identify a need for a (new) solution. In social sciences and the humanities the problem is described as an anomaly. The scientist or the practitioner identifies an inexplicable result or situation, which cannot be explained with the existing knowledge. The observed anomaly initiates curiosity or wonder that motivates and drives the research towards new understandings. These definitions leave room for theoretical and abstract problems. When working problem-oriented the project will often be cross/trans/interdisciplinary, because most problems will generate and present complex patterns of questions. The observed problems identified in society/in work practices/in theory will most likely involve theory and methods from more than one scientific tradition in their solutions. So the Aalborg PBL Model is implemented on the different faculties and on the different study programmes, in ways that match their profile. But for hybrid study programs, that span different scientific fields, there are no established traditions to follow, which makes the implementation of the PBL approach in the study programmes a significant marker of the profile and identity of the study program. In this paper, the Art and Technology programme will serve as an illustration of this nexus.

The hybridity in the study program means that the students get double qualifications. They must develop professional and cross-disciplinary competencies, including competencies of learning and cooperation. The pedagogical challenge is to teach the students to be both creative, analytical and have technical abilities without letting one aspect getting in the way of the other, and make sure that all three aspects contribute in a meaningful way to the project. The concept of practice is an essential part of the Aalborg Model for Problem-Based Learning, as the project work aims at having clear connections to the practises on the job market outside the institution, both during the educations as collaboration with external partners on student projects, but also due to the demand of exemplarity of the problems. The learning ideal draws on David A. Kolbs concepts of experimental Learning and Donald Schöns idea of the reflective practitioner. Problem-based project work facilitates an experience-based learning cycle, as the learning happen through the activities in the project: experiences, reflection, knowledge production that can result in new experiments and experiences, are key parts of a project process. During the project the students are reflecting-in-action, as they are working actively on the different aspects and phases of the project: in the ideation phase, in the design phase, etc. The group work in the Aalborg PBL model support the reflecting-in-action, since the students are forced to communicate and collaborate on the project. Group work makes verbalization and argumentation a continuous requirement as the group members need to able to talk about their work, and discuss the results with their peers and supervisor. In the report the students are reflecting-on-action, in Schön´s terms. They are looking back at their artistic proposal and the process that lead to the end result, and reflect on their efforts through discussion, evaluation and contextualizing the project, informed by the methods, theories, analysis´ they employed in the project.

BA IN ART AND TECHNOLOGY AT AALBORG UNIVERSITY

In hybrid study programs the sources of problems can be found within different traditions, so the ”playing field” is large and complex for the students to navigate in. The pedagogical task is even more complex in study programs where an artistic output and training in artistic methods are yet another part of the curriculum. In the case of the BA in Art and Technology at AAU, each student project is the result of a double investigation into an “art-and-technology problem”. The first investigation is done by the semester coordinator(s), who identify and describe a problem field that match the learning goals in the study regulations. As mentioned above, the problem must be exemplary so that the learning outcome in terms of content and approach are transferable to similar situations the student might encounter later in their work life. The identification of a problem field by staff helps keeping the student projects within the scope of exemplary problems, and it makes it possible to offer courses that align well with the proposed problem field. The students are presented with the problem field, and they do the second investigation into the “art-and-technology problem” in their project groups, as they utilize knowledge about the problem field to identify a more specific problem for them to explore, address and give form in their artistic project.

Each of the six semesters of the BA in Art and Technology curriculum consist of a project module and a series of courses. All project modules have a thematic headline, which indicates the variation and breadth of themes in the curriculum and has a horizontal organisation, where each semester introduces new themes. The themes are, however, structured with increasing complexity to secure progression. The first year of study the curriculum focus on sculpture and installations, then move on to dynamic systems in art and a stronger focus on interaction in the second year and in the third year the main themes are narrativity and creation of experiences. The deliverables for each project module are an artistic project and an academic report about the project. This means, that every semester the students develop an artistic project or product; an artistic *proposal,* as the response to the initial problem. The evaluation of the artistic product relies on the problem formulation, the cohesion between the problem formulation and the proposal, the reasoning and the choices made during the ideation and realization process, and the account thereof in the project report. Thus the report serves several purposes. It communicates and documents all phases of the project and by putting forward all choices and results, the report serves as documentation of academic skills and requirements. The report also gives the students an opportunity to evaluate their artistic proposal, to contextualize their work and to demonstrate more detailed knowledge of the contexts the artistic project addresses and refer to

The study program focuses on the interplay and overlaps between art and technology. The domains of art and the sciences associated with technology belong to two different knowledge systems or paradigms. While technical sciences are dominated by the positivist traditions within the natural sciences, the domain of contemporary art is sprawling in many directions and also linked to the human and social sciences. Similarly, artists are not scientists, but operate with other forms of knowledge production, than in academic traditions. Art and Technology shares this kind of hybrid identity with other interdisciplinary programs that involve designing/constructing components. Within the AAU, e.g. the engineering program with a specialization in architecture, where the scientific paradigm account for many parts of a project, and scientific ideals of truth determine whether any given task is solved in the right way, but at some point in an architecture or Art and Technology project, science is not enough and can not stand alone, as Lars Botin puts it: ”*at some point in the design process art, aesthetics, faith and convictions will take over, and it does not make sense to talk about these aspects of the educations as science, but as kinds of knowledge production”*. The question of how to implement the “Aalborg Model” in the creative/artistic educations at AAU, has been discussed and exemplified in a number of research papers that primarily focus on the study programmes within architecture and design at AAU, that highlight the need for attention towards the development of an artistic skill set in the individual student, and the role of talent and artistic identity that inevitably are parts of the professional identity the students of these subjects have to establish.

ART AND TECHNOLOGY PROBLEM FORMULATIONS: THE STUDENTS´ CHOICES OF PROBLEMS

In the study regulations, the theme of the bachelor project is “*Art and Technology as Experience*”, which intentionally is very broadly formulated. It is a requirement that the students choose three subject focus fields from the main modules of the program, they want to incorporate into their bachelor project, and thereby demonstrate that they can synthesize knowledge from the whole curriculum in their BA project. Furthermore, it is stated in the learning goals of the semester that the students must demonstrate skills in: “*identifying and formulating an artistic challenge and experience-oriented demands on the basis of a problem* *statement defined by the student"* and a similar intention is expressed in the overall competence profile of the program that states that the students acquire skills in *"identifying, formulating, analyzing, and solving artistic and technological problems".* There is an emphasis on identifying an artistic challenges or problems, as well as technical problems in the study regulations, which leaves the students in charge of the problem formulation. This also gives the students an opportunity to specialize according to their interests and future plans.

For the summer exam in 2017, students at Art and Technology at AAU executed 15 BA projects. The students handed in preliminary problem formulations early in the semester, to get their project ideas approved and this mini-survey is based on these documents, as an example of the types of problems that the Art and Technology students work on. The sample only gives an indication of typical types of problems that can be found on a semester but obviously there will be variations from year to year, that can depend on both the student group and the available teaching staff.

The problem formulations from 2017 fall in two main categories:
Seven of the BA projects from 2017 focused on narrativity in connection intermedia art executed in various artistic genes like performance, immersive installations, plays capes etc. One reason for the preference of this theme might be that students find it attractive and sensible to continue working with themes they encountered on 5th semester. The projects that deal with narrativity can be characterized as explorations and tests of inclusion of various new media as means for story telling and communication with different audiences. The projects are thereby developing existing formats, having an innovative approach to the use of existing technologies in art. Three projects use art as a tool or a special medium for communication about a specific cause. These projects utilize the combination of art and technology as a mediator to facilitate communication and understanding between mentally ill and healthy persons, or as a medium for communicating and illustrating knowledge about the brain, drugs and creativity. In the problem formulation for these projects the students wonder about the potential and limits of new technologies in storytelling and of art as a means to investigate specific issues and has a communicative stance.

The remaining five projects, take a particular societal situation into account, as the starting point for the project, and use the artistic project as medium either to generate debate among the audience, initiate transformative processes etc. These are BA projects, that are developed for specific settings, e.g. Urban sites and projects that take departure in current technological realities and their influence on everyday life, such as big data, wearable computing, the Internet of things etc. These projects have a distinct humane-societal outlook, and in the project the students are developing new ways of implementing art and technology into various social situations. The problem formulations focus on the situated-ness of art and new media, as well as the new conditions for contemporary life that new technological innovations introduces.

BA Projects 2017 Art and technology as experience		
Intermedia narratives		Art and technology and contemporary challenges
7 Projects Keywords: Performance Play Immersion	3 Projects Keywords: Communication Avareness	5 Projects Keywords: Big data Urban transformation Wearables Internet of things

Ill. 1. Topics and problems in the BA Projects 2017 at Art and Technology, AAU.

In both groups there are projects that strive to develop new interfaces, new possible uses of technology, and new experiences by exploring new ways of using existing technologies. A few projects dealt with ways to utilize wearable technology in footwear and develop a concrete touch-interface for outdoor use. These projects had a component that dealt specifically with the technological possibilities of the future and the artistic concept functioned as a framework and driver for the technological developments in the project. Some of the projects actually work on innovating, hacking or transforming existing technology to fit and serve their artistic purpose better. In these projects an element of technological innovation take place, but it is important to notice that the technological content is not the main focus in the problem formulation. The choice of technology is in most cases subordinated the artistic concept, which reflects one of the overall learning goals the students should meet after completion of the BA program: "*identifying, describing, evaluating, selecting, and applying appropriate technologies and construction methods for the production and use of art and technological artefacts*"

THREE FORMS OF PROBLEM ORIENTATION

In order to analyse the characteristics of art-and-technology problems philosopher Mogens Pahuus diagrams of three types of problem orientation and knowledge production can be used as a tool to categorize the problems that are dominant in the curriculum, and to find out what kinds of problems the students focus on in their projects. Pahuus describes two main principles in problem orientation in his paper on "*Scientific Method, Problem Orientation and Types of Science*" as to work with theoretical problems and to work with practical problems.

The practical problems can be divided into two sub categories: the humane-societal problems and the practical-productive problems. It is possible to operate with all three types of problems orientation within the same study program, while one type often will dominate, either in the program as a whole, due the nature of the study program and its scientific traditions, or the different types of problem orientation can be applied in different types of courses and projects throughout the curriculum. The different types of problem orientation also hold the potential to give the students a possibility to specialize in different aspects of their field of study.

According to Pahuus the humane-societal problems take their point of departure in registration of human suffering, problems relating to notions of the good life, fairness and justice in connection to negative problem complexes. This type of problems can also be societal problems, because the humane problems are situated within a broader societal context. In the 1970s when problem orientated project work was introduced as a pedagogy and a way to organize learning processes, it was this kind of problems that primarily was in focus and actual, authentic problems were identified in in the surrounding contemporary society.

What Pahuus describe as theoretical problems cover phenomena that are unexpected or surprising when correlated to known theories in the field or theoretical assumptions appear to be anomalies, so that existing knowledge is insufficient. Therefore a need for new knowledge, development of existing theory or new combinations of theoretical approaches representing different scientific traditions is necessary.

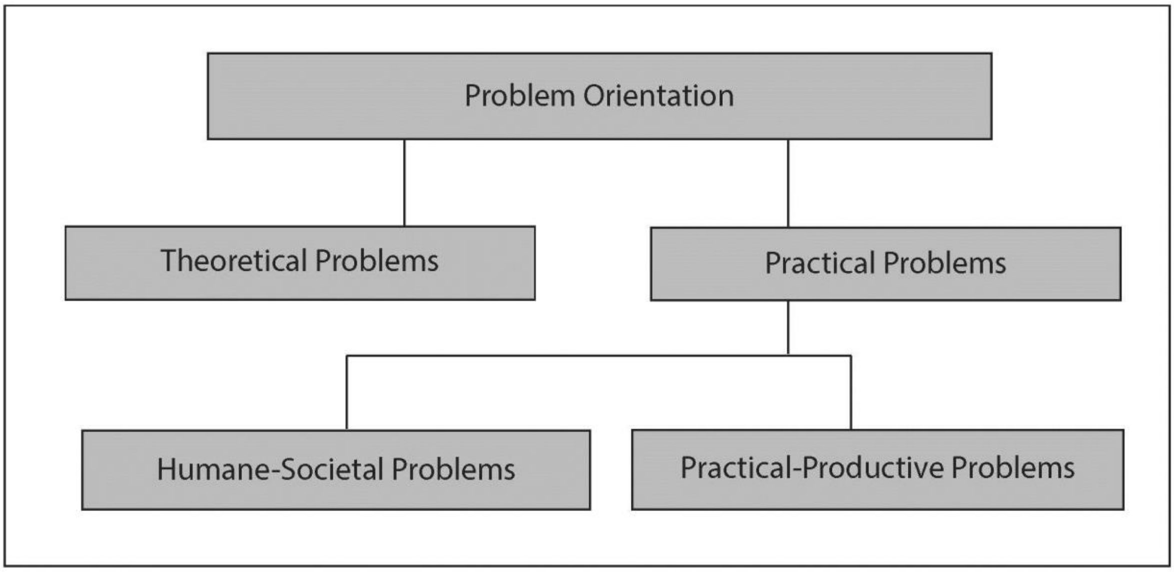
Praxis-productive problems deal with situations that can be improved in terms of functionality or efficiency. This type of problems aims at improving or expanding existing methods, tools, techniques and the result is a translation of scientific knowledge into e.g. New technologies. According to Pahuus this knowledge is produced from working with these problems are knowledge-in-action or know-how and a kind of knowledge that is closely connected to a praxis-activity. Pahuus states that within activities like sports, arts, crafts and skills developed within certain trades, it is difficult to draw distinctions between research and praxis since reflections on praxis and new knowledge is developed within or through praxis.

The art and technology examples from 2017 show how the problem formulations primarily address Humane-Societal problems. The projects often include a number of sub-problems that can be theoretical and/or practical-productive problems, but the artistic product, becomes a medium for investigating humane-societal problems as the main type of problem orientation.

The ability of art in general to address, illustrate, discuss and highlight all types of problems in contemporary art, and the many different media contemporary art can use to convey its meaning and message indicate the large field that art teachers and students must navigate in. The consequence of this kind of problem orientation in art is a focus on the nature of the problem and the investigation of the nature of the problem, and not so much on the (final) solution to the problem. It is a process-oriented way of understanding the problem. In some scientific traditions it is possible to prove that you have reached a correct or even the best solution to a given problem, while problem orientation in humanities and art tend towards systematic investigations of the problem, which can lead to new knowledge, new perspectives and even more questions.

The practical-productive problems are present in the BA program, both as a way to solve necessary sub-problems, but also as the main aspect in some projects. The practical-productive problems include innovative use of technology or technological innovation, by applying artistic methods to the field of technology. The artistic methods, and the artistic form of representation, have the ability to “expand” the toolbox and approach the problem field with fresh eyes. Generally design thinking is aimed at problem solving, while the artistic approach can investigate the problem, and not necessarily provide a solution to the given problem. In an art project it is possible to deal with a problem through provocation, be challenging, create discomfort and unease and explore the dark sides of a problem, to make the audience more aware. In the practical-productive problems the uses of existing technologies can be tested in new contexts, new uses can be invented or modifications can result in new possibilities for either artistic expression or for implementation of technology in new contexts.

It would be possible to explore and challenge theoretical problems in an artistic form, within the framework of the Art and Technology study program, but this is not a prominent approach.



Ill. 2 Diagram from Mogens Pahuus' three types of problem orientation.

All three types of problem orientation are reflected in the pedagogical reality of the study program, but they play varying roles in the projects. The majority of knowledge produced in the project work at the Art and Technology program is what Pahuus describes as practical knowledge. As mentioned above, practical knowledge is often closely linked, almost intertwined with a specific practise as innovation, development and new knowledge is created through participation in an activity – like in art, sport or crafts – but in a university study program knowledge production that live up to academic standards must be met. The goal of a university degree exceeds the development of highly personal and individual, tacit knowledge-in-action. The knowledge produced must be well researched, tested, communicated and be transferable to other practitioners or other situations with a similar result. The demand for exemplarity in the Aalborg Model makes the definition of problem fields and problem formulations focused on knowledge production and applicability to "real life" situations/problems. In the BA program of Art and Technology the written report that is handed in along the artistic project, provide a framework for elaborating on the ideas and decision behind the artefact. The double format in the deliverables, ask the students to demonstrate that they are able to carry out project work, produce an artistic project and to reflect on their own practise in a broader academic and artistic field.

CONCLUSION

PBL provide a realistic and complex framework for learning, also in an art program. The students are enrolled in a learning situation, that include physical contexts, actual audiences, budget requirements etc. that are similar to what they will encounter after graduation, so through the project work, they learn to apply their skills, knowledge and competences in various contexts and be prepared to adapt to varying conditions. In a learning situation, however, too much ’reality’ and problem orientation, can restrict the students work, if they focus too much on the input from external partners and on problem-solving instead of focusing on innovation, critical thinking and the knowledge production in the project. The PBL methodology and the Aalborg Model seem to pull many projects in the Art and Technology program in the direction of ’applied art’ with a defined purpose and include a high level of evaluation and reflection on the effects and results of the projects. This is a balance that is challenging to find for BA students, and must be taken into consideration when defining the problem field. The great variety in methods and theories that an interdisciplinary hybrid study program contain, result in a lack for specialization, where the students get introduced to theories and methods from several scientific fields, with a risk of superficiality in the learning. While interdisciplinarity result in an expansion of the artistic and academic tool box it can be difficult for the students to find time and spaces for deeper understanding of the different subject fields. The wide framework of art-and-technology and all the different types of problem orientation it entails, leave room for the students’ artistic/creative input and innovative thinking, but it is also a chaotic field, difficult for young students to navigate.

This paper does not deliver the final definition of what an art-and-technology problem is, but the three types of problem orientation, as outlined by Pahuus give an overview of different types of problems that is possible to deal with, also in art and technology projects and not only in the specific Art and Technology education in Aalborg, but in the field of Art and Technology educations in general. Combined with the small sample study of what type of problem orientation, Art and Technology BA students choose for their final BA project, some new questions is generated, which must be researched in further case studies:

- What would the effect on the curriculum be, if it specialized in one form of problem orientation? A streamlining of parts of the curriculum would create better conditions for transferral of knowledge from one semester to the others, but it would also take away some of the students responsibilities and their authorship over the problem formulation. The three types of problem orientation provide both teaching staff and students and understanding of art-and-technology as a diverse and complex field, that allow for many different approaches. The complexity provides unique competences, but is pedagogically complicated.
- Is a very broad problem field, and many different kinds of problem orientation a necessity in order to be exemplary in a study programme that include artistic output, because the field of contemporary art is so diverse? If the multitude of different types of problem orientation is meaningful for a field such as art-and-technology, the different possible types of problem orientation must be addressed in a systematic way, as part of the ways problem fields are defined, so the students get the right scaffolding to lean on in their learning processes. A second question for further investigation is how to teach multiple types of problem orientation to new students?

An important learning outcome of the BA in Art and Technology is that the students are trained in identifying a problem, and deal with that problem from two perspectives: in the form of an art project, and in the form of an academic reflective report. The identified problem is important for the artistic concept: often the problem is almost identical with the concept, as the problem is what the art project is meant to unwrap. The identification of the problem, the problem formulation and the way the problem is represented and dealt with in the project, is equally important to the specific answers or solutions that the project might end up with. In art the students are not meant to solve the problem, smooth out the surfaces or *"sugar-coat"* the messages, but provide new perspectives on the identified problems, formulated and communicated in an artistic project. Therefore it is important that the teaching staff ensure that there is a well defined semester framework for the students to problem formulate within, that leave room for multiple ways of attacking the problem field: multiple methods, different theoretical approaches, room for various types of artefacts and experiences. The pedagogical task is to create room for the students, where they can challenge existing norms and notions in order to push the boundaries of the field.

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SCHOLARTISTRY: INCORPORATING SCHOLARSHIP AND ART

Or: A polyphony of voices in conversation about a couple of images with reference to problem-based learning

*Michael Shanks and Connie Svabo**

ABSTRACT

The notion of scholartistry, hybrid scholarship-arts practice, is introduced by situating it in the academic literature on research methodology. The article offers dynamic, dialogical exemplification and demonstration; it takes the form of a conversation among the visitors to an imaginary exhibition of scholartistic artifacts. Several examples of arts-based research methods are discussed in terms of knowledge production and creative competencies. Connections are drawn with post-disciplinary agendas in the academy and beyond. The argument is made that a distinctive field of scholartistry offers an expansion of project- and problem-based learning in manifold cultural and organizational fields that are looking for open-ended creative modes of design and production.

Keywords: arts-based research, scholartistry, problem-based project work, post-disciplinarity, design thinking, play-based learning, archaeology, performance design

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Hello, welcome...

Voice #1, our guide, clears his throat to summon the attention of the visitors. We are in the heart of rural west Wales, at the entrance to a temporary "pop-up" exhibition that has been arranged in the corridors of a nineteenth-century abandoned mental asylum under redevelopment as luxury apartments.

* Michael Shanks, Department of Classics, Stanford Archaeology Center, Stanford, CA
Email: mshanks@stanford.edu
Connie Svabo, Department of Communication and Arts, Roskilde University, Denmark
Email: csvabo@ruc.dk

Please, hello – thank you.

The man smiles at the disorganized crowd of people.

DRAMATIS PERSONAE - VOICES

Voice #1 – the guide
Voice #2 – an archaeologist and academic – scholartist
Voice #3 – a performance designer and media academic – scholartist
Voice #4 – a disembodied voice heard over the public-address system – a "meta-voice" – the manager of the exhibition space, the "Editor" of the journal
Voice #5+ – various responding voices, visitors to the exhibition; one may hear the voices perhaps of an art sceptic, a conventional archaeologist, a theater actor (who performs dramatic scripts), a traditional academic, an academic cultural critic, and others of uncertain identity).

THE WAY OF CREATIVE SCHOLARSHIP

The group stands in a large hall-like space with a curtained entrance. The oxblood-red walls and dim lighting create a compact atmosphere.

Hello, hi – it is my great pleasure to welcome you on this exclusive guided tour of a special exhibition of works of scholartistry.

He has a good voice for talking in spaces like this. Visitor eyes are on him.

Yes, *scholartistry* – this being a combination of scholarly and artistic work (Lewis & Tulk, 2016). Scholartistry will be our angle today, in our somewhat specialized topic of *Integrating Academic and Artistic Methodologies within Problem-Based Learning*.

We realize, of course, that it is not conventional for a paper in an academic journal to take the form of a guided exhibition tour, but a short etymological excursion might help us understand that this is not as far-fetched as one might think. As we conventionally understand it, a journal is a serial publication of a collection of texts.

He looks out at the visitors and several nod.

In fact, *journal*, traced to Late Latin *diurnalis*, derives from *dies* – day, and in Old French, *jornel* – it may mean a day's travel. We take this notion of travel, of a day's journey – and offer a journey, a guided tour of our subject matter…

Inspired to contribute to the introduction, the archaeologist and Stanford University Professor of Classics steps in next to the narrator guide. He looks out, spectacles crouched on his long nose.

Voice #2. Archaeologist, Professor of Classics, Scholartist.
Ah yes – our topic is one of method – how to operate and maneuver as scholartists in the space, the borders between scholarship, research, and creative artistry. Here we might note the derivation of method from the Greek *hodos* – a track, path, road, with *meta* adding a sense of pursuit after or following something. Our topic is *met-hodos*, method, understood as looking for *the way* of creative scholarship.

Image One. The way of creative scholarship. The path to the heugh, Lindisfarne, Northumberland. From the book *Itinerarium Septentrionale (The Northern Journey): A Chorography of the English-Scottish Borders*, Michael Shanks, 2013.

The Associate Professor of Performance Design steps up next to the grey-haired archaeologist. A redhead, a head taller than him, wearing black.

Voice #3. Associate Professor of Performance Design and Visual Culture, Scholartist.

Meta – hodos: the way of research – the journey towards knowing.

She says it slowly and continues.

Hello all, we are pleased to be here and so happy to be able to exhibit our work as manifestations of what we would like to contribute to problem-based project work.

Voice #2. Scholartist – archaeologist.

And mind you – we think project work is great – it is student centered and engages people in working with relevant real-life situations! That's marvellous.

Voice #3. Scholartist – performance designer.
Agreed, yes, BUT, what we'd like to contribute to problem-based project work is aesthetics – aesthetic learning experiences (Uhrmacher, 2009). We exhibit these works here today as manifestations of processes of sensuous cognition (Welsch, 1997), what we, based on Baumgarten, call sensitive knowing (Kjørup, 1999).

We would like to suggest that problem-based project work can be enriched by engaging students in learning experiences that have their aesthetic components heightened in processes of making. Our images and this guided tour are meant to be sample suggestions for incorporating aesthetic ways of working in academic projects.

Voice #1, our guide, clears his throat, gently interrupting the flow of words from the academics, the scholartists. He draws back the curtain.

Let's enter.

He ushers the group through an archway. The visitors walk a little way into a corridor and stop at two images.

The first image appears to comprise superimposed, layered, and altered photographs with surface attachments. It seems to be an outdoor scene, but it is blurred. The second is an abraded mirror-like surface with a dim emergent image of what looks like a face. Both images seem to be composites, layered, with disparate elements brought together.

Image Two. In medias res – starting in the midst of things and following connections, working and remediating. A screen shot of the video installation *Driven Pheasant* (collage/montage of YouTube footage Hunting at Powis Castle, Wales, and mixed media artwork, Brændeskov Denmark), Connie Svabo, 2013. An image from the book *Ghosts in the Mirror: A Media Archaeology* (daguerreotype, anonymous USA c1850, purchased eBay 2003, rephotographed), Michael Shanks, 2013.

Voice #1. Guide.
Professors, please tell us about these works.

How did your projects start? What are their origins?

Voice #3. Scholartist – performance designer.
Ha! – Good question, where does any work start?

PROJECTS EMERGE IN THE MIDST OF THINGS – IN MEDIAS RES

Voice #3. Scholartist – performance designer.
Animal relations. I am interested in negotiations between human and non-human lives, negotiations between "nature" and "culture", the boundary lands and conflict zones between different forms of existence.

Driving along the roads of the rural landscape I live in, these conflicts play themselves out with fatal consequences: road kills. I often see pheasants lying dead at the side of the road. I also often see people driving cars on country roads holding their phones in their hands, glancing at them, texting. I even feel the urge myself, to text and drive, from boredom and need for connection through mediation. One day while driving, these two things associated in my mind: texting and dead animals. This, combined with my appreciation of the beauty of pheasants' feathers, led me to create a painting: *Pheasant Killed by Text* – plastic screen, a canvas very like translucent vellum, with layers of acrylic paint and pheasants' feathers smattered on it. Red, brown, white. Dramatic. One thing led to the other – I wanted to work with video projection, and why not project on this canvas, this skin?

On YouTube I found some footage of a pheasant shoot at Powis Castle in Wales. It was a point-of-view recording, made with a head-mounted GoPro Camera, a "document" of a man with a gun shooting the birds, one after another after another, with his labrador retriever dutifully fetching the bodies for him. The Go-Pro camera is fixed to his head; every time he moves his head, the camera moves – you see along the barrel of the gun as he fires. And BANG, BANG, BANG, you hear the loud noises.

She pauses.

What I mean to say is – for me, the starting point is a chain of associations: driving, landscape, roadkill, texts, beautiful pheasant feathers, a plastic screen, paint, video projections.

Voice #2. Scholartist – archaeologist.
Photo traces. I have long been interested in a curious convergence of field and practice between early photography and antiquarian interests in old ruins and artifacts that became the modern field of archaeology. One of the first-ever photography books, for example, Henry Fox Talbot's *Pencil of Nature*, is a deep exploration of what we can call an archaeological sensibility – an attunement to the remains of the past in the present, their presence, their record, the (al)chemical transformation of perception into document and archive.

I was aware of the competitor to Fox Talbot's early 1839 photographic negatives – Louis Daguerre's one-off photographic plates. I had seen some in the San Francisco Museum of Modern Art and was fascinated by their materiality, the image caught positive-negative in the surface of a mirror – daguerreotypes are light-sensitized polished silver on copper-plate substrate, exposed to light, which leaves a positive-negative image when chemically fixed. I found many for sale on eBay and the archaeologist in me was drawn to the ones, the cheapest, that were scratched, oxidized in patina, such that you can hardly now see the image. I bought about 50 at only a few dollars apiece in the summer of 2003.

I wanted to see into the images, through the veil of scratches, abrasions, the aging of the daguerreotypes, a kind of archaeological excavation of these old photos. A kind of media archaeology (Svabo & Shanks, 2013). How might this be achieved? I scanned and photographed with different light and settings, and lost images emerged from the gloom. Faces not seen for maybe a century – revived. Remediated.

Fascinating. And I remembered Adorno's aphorism – that the best magnifying glass is a splinter in the eye!

He looks out at the audience. Several have raised their hands.

He nods at them. Several start saying something.

Voice #5+.
It seems almost random, and certainly accidental – your discoveries of eBay daguerreotypes and selection of YouTube videos?

Voice #5+.
How did you choose such starting points?

Voice #4. Editor.
Forgive me, but what you are saying seems to have little to do with problem-based project work.

Voice #2. Scholartist – archaeologist.
Typically, in our academic training, we learn about method, procedures, algorithms – how to approach a topic. It might start, for example, with the definition or framing of a field and then gathering data.

Voice #4. Editor.
Or with problem orientation!

Voice #3. Scholartist – performance designer.
Our own *modus operandi*, in scholartistry, is to bracket, to place in parentheses such methodological principles, and instead, to plunge *in medias res*, to immerse oneself and see what surfaces.

Voice #2. Scholartist – archaeologist.
This, for me, is not a random process but involves gathering possible candidates for a starting point and assessing their potential to generate commentary and critique. The key is to consider rhetorical purpose. This is a specific matter related to the concept, audience, and purpose, and broad principles of genre, such as what kind of media(tion) and argument you might wish to pursue. There is a full discussion, with case studies, of such plunging *in medias res* in my book *Art and the Early Greek State* (1999) and in *Archaeology: the Discipline of Things* (2012).

Voice #5.
I don't understand – this seems very highbrow to me – it's almost like contemporary art!

Voice #5.
Is there a systematic *method*? Is there a logic to all this?

Voice #4. Editor.
Professors – I need to remind you that you need to talk about problem-based learning.

Voice#3. Scholartist – performance designer.
Yes we should deal with our sponsor, the journal, with its topic of problem-based learning. After all, that's the reason we are here!

Image Three. Working with aesthetic learning in student project development. *Thesis Landscape* (collage, photographed), by Performance Design student Linh Tuyet Le, 2017.

EXERCISING AESTHETIC LEARNING IN STUDENT PROJECT DEVELOPMENT

Let me try to relate what we have talked about to my practice as an educator: I am responsible for the thesis-writing module in the Performance Design Master Study Programme at Roskilde University – where problem-based project work composes half of the students' activities. I do workshops with all thesis writers, and when I work with students starting up their final theses; one of the sets of exercises I do with them is to guide them through envisioning their projects. For example, in a workshop, I may ask them to imagine their projects as "landscapes". I ask them to explore their thesis: what kind of landscape is it? Is it full of mountains? Is it a vast open meadow? How is the foliage, the light, the atmosphere? Sometimes I give them a large piece of paper and ask them to draw this landscape; sometimes I ask them to describe the landscape in a free-associative kind of writing.

When this is done, the students have made manifest in either text or image some qualities of their "thesis landscape". They have created something that potentially acts back on them, makes them understand and see new things about their thesis and how they feel about it.

The audience looks a bit puzzled. She continues.

After this, I typically ask them now to imagine they are going to guide a traveler through the landscape. I ask them to imagine they are tour guides; they will take a potential reader/voyager through the landscape – what might the highlights be? What would the traveler experience? To which special features of the landscape would they as tour guides draw attention?

This exercise is a continuation of the work with the imagined thesis landscape from before, but it introduces a shift in perspective and dialogical form as new "generators of insight". Imagining this "taking on a voice of authority" in relation to the thesis landscape – accounting for it (Butler, 2001; Hughes, 2005, p. 72) – again generates new insights about the thesis. The imagined landscape and the imagined dialogical account of it helps one to envision and understand the thesis in its becoming. The thesis is imagined, and in these processes of imagining, of drawing and telling, a vision for the thesis is generated, crafted, created.

What I do here, as educator and creative process facilitator, is to provide a starting point. For example, "landscape". This is a creative, associative technique. Insights are generated about one thing, by exploring them through the features of something else. The thesis is enacted as landscape and as dialogue about a landscape. These actions are not targeted "problems" or "solutions". They are aesthetic, evocative, and imaginative.

Now let's link this back to the works we have on display here; let's link back to this exhibition and why we think our images have something relevant to say in relation to integrating artistic practice in academia – and specifically to problem-based project work.

What form do things take when we explore and experiment with aesthetic form giving? What emerges?

I have attempted to demonstrate how I, in my work with students, attempt to generate aesthetic learning experiences, which provides insights about the project at hand. These kinds of exercises feed into the process of "making" a project – of performing it into existence through imagined spatiality, visuality, and dialogue and through processes of translation and mediation (Svabo, 2016).

We posit that the making of a project (an academic thesis, for example) can benefit from the creative, crafting exploration, which characterized the creation of the images on display here, that by "making" in aesthetic forms (drawing a landscape, telling a story) the project is also made. Important insights are generated.

So what we are trying to communicate is that evocative, imagined, intuitive, play-based, aesthetic forms of working offer an expansion of problem-based learning. They add aesthetic learning experiences to project work. Scholartistry highlights aesthetics in academic work, suggesting that working with aesthetic forms and expressions adds to the epistemological rucksack of the journeying project worker.

Voice #1. Guide.
All right, that does make somewhat more tangible how scholartistry may actually be implemented in learning in higher education – although I do have some issues I think could be clarified …

The voice of the guide is abruptly interrupted by the Stanford Professor of Classics, who clearly also has a take on the issue of learning and forms of knowing.

OPEN KNOWLEDGE-MAKING PROCESSES

Voice #2. Scholartist – archaeologist.
It's not controversial to see problem-based learning, and related project-based learning and experiential learning, as long-standing efforts to deal with the relation of learning in the academy to worlds beyond that are not organized in disciplinary ways. Involved are shifts from formal instruction to student-centered differentiated learning and, yes, beginning with a problem, a challenge to be pursued through (improvised) problem-solving skills or competencies.

If I may speak as a student of classical antiquity, in a traditional sense, we are dealing with the reconciliation of modes of learning and knowing in that genealogy of the body politic since the polis, the ancient city state. The challenge has long been to reconcile what in antiquity were called *episteme* (scientific knowledge), *sophia* (theoretical wisdom), *techne* (practical know-how and applied knowledge), and *phronesis* (socio-cultural savviness) – manifold epistemic fields ranging from formal bodies of propositional knowledge, to technical skills and creativity, to ethical dispositions with respect to knowing of what consists the *good life*.

And let's not forget that we are dealing here with an elision of learning and knowing – these forms of knowledge all refer to competencies thought essential to leading, contributing to, and shaping a rich life as a full member of a political community.

Voice #3. Scholartist – performance designer.
So – we are tackling here how the academy – as research and as educational environment – produces knowledge for society and citizenship. And, indeed a classical, archaeological approach offers a broad-brush understanding of this.

Voice #2. Scholartist – archaeologist.
(Chuckle). Yes, indeed! We archaeologists offer an almost geological perspective.

At the beginning of my career, I was also part of a significant shift in how archaeological science was construed. Eschewing an essentially inductive process of digging up the past – visiting and investigating sites, gathering remains, categorizing, synthesizing, interpreting, and explaining – from the late 1960s, archaeologist in the Anglo-American academy promoted what was called hypothetico-deductive reasoning. As archaeologists, we weren't to set out simply to explore and discover. Direction was required – problem orientation – a methodological precept construed from *philosophy of science*.

Voice #3. Scholartist – performance designer.
Aalborg and my own University at Roskilde in Denmark were established in the 1970s to deliver problem-based experiential learning (Andreasen & Nielsen, 2013 Andersen, 2015).

Voice #2. Scholartist – archaeologist.

I recall studying their curricula as part of the dissertation I wrote for my Masters in Education on radical student-centered pedagogy.

Voice #3. Scholartist – performance designer.
Yes, so we very much draw on and are sympathetic to the intent of project-based learning. However, let's say right off that we are awkward with problem orientation.

Let me share an anecdote from the process of writing my doctoral dissertation.

In a somewhat confessional style, she looks at the audience.

I found it extremely difficult to work with the much-heralded phase of *problem formulation* in problem-oriented project work – which is the Roskilde University version of problem-based project work (Olsen & Pedersen, 2015).

At one point, I even had a list of 121 problem formulations! I couldn't settle on any one of them!

This was not about writing. I wrote a great deal during my thesis work, publishing several articles and book chapters along the way, and on top of this, the monograph. But the process of problem formulation did not work well for me. My way of working was more one of crafting texts.

I worked ethnographically with a broad focus and interest in the interactions between sociality and materiality in visitor experiences of a museum of natural history (Svabo, 2010). Given the exploratory character of this fieldwork, it was counterproductive and actually quite impossible to predefine what I was after. The focus of my project, indeed the formulation of its problem, emerged in parallel with my presence in the exhibition, and indeed one specific "eureka"-like moment in my participant observation generated the focus of my thesis.

I suggest there is an *overestimation* of the importance of initial problem formulation, at least in the way we practice problem-oriented project work at RUC.

Voice #2. Scholartist – archaeologist.
I concur.

My own doctoral research indeed started with a broad problem – why in the middle of the first millennium BCE we see the emergence of city states across the Mediterranean. I translated this problem into a question. As an archaeologist interested in design, art history, and material culture, I framed the problem as follows: how might the design, style, and manufacture of widely traded and consumed ceramic wares be related to the social changes associated with the formation of city states in the Mediterranean? But this framing of the "problem" didn't help me figure out what to actually do, where to start, how to proceed, even though I was very aware of the methodological precepts in archaeology regarding the positing of hypotheses to be tested against data. There was something of a paradox – if I came up with a specific hypothesis, that ceramic design represented ethnicity and so could be used to track the settlement of different peoples in new kinds of community; for example, I would be predetermining the story I could tell.

Later, I researched how archaeologists actually work on their projects, in contrast to what textbooks tell you that archaeologists and other social scientists do. In a series of interviews on how archaeology works – what became of the book *Archaeology in the Making* (Rathje, Shanks & Witmore, 2013) – I found that identifying and solving problems was just a small part of a complex and very messy process of doing what gets called archaeology. The work of archaeologists is actually much more open than what method and theory stipulates (Shanks, 2012).

Of course, this is the great insight of science studies, the understanding of scientific practice that has emerged since the late 60s, rooted in ethnographies of knowledge making in science: science is a mode of cultural production (Latour 1987; Latour & Woolgar, 1979).

Image Four. Opening up knowledge making. Interdisciplinary scholartistry carried out in more than twenty years of the theatre/archaeology of performance artist Mike Pearson and archaeologist Michael Shanks. Rearticulating fragments of the past as a real-time event: visiting the ruined farmstead of Esgair Fraith, Wales, and derivé through the streets of Riga, Latvia. From Theatre/Archaeology: Pearson/Shanks 1993-2013, see also Theatre/Archaeology: Reflections on a Hybrid Genre, Mike Pearson and Michael Shanks, 2001.

Voice #5+.
You are both focusing here upon *research*, are you not?

Voice #4. Editor.
Do explain how this is connected with problem-based *learning* in higher education.

PLAY-BASED LEARNING AND DESIGN THINKING

Voice #3. Scholartist – performance designer.

There is a growing interest in exploring the role of creativity and aesthetics in problem- and project-based learning (Armitage, Pihl & Ryberg, 2015). One specific example of calls for aesthetic learning, which relates precisely to problem-based learning and project work, comes from a professor of architecture at Aalborg University, Hans Kiib. He has promoted the idea that problem-based project work needs an injection of *play*. Kiib and colleagues have developed a model for problem-based learning, which they call PpBL: *problem- and play-based learning*, which seeks to focus on the interplay between the intuitive and the goal-oriented aspects in university pedagogy (Kiib, 2004, p.195).

Kiib says: “PBL requires intuition, play and action in a continual dialogue with reflection and rational problem solving. This requirement is strong in all educational programmes, but perhaps more particularly those programmes that focus strongly on innovation and artistic development, coupled with technical competences.”

Kiib supports this by referring to Kolb (1984) and Schön (1983, 1987) for their focus on experiment and intuition (Kiib, 2004, p. 202).

Feezell (2013, p. 23) sums up some of the features of *play* that have been emphasized and analyzed in the literature on the topic – mentioning, among others: freedom, non-seriousness, illusion, unreality, purposelessness, make-believe, superfluousness, suspension of the ordinary, internal or intrinsic meaning, serious non-seriousness, diminished consciousness of self, absorption, responsive openness, contingency, spontaneity, improvisation, fun!

Voice #2. Scholartist – archaeologist.
With play we might well associate design thinking, for which the design group at Stanford has become notorious (Kelley & Kelley, 2013; Plattner, Meinel & Leifer, 2018), as another way to enrich and develop creative aspects of problem-based learning.

To paraphrase Jackson and Buining (2011, p. 160): in Design Thinking, problem framing and diagnosis are developed and often replaced with a process of exploration that is facilitated through extensive questioning, through research. Through research exploration, design teams come to understand the human complexities that are often embedded in a problem. This makes it possible for them to see more easily a multitude of problems from different perspectives. A common outcome of this human-centered research is thus a complete reframing of a design challenge or problem. This exploratory stage provides the basis for a generative stage in which numerous potential solutions to the explored problem(s) are identified and explored through prototyping processes – much akin to learning through trial and error.

Design Thinking does not follow an analytically reasoned pathway; it is fundamentally different from the scientific, rational, linear, and convergent processes that tend to be encouraged in academic higher education environments. Yet also, and as Peter Miller (2015) has argued, design thinking in many ways mirrors – in its pragmatic focus – the features of what have been traditionally called the liberal arts, a cornerstone of the western academy. The *artes liberales* are the competencies (*artes*) appropriate to lead the life of a free and creative member of a community (*civis libertus*).

Voice #4. Editor.
I am so glad you've brought up the distinction between the arts and design – in relation to the academy and life beyond!

Voice #2. Scholartist – archaeologist.
Indeed, we don't want to be drawn into the old and very pertinent distinctions between fine and applied arts (Schnapp & Shanks, 2009), and the role of the designer as agent in industrial production, though this again raises the perceived need in many business fields for a disposition toward creative innovation and associated competencies.

Voice #3. Scholartist – performance designer.

We are focused on the convergence here between art, play, and design as activities that involve open-ended, autotelic, exploratory, improvisational, and intuitive *workings*.

Voice #1. Guide.
This exhibition is about arts-based research and learning that takes in techniques and attitudes from the fine and applied arts (design) that foster creative, open-ended, action-oriented exploration, with associated competencies.

Voice #3. Scholartist – performance designer.
Yes, we call this *scholartistry*.

Voice #1.
The term scholartistry here refers to work exemplified in the academy that subsumes research and learning through open-ended processes of exploration, experiment, and yes, the pursuit of knowledge of different kinds.

And problem-orientation may be part of such scholarship, but not the defining feature.

Voice #2. Scholartist – archaeologist.
Scholartistry adopts a tool-kit, rather than a methodology, from the fine and applied arts and is rooted in age-old competencies identified with the field of rhetoric.

I'm sure we'll come back to this in a moment as we pursue the question of method.

HYBRIDIZING THE ACADEMIC GENRE

Voice #3. Scholartist – performance designer.
Certainly the attempt at integrating art and academia is a scholarly act of putting oneself (and/or one's research) on the edge, in contested territories, in boundaries and borderlands. Borgdorff (2011) and Schwab and Borgdorff (2014) have also pointed this out.

Arts-based inquiries potentially hybridize the academic genre – making it impure, bastard, monstrous (Czarniawska, 2004, p. 135). Scholartistry may be seen as a hybrid, a bastard kind of research and learning. A hybrid is an offspring that has dissimilar parents; it is impure, monstrous. Cognate terms that may be invoked are pirate, cyborg, phantasmatic, schizo, polymorphic, perverse. And an-archic (playful) inversion or negation of state-authorized and/or disciplined normative states of being in the world. Scholartistry is carnivalesque.

Hybrid research may deliver textual works that inhabit the lands of in-between, not being purely one thing or the other, mixed-up works. Familiar examples of this kind of work are literary non-fiction, the personal anecdote, and pieces of prose-poetry… "texts which do not know what they are, texts which hold qualities of being something and something else" (Svabo, 2010, p. 146).

Image Five. Hybridizing the academic: *Scholartistry* explored in a katachrestic aesthetic (mixed media collage/montage of found imagery and derived tagcloud), Connie Svabo and Michael Shanks, 2017.

Voice #2. Scholartist -– archaeologist.
Scholartistry may be essayistic. An essay (Latin *exigere*, to assay, weigh, make trial) is an experiment, a trying out to see what results.

Voice #3. Scholartist – performance designer.
A book comes to mind from the *Swedish Academy for Practice-based Research in Architecture and Design* (Grillner, Glembrandt & Wallenstein, 2005). Concerned with experimental research in design and architecture, this book advocates the value of experiment – understood as open-ended processes of inquiry – in academic work. It is based on the premise that a central quality of research is to explore and to experiment. Exactly this quality is a crucial quality of arts-based research. It is research for *inquiry*, more than *proof*.

Pelias (2011, p. 660) makes the point that writing may function as both realization and record: "These terms – realization and record – point toward the writer's process and completed text. Writers come to realize what they believe in the process of writing, in the act of finding language that crystalizes their thoughts and sentiments. It is a process of 'writing into' rather than 'writing up' a subject. When writing up a subject, writers know what they wish to say before the composition process begins. When writing into a subject, writers discover what they know through writing. It is a process of using language to look at, lean into, and lend oneself to an experience under consideration."

Techniques derived from the fine and applied arts are great for such exploration – doing stuff without knowing where it will lead or even why you are doing it. We suggest that creative and productive processes of opening up and writing into (open exploration) are essential extensions to problem-based playful learning and project work.

Voice #2. Scholartist – archaeologist.
Our works on show here are meant to foreground slippage, shape-shifting, metamorphic processes.

Outrageously, perhaps, the essayistic shape shifting may end up more important than any distinctive message or proof. Playful exploration may become an end in itself. The scholartist might not actually have anything to say!

Voice #3. Scholartist – performance designer.
The arguments for arts-based research (as well as design-based research) extensively overlap with and draw on the arguments for qualitative research that have been developed in, for example, anthropology, since the representational crisis of the 1980s (Denzin & Lincoln, 2011; Knowles & Cole, 2008; Van Maanen, 1988). Again, Michael, we might cite your work *Experiencing the Past* (1992) in this context.

The broad point is that, in writing, in authoring, text is not an innocent medium (Conquergood, 2002; Geertz, 1989). In writing of people and culture, scholarly work is very often narratological work. As scholars, we concoct narrative devices (Czarniawska, 2004) in order to make our point. We make active choices of making our texts seem realistic, descriptive, or not. We can also make active choices of foregrounding our personal standpoint, positioning ourselves and our work in relation to the topic of inquiry (Baarts, 2015; Ellis & Bochner, 2000; Richardson & St. Pierre, 2005). We can employ various writing strategies, for example, writing explicitly from the positions of the personal, the poetic, or the performative (Pelias, 2011).

PRAGMATICS AND SCHOLARISTRY AS ACTIVE ENGAGEMENT

Voice #5+.
This is all very fuzzy, it seems, and not the kind of rigorous application to problems that we need in today's complex runaway world!

What has happened to *discipline*? What are the procedures of scholartistry, its methods?

Voice #3. Scholartist – performance designer.
Okay, we have arrived at method!

We suggested earlier that we think of method as being about the way of knowing. How to operate – how to proceed – how to find one's way.

Voice #2. Scholartist – archaeologist.
Another way of saying this is that we see discipline and method as *modi operandi*, ways of doing things – pragmatics.

Design thinking is quite well conceived as a kind of pragmatics, as action-oriented project management. There is no formal methodology, and this makes it difficult to teach and learn. As faculty in the d.school at Stanford, we show and share, rather than tell and instruct. This kind of pragmatics is best learned through doing, by pursuing projects, typically in studios, that run through inquiry, ideation, framing, interpretation, explanation, testing, modeling, manifestation (document and delivery).

Rather than (conventional understandings of) method and theory, this is *met-hodos*, itinerant – the *way* of design. Scholartistry is in a similar manner the *way* of knowledge making.

Voice #3. Scholartist – performance designer.
In relation to the orientation on problems in problem-based learning, our objective in scholartistry is to elaborate the space, the transgressive space between problem and solution – between formulation and production.

Voice #2. Scholartist – archaeologist.
We will not be the first to comment on the problem-solution fixation of so much of the wealth, business, and culture of Silicon Valley (for example, Morozov, 2013) – an engineering attitude, seeking problems for which solutions may be engineered and, in so doing, delivering value, whether that be wellbeing, a new gadget, or monetary profit...

Voice #3. Scholartist – performance designer.
It's not at all wrong to be problem oriented, but we wish to make space for open exploration, to consider alternative perspectives, to consider other frames of reference, holding problems and associated solutions in parentheses, *deferring* definitive statement, diagnosis, and prognosis.

Voice #2. Scholartist – archaeologist.
Scholartistry is peripatetic, wandering, browsing, selecting, discarding through dérive, through borderlands and temporary autonomous zones or third spaces.

Voice #5+.
Right, Okay. You are both academic faculty. Do your students help you? How do you do this in the classroom?

How does this connect with school and college curricula, if at all?

Voice #2. Scholartist – archaeologist.
Scholartistry is about our lives as full members of a creative community.

Scholartistry emphasizes an aesthetic of sensuous embodied engagement, personal, committed, inflected. By aesthetics, we mean the complementarity of
thinking, sensing, and feeling in the *experience* of knowledge making – the cognitive, sensory, and evaluative/emotional are all involved, as they were in ancient rhetoric.

Voice #3. Scholartist – performance designer.
The interstitiality and potentially transgressive politics of scholartistry relate to its situated character, that we are always located, never neutral. We always stand for something (Haraway, 1988).

Ultimately, scholartistry is an essential component of active engagement with the world. This is surely also the objective of problem-based learning – to effect such active engagement, to make the most of our individual and collective *agency*.

I was reading a text by Ronald Pelias the other day (2011) about compositional strategies and writing. He includes a quote. I don't remember by whom. But I remember the direction of the quote. To write is to make a demand on the world. Research demands space. The quote even said that to do research is to colonize the world.

Energizing scholartistry is the conviction that expression, giving voice, having a say is a crucial capacity, a key human faculty. Expression that comes from the heart, gut, mind (Behar, 1996; Pelias, 2011; Rosaldo, 1989). Expression that is situated, located in one's body, coming from the corporeality of one's being. Our agency is precisely the acknowledgement that such expression is valuable and legitimate. Our agency is the conviction, thought, and felt, that we matter.

Maybe this is the colonization, the making of the world as one's own in fleshed out making of knowledge.

Image Six. Scholartistry at work. Remains in a studio space of an exercise in collaborative graphics used to explore concepts and connections (color crayon on paper). Roskilde University research collective in arts-based research: Connie Svabo, Dorte Jelstrup, Pernille Welent Sørensen, Anja Lindelof, Sine Nørholm Just, facilitated by Henriette Christrup, 2017.

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Interactive Art, Performance and Scientific Research into Corporeal Empathy

Alexsandro Almeida Da Silva *

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.

* Alexsandro Almeida Da Silva, Department of Communication and Psychology, Aalborg University, Denmark. Email: asandro@hum.aau.dk

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 bulling: 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 brainstorms, 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)

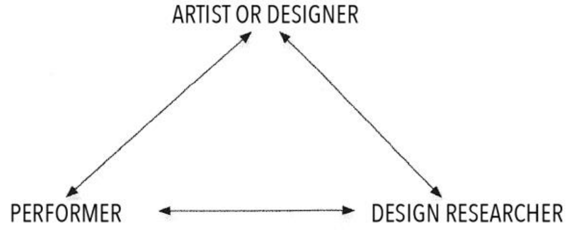

Figure 1: Model of potential roles in this project:

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 argumented 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.

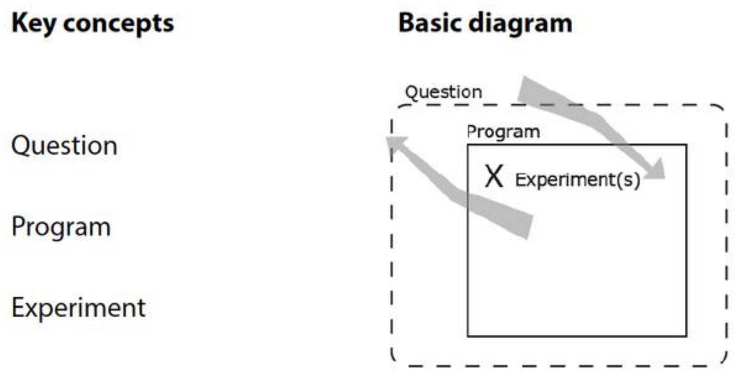

Figure 2: Experimental design research diagram by Brandt and Binder

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.

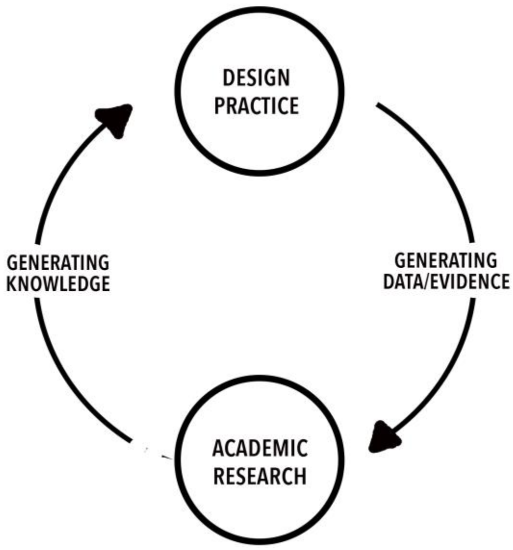

Figure 3: Experimental Design Research Method

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.

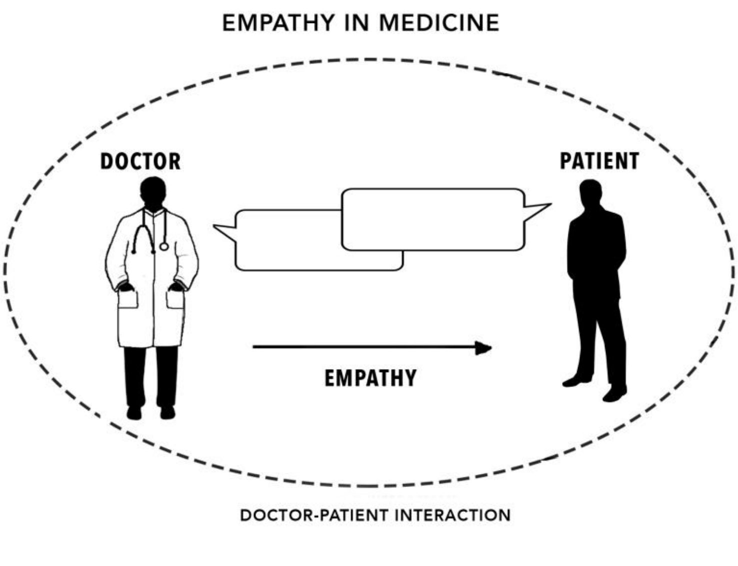

Figure 4.1.: Empathy in medicine without the physiological data displayed on the electronic device – LOW EMPATHY

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.

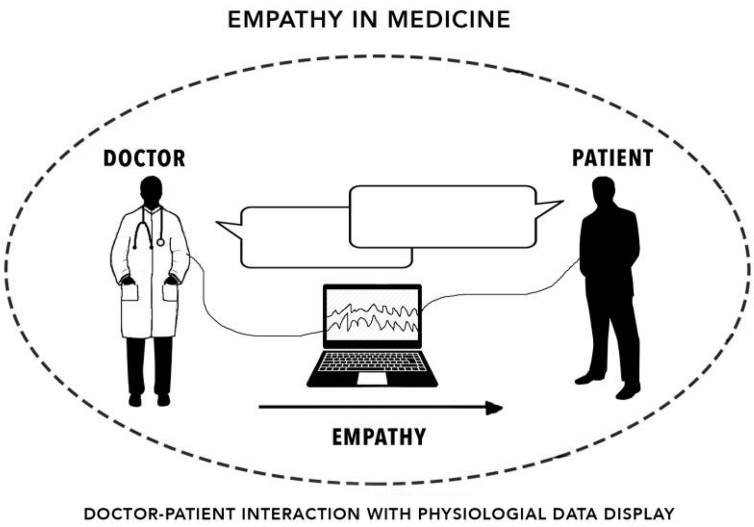

Figure 4.2: Empathy in medicine with the physiological data displayed on the electronic device – HIGH EMPATHY

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[1] 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.

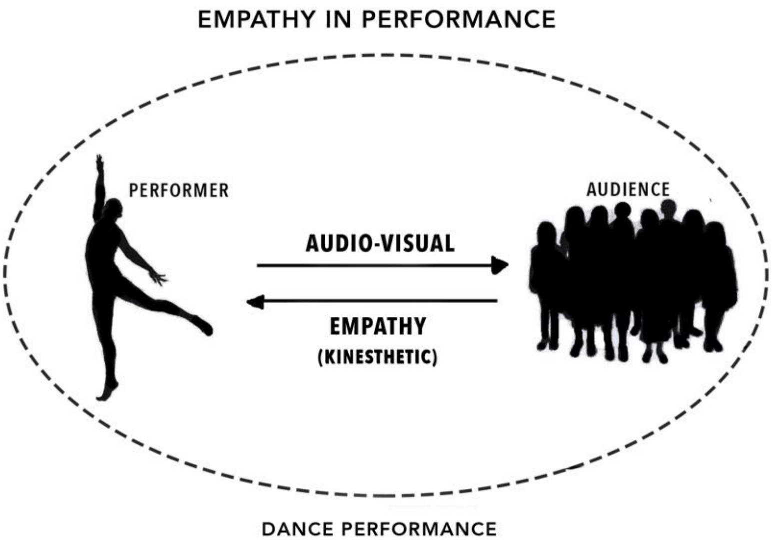

Figure 4.3: Empathy in staged performance without the interactive art installation – LOW EMPATHY (?)

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).

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

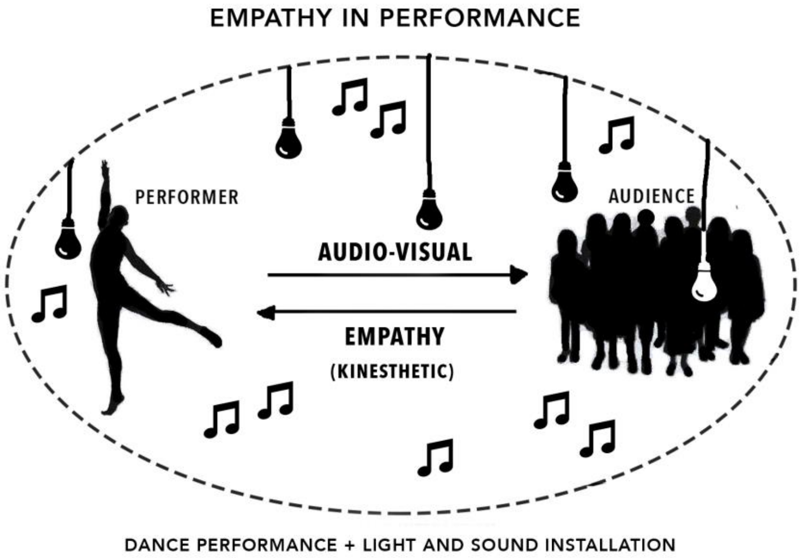

Figure 4.4: Empathy in performance with the interactive art installation – HIGH EMPATHY (?)

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)[2] and human-computer interaction (HCI)[3]. 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[4] as part of the Sol Festival[5] in northern Denmark. Six performances of "My Body, Your Room" occurred over six days during the festival (20th through 28th 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 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

[2] Human-human interaction (HHI) is when a person interacts with another person and one affects the experience of the other.
[3] Human-computer interaction (HCI) is when a person interacts whith a computer system and one affects the other.
[4] 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.
[5] 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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A Co-Lab on Developing Cyborg Arts – Interdisciplinary Collaboration and Practice Based Solutions

Ellen Pearlman *

ABSTRACT

A co-lab in Cyborg Arts was conducted at Parsons/New School University, a leading design school in New York City, over the course of sixteen weeks. This paper discusses the use of Bruno Latour's Actor Network Theory (ANT) (Latour, 2007) in facilitating creative collaboration solutions. Previously, an open call had been placed in targeted venues such as Art and Education, as well as a number of technology user groups in the New York City area to solicit ideas and participants. With the assistance of the Cyborg Foundation three teams were chosen to build prototypes of a new cyborg sense: Team Glass, Team Radiation, and Team Haptics. Team Glass strove to make a cyborg sense detecting the rhythm of changes in the sun's solar flares. Team Radiation made a sense that distinguished between, and alerted the user to different types of organic and inorganic radiation in the environment. Team Haptics used the team leader's own body as a site environment to correct a medical problem by developing a new cyborg sense. Students from Parsons chose which team to work with. Experts and guests either visited the co-lab in person, or used Skype to converse with the participants throughout the course of the semester.

Registered Parsons students stayed committed to the lab in order to receive a grade. Other participants had various reasons to remain involved, such as learning new skills, seeing their ideas realized, or stepping outside of their core discipline. The major conduits of communication for the teams outside of lab time were the web-based Slack application that logged a history of their thoughts and interactions, as well as a private student Tumblr to document their progress. This paper discusses how an ANT analysis of practice based learning led to incremental breakthroughs such as starting, stopping, abandoning, and resuming developing these sensing techniques. This resulted in proof of concept artworks, and showcased new aspects of cyborg art.

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* Ellen Pearlman, PhD School of Creative Media, Hong Kong City University Faculty, Parsons School of Design/New School University, New York
Email: ellenluminescense@gmail.com

Key Words: cyborg, cyborg arts, co-lab, cybernetics, practice based, actor network theory, creative group dynamics

INTRODUCTION

After consulting with the Cyborg Foundation consisting of living cyborgs Neil Harbisson and Moon Ribas, an open call was placed in a variety of media, art and technology sites for a "collaboration between artists, technologists, designers, engineers, makers, and/or scientists to create and develop technologies that expand human capabilities and perception" (Harbisson, Ribas, Pearlman, 2017). Posthuman scholar Katherine Hayles defines the cyborg as having "informational pathways connecting the organic body to its prosthetic extensions" (Hayles 1999, p. 2). The idea behind this call was that enhanced senses using various digitized parts would eventually be implanted inside the living tissue of the human animal, but not as part of the co-lab, where they would only exist as built proof of concepts. Harbisson, born color blind implanted a sensor into his skull that turned the colors he could not perceive into sounds, a process he currently uses in his creative output. Ribas has a chip implanted in her arm and both feet that senses earthquake data twenty-four hours a day. She uses that data to create live time choreography (Harbisson, Ribas, 2016).

More than seventy people responded to the open call, with three project ideas selected with the guidance of the Cyborg Foundation. Approximately twenty-five individuals with varying skill sets were chosen to work on the three teams. Each team was led by artists: Team Glass, Team Radiation, and Team Haptics. Team Glass, headed by glass artist Laurie focused on a sense to detect changes in the sun's solar flares using data obtained from NASA readings. Team Radiation, led by artist Arnold strove to develop a sense to detect organic and inorganic radiation. Inorganic radiation in this case refers to electromagnetic signals, and organic radiation meant something as simple as a sound wave, meaning a natural type of occurring radiation. Team Haptics, headed by Marcella, wanted to make a cyborg sense to coordinate her gait, which had been impeded by a medical condition. Students self-selected the team they would work with.

CO-LAB IMPLEMENTATION

The Parsons co-lab was a collaborative laboratory approximately sixteen weeks long that included external professional participants, and various invited guests within the confines of an academic setting. A co-lab differs from a workshop, which is usually a skills based short-term exploration of a particular set of tasks. The goal of this co-lab was to produce a tangible proof of concept art work that could theoretically be turned into a cyborg sense. This proof of concept was developed through transdisciplinary modes of knowledge production, thinking, and making. The selected team members, culled from the open call were comprised of programmers, research scientists, designers, artists, indy makers, creative business studios, and even non-profit executives. Students were treated as fully engaged apprentices in a transdisciplinary problem solving environment. They logged the progress of the class on a private Tumblr account, as well as posted their team's progress onto the co-lab's group Slack account. This posting allowed them to track and monitor their progress and research. The Slack also allowed me, as facilitator, to monitor group dynamics, progress and setbacks in terms of ANT analysis.

The students were assigned readings on the posthuman and cyborgs, and one reading about creative collaborations. Some students jumped right in and began contributing either their coding or design skills towards the creation of cyborg senses. Other students chose to study theoretical aspects of the topics they were learning about by researching and composing papers on the topic of the posthuman.

During the semester different guests participated via Skype, or in person. The Cyborg Foundation's Haribisson and Ribas Skyp'ed in from Barcelona, Spain to initiate the first class, and to view and comment on the team's projects for the last class. Other guests included scientific researchers, other cyborg artists, cyborg start up companies, body hacking conference organisers, and directors of maker spaces, all who lectured on their areas of expertise and gave the teams feedback.

The teams would present their project ideas to the guests with both sides exchanging viewpoints. The need for external guests, expecially in the beginning of the semester was important because the topic of living cyborgs was new to almost all of the students, and not deeply familiar to the professional participants. All members of the co-lab needed real world examples supplied by conversing with guest mentors. The students and other participants were not introduced to the theories of Bruno Latour's ANT, as ANT was used solely in my role as supervisor/facilitator to mediate the learning goals and monitor their development.

METHODOLOGIES -ANT AS PRACTICE-BASED RESEARCH AND LEARNING

I employed Bruno Latour's Actor Network Theory. The actual working method includes examining both people and things. ANT became an invaluable methodology enabling myself as facilitator to deal with, and better understand the failure and crisis of multiple actors (human and non-human) in the network. ANT portrays both human and non-human elements as equal actors. It does this by employing a 'sociology of translation' with each 'actor' representing a vital link in the network, and the types of interchanges that occur between objects and individual subjects. A signal that was not processing information correctly, or computer code that was compiling with multiple errors was just as important as the communication between the two people that may have been trying to rectify the error. All components were actors in the network.

Latour concludes that in ANT it is better to trace connections or "associations" between controversies than explain the actual controversies themselves. ANT examines the problems being tackled, the actors involved, how to make other actors interested in the situation, have actors agree with their assigned roles, and make sure the delegated actors represent the situation correctly. If the actors are not in agreement, then the network under consideration ceases to function, or communicate. This type of breakdown happened a number of times during the sixteen-week co-lab. Latour states:

> You have to follow the actors themselves, that is try to catch up with their often wild innovations in order to learn from them what the collective existence has become in their hands, which methods they have elaborated to make it fit together, and which accounts could best define the new associations that they have been forced to establish. (Latour, 2007, p.12)

He notes information technologies are equipped in such a technically sophisticated way that they allow us to trace the associations that were previously impossible to track.

ANT's methods revolve around a 'sociology of translation' that consists of four aspects for living and non-living actors and the situations they are involved in. It allows for the inevitable things that break and fail. Everything can be an actor (human and non-human) in a network, depending on how it is interpreted. For example, the participation of a key 'actor' (person) or their non-participation can lead to a host of new decisions and directions to take. Likewise the functioning, or non-functioning of a key non-human actor (a piece of equipment) can lead to other new decisions and directions. Each change or disruption must be dealt with either on the spot, or at a later date depending on its urgency.

English professor Bruce Clarke says Latour follows the circulation of "quasi-objects" that "name the objecthood of subjects (such as human persons) and the subjecthood of objects "such as machines and on-human organisms” (Clarke, 2008, p. 44). He says, “Latour comes to see that this more refined ontological and procedural mode of translation as one of the two poles of modern practice” (p. 49). Latour admits many of his concepts and methodologies are ethnographic in nature, and derive from the “sociology of science and technology” (Cressman, 2009), and that the central tenants of ANT come from a ”sociology of translation”.

ANT is comprised of four aspects. The first looks at the problem being tackled, and which actors are involved. According to Latour, the lead actors position themselves to become indispensable. The second aspect is to make other actors interested in the situation. The third aspect is having actors agree with their assigned roles. The fourth aspect makes sure the delegated actors represent the situation correctly.

Latour’s use of the word ‘actor’ is extremely complex and loquacious. He says, “An ‘actor’ in the hyphenated expression actor-network is not the source of an action but the moving target of a vast array of entities swarming toward it…Action is borrowed, distributed, suggested, influenced, dominated, betrayed, translated” (p. 46). I understand the use of the word ‘actor’ as any person or thing involved in an exchange, or chain of events that relates to a situation in the past, present or future that affects the outcome of that situation.

ANT clearly recognizes that works employing complex technologies are bound to stall, fail, and fall apart. This methodology also covers relationships between things (equipment, cameras, computers, cable connections), and transient, dissolving and re-forming relationships between “actors” (humans) and things. It allows for adversarial relations, since conflicts arise between human agents, or software and hardware components, or combinations therein.

Within this context any actor serves as an amalgamation of all the parts in a specific situation communicating with one another. This is referred to as punctualization. Punctualization can also be thought of as ‘encapsulation’ a process of enclosing bits of software programming code in ‘capsules’ that forms the basis of object-oriented programming. If the network breaks down, then the punctualization or communication breaks down, and the capsulation is broken open. This is referred to as depunctualization. Cressman refers to punctualization as “ the process by which complex actor-networks are black boxed and linked with other networks to create larger actor-networks” (p. 5). Depunctualization would be its opposite, where networks de-link from larger actor-networks. Interactions between specific actors are referred to as “tokens” or “quasi-objects” in a network. Tokens are created when networks connect, or experience punctualization. They can be thought of as tiny little objects existing for a brief moment in time. Creating tokens that are continually used strengthens the network. Tokens that do not perform transmission, either between objects, people, or objects and people, through either breakdown, conflict, or even boredom can cause full network breakdown. When an actor does not transmit the token, punctualization and reification decrease accordingly.

One of the difficulties of articulation in ANT is that everything can be viewed as either an actor, or as part of the network. It all depends on the perspective, or framing of the environment as to which label is applied at what time. In a physical network one computer can be one node alone by itself, or part of a multi-node system – depending on how one focuses on it. This analysis is definitive in working with both human and non-human 'actors', meaning components of the technology the co-lab teams worked within the context of their larger networks.

IMPLEMENTATION

Team Glass was unclear about how to actually implement their cyborg sense of interpreting solar flares. The team leader Laurie considered all suggestions from all team members. She decided all ideas were equally importance, which led to the team unable to make a decision, as all decisions were treated the same. Therefore, no one decision was acted upon. Team Radiation had a dominating team leader Arnold, who shut down other points of view. This led participants to withdraw, which led to a similar result in that no one decision was acted upon. The other team members resented his dominance, and refused to contribute anything further. Though the two team's styles were completely different (indecision vs. dominance), their outcome was similar in that both teams could not come to an informed decision to progress to the next step. Team Haptics had the most effective style of decision making brought about by team leader Marcella. Though she considered other's suggestions and talked through their approaches with them, she was able to make the final decision, albeit with everyone's consent.

The most effective way to have everyone in Team Glass come to a consensus and move to the next step was to sit with them during class and discuss their ideas as a group. After one particular rough patch of listening to all their concerns and difficulties about finding a solution to creating a solar flare sense, I analyzed the situation using ANT methodology. I saw that they had no 'actor' in that they had nothing supplying raw information for their project's goal. I suggested they consult NASA's on-line database of solar flare data to anchor their concepts in something tangible and known. A team member then came up with a programming solution to connect the raw data from the NASA space station to a piece of actual hardware. The data, though programming code, triggered a small light to turn on each time it reached a certain numeric threshold. Though it seemed like a small breakthrough, it completed the ANT network comprised of people and non-human 'actors'. In this case the 'actor' turned out to be raw data that linked to programming code. Once the team saw actual progress in their project, they gained confidence in agreeing on a next step. They were now 'punctualizing' and passing 'tokens' between one another, and within the overall existing network. The next step consisted of finding the correct grade of silicon to make a synthetic skin that would encase LED lights. This skin would eventually be placed on the body.

Sitting with Team Radiation during class was not as effective. They required delicate intervention on a one-to-one basis, either right before, or right after class, or through email, and only in private. Team leader Arnold deliberately spoke in more technical terms than the rest of his team in order to both confuse and dominate them. He viewed it as an affront to his abilities and competence if he were directly questioned in front of others. Only one other team member was technically knowledgeable enough to even challenge him, which led to a very public stalemate between the two. When this stalemate happened 'tokens' or messages between actors ceased. What was necessary was to have all actors exchanging tokens, or units of information in order to drive the creative process forward. I sent individualized, personal emails to the two clashing members, and then spoke to one of them privately before class. I suggested he reconsider his perspective. This ultimately led to the reintroduction of tokens, or the exchange of information.

Witnessing these real life experiences bewildered the Parsons students on each team. They needed assurance that the lab was not running itself into the ground, and that these types of disturbances were a natural and disruptive process of creative inquiry. The students were also grappling with readings on the posthuman, experiencing authentic encounters with real cyborgs, as well as coming to grips with the newness of robust team interaction where their input mattered just as much as any seasoned professional. At the conclusion of every session each of the team leaders stood up summarizing and reporting to the other two teams what their progress and setbacks had been for that particular week. This showed each team that the other teams were experiencing similar trajectories, meaning breakthroughs and obstacles within their progress. For example, Team Glass may have understood that day what circuits to use, but their software coding did not work. Team Radiation may have connected two different pieces of hardware together, but the output was not clear, and there was no way to interpret their data. Team Haptics may have been unable to coordinate their four accelerometers, but they were all in agreement about the difficulty. When each team listened to the other teams experiences, this became part of their ability to see ANT in action, though the term was never discussed. It was not discussed because it would have shifted the focus from a hands-on, practice based lab to a theory-based discussion of methodology of collaboration.

With Team Haptics the team leader used her own body as the site for experimentation. Due to a medical condition her gait had a delay between her intention to walk, and her actual leg movements. The idea was to build a portable motion capture detection system placed on her body that would alert her though either a slight haptic pressure, or audible sound that she needed to change or modify her gait.

An ANT analysis of the situation revealed a functional dynamic between all the participants with a constant flow of 'tokens'. The team leader's body was the main 'actor'. That body was not communicating correctly with all its sub actants. It was not 'punctualizing' with its various parts. The solution was to color code specific points on her body as nodes of different colored light, then film them in order to assess her actual gait, and this strategy re-introduced punctualization between her body parts. It was accomplished by using portable accelerometers that interpreted the numeric of "X "(length), "Y" (height), and "Z" (depth) coordinates. The team would then mathematically create a responsive software formula to read the X, Y, or Z body coordinates over time. This data served as the basis for re-punctualizing the coordinates of a depunctualized 'actor's body.

ANT METHODOLOGY AND ARTS PRACTICE AS PRACTICE BASED LEARNING

How can one define and defend arts practice as research and learning without a results-oriented investigative methodology that is quantitative or qualitative? Linda Candy, a professor of creativity and cognition research states this tension arises because of the need for professional practices to be defined in a way that is commonly agreed (Candy, 2011). This commonality takes place within the confines of the research university, as opposed to other locations and institutions. The research needs to conform to those norms in order to be validated and certified as having worth, and contribute towards the production of knowledge.

Arts professor Stephen Scrivener (2004) defines research as "an original investigation undertaken in order to gain knowledge and understanding." However, art making does not just contribute 'original knowledge' in the form of the end product art object (p.1). It is the entire process, and the knowledge gained during the process that contributes towards the making of original art in a practice based setting that spurs innovation. Scrivener argues linguistic statements or propositions are more valued inside academia as contributing something of substance rather than art objects or creative works in and of themselves. The works produced by artists, such as speculative cyborg senses do not always contain 'arguments', the pillar of academic discourse. Because of that arts practice, even using methodologies like ANT, has been viewed with varying degrees of suspicion.

Curatorial and interaction design professor Lizzie Muller (2012) argues that the artist/practitioner creates new knowledge while engaging in 'real situations' instead of solely setting up situations to create new knowledge. There is no hypothesis to disprove in these events, just an experimental path to engage with, as was the case with Teams Glass, Radiation and Haptics. The practitioner's role becomes that of someone adopting a 'stance towards enquiry'. New tools of enquiry must be chosen from a range of practices that involve art, design, science, engineering, psychology, and critical theory to make these types of inventive explorations within practice based scenarios. It is under these circumstances the artist is working with a hybrid or a "transdisciplinary" mode of inquiry. The work of Robin Nelson, Director of Research at University of London Central School of Speech and Drama has models of 'knowing' that more realistically resemble the environment of today's interdisciplinary and transdisciplinary practices (Nelson, 2014). Nelson's models also align more closely with Latour's ANT methodology, in that the 'know what works' can incorporate both the working, and non-working actors in a network.

Creative practice does not usually begin with a problem. It begins with, according to MIT professor of community development Cesar McDowell, an odd or ‘messy’ situation (McDowell, 2007). How to figure out what the problem is within any disorganized situation uses a process of framing. The origins of the idea of framing arise with John Dewey’s notion of the ‘Problematic Situation’. McDowell explains it begins with a ‘vague image of a reality’ that is identified from a surfeit of the complexity. These identified parts or features are coherently organized in such a way that the problem can be defined. The goal is to drive the thrust of the transformation of the situation by using the elements derived from the information in the frame. Understanding the framing and applying ANT analysis to its outcome was a driving force behind the co-lab.

Framing looks at how the issue or problem is named, organized, and described. Rhetorical frames can be compared to espoused theories, or what an individual or group thinks they know through speech and writing. This became evident in the Team’s Slack postings, and in the student’s Tumblr. Action frames can be thought of as theories-in-use (op. cit.) in live time response to difficult or perplexing situations. This would occur during class time during the building of the cyborg senses. Rhetorical frames can debate with other rhetorical frames of meaning, convincing others that a specific conceptual frame is correct. The conceptual or rhetorical frame that wins this kind of debate does so by exposing the weakness of the other frame, while making sure at the same time to cloak its own inherent logical weakness. Radiation team leader Arnold was especially skilled at this approach. Action frames occur during process, time based moments. They are often non-verbal and require action tasks, or motion based changes in behavior that affect instant changes. They may or may not incorporate the knowledge of a rhetorical based frame, or they can derivate and create something new. This would occur most frequently with Marcella’s Team Haptics, which experienced the least amount of personal friction. The two types of frames can work together, or separately. They are not dependent upon one another, though they can rely upon one another according to circumstances. Connecting the frames through ANT analysis became a methodological solution to moments of inaction, miscommunication and system failure.

McDowell also notes that identifying assumptions, which are part of action framing, is difficult. That is because tacit thinking is an assumption, or an underlying action frame. Once it is made obvious it usually turns into a concept or rhetorical frame. Values are the way we decide something, making a judgment if it is appropriate or inappropriate. McDowell says when we frame a situation live time we do so as an action frame, and apply tacit values. The reason it is so hard to find out what an assumption is because it “is a kind of reverse engineering that disturbs our belief” (op. cit.). It also takes a lot more time to reverse engineer a tacit assumption, instead of a more obvious and stated rhetorical frame. This working with assumptions that turned into concepts stood out the most in Team Radiation. Working in dynamic, evolving group situations can bring conflicts between disparate framing modalities, or can enhance these modalities. It depends upon the ‘actors’ within the framework. Practice based learning in conjunction with ANT methodology involves identifying which actors are not passing tokens, how the network is de-punctualized, and if it is possible how to restart modes of communication between points in the network.

CONCLUSION

There were approximately 40 team members and students, as well as various guests for a sixteen-week co-lab developing cyborg art at Parsons School of Design in New York City. Three cyborg senses were created as functional proof of concepts. Using the methodologies of Bruno Latour's ANT, team members collaborated in a practice based learning environment. ANT identifies an 'actor' within the network as either a person or a thing. This dynamically evolving designation evolved as the main 'actor' of each team shifted during the weekly meetings. The 'actor' could be the team leader, or the 'actor' could be the programming code. The next week the 'actor' could be the hardware. The following week it could be any of those three designations, or even more than one of them.

The 'actor' was examined to see how it communicated (punctualized), or did not communicate (depunctualized) within the confines of the network, including what kind of 'tokens' were, or were not passed. Structuring framing modes based in ANT analysis allowed various solutions to emerge. It required a skilled assessment of group dynamics with non-didactic interventions to keep all the 'actors' in the network fully engaged. As a methodology for a practice based learning environment in an art and design co-lab, ANT implemented practical solutions within a dynamic matrix of professionals, students, and evolving technologies.

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Integrated Design Process by Sequential Primary Generators

Isak Worre Foged *

ABSTRACT

This paper proposes, exemplifies and discusses a new design method that includes both artistic and scientific modes of working. It is based on the idea of integrated design processes driven by strategic implementation of what is termed sequential primary generators. The paper begins by discussing design and creative process research and then filters central aspects that are coalesced with a proposed three-phase early-stage design method. The proposed architectural design method has been applied in three university projects. In the last project, students were asked to respond to a questionnaire survey to identify the growth of design and creative capabilities from a student perspective. The paper presents the results and discussion based upon these projects and studies. Survey answers show that the proposed design method increases both design quality and design knowledge. This suggests that other creative processes may be addressed through this design methodology, which features both problem- and solution-driven procedures.

Keywords: Integrated design processes; Primary generators; Design knowledge; Advanced design processes; Design didactics

INTRODUCTION

Architecture can be understood as an interface of demands and desires. Arguably, the demands appear to become more strident as international and national building legislation pushes for, in particular, requirements for lowered energy use and specified indoor climate regulation based on climate change (IPCC, 2014; Klimakommisionen, 2010). The increasing requests on

* Isak Worre Foged, Department of Architecture, Design and Media Technology, Aalborg University, Aalborg, Denmark. Email: iwfo@create.aau.dk

science/engineering aspects add to the many other factors that need inclusion in the artistic design process of buildings. This in turn injects a series of predefined problems for the creative process, pointing to a problem-based approach to design. The development is not entirely new, nor is the knowledge that the earlier the different factors are considered in the design process, the larger potential positive impact they have on the outcome of the design (Ulrich & Pearson, 1993, p. 160).

Such knowledge pushes the tendency to include ever more evidence-based design parameters and related ideas in the early artistic, open and conceptual-based phases of design. The approach of early specific problem inclusion promises an increasing awareness of all facets and supports the idea of building-information modelling for the control of and argumentation for informed design decision making.

The approach of extensively informed design processes creates evidently comprehensive design models, typically aided by different software systems and computational methods (Kalay, 2006; Kolarevic, 2003; Kolarevic & Malkawi, 2005), enabled by growing computational handling power. While the technical issues of such systems mature and become more fluidly applied and robust in their functionality, a gap between the *free* conceptual-based design process and the problem-based *constrained* building information-based design process, which ideally should cross-inform each other, is identifiable (Bernal et al., 2015). Rather than becoming a means for better design proposals, the increasing integration of multitude parameter sets, which relates to a design problem, may halt the underlining processes towards the combination of systematic informed and unstructured—and at times impulsive—creative design processes. Nevertheless, it promotes the idea of an integrative approach, which is intended to facilitate a more comprehensive understanding of the complexity of design processes, and the making and maintenance of buildings.

Hence, from a design perspective, this suggests a study that furthers an understanding of relevant design approaches and how these become instrumental design methods, facilitating both technical demands and creative making. This offers us two questions of inquiry. What design approaches are relevant for the integration of technical aspects into creative processes? And, how can these approaches be made instrumental in design?

Methodology

To address these questions, this study employs a hybrid methods model, using literary studies, case studies, observation of students' design processes through supervision, observation of design progression through design schemas and a questionnaire, which asked students 20 questions on the topics of design knowledge, design processes and design tools.

The background on previous solutions is based on the observations from the literature of how designers work and think. These studies have not necessarily discussed and elaborated on the notion of problem-based integrated design processes. However, if we consider the term *integration* as based on the definition of complexity, which states that *differentiation* is the number and differences of elements, and *integration* is the relations between these elements (Weinstock, 2010), we may have an understanding of integrated design processes as something that approaches design through the relations established between design elements. This, from the outset, suggests that all design activities intrinsically are kinds and parts of integrated processes.

Design processes

Christopher Alexander's (1964) *Notes on the Synthesis of Form* explores how design elements can be related and how they can be logically structured so as to understand these relationships. Alexander argues further for such relations and processes of design, which strive for a holistic design outcome through *harmony-seeking computation* (which are just as much logical processes as digital computational systems) that is based on progressive adaptive iterations (Alexander, 2009). The central argument is the idea of *wholeness* in which design aspects are structured as morphological transformations around a composition that is achieved primarily from formal relations, such as scale, dimensions, symmetries and so forth. To capture design relations, as illustrated by Alexander, is to try to visualise through schematic diagrams the often complex structure of a design process, whether it is a serial branching or a non-linear web of ideas and solutions.

A diagrammatic and possibly simplified version of a semi-linear process is depicted by Bryan Lawson's pyramid (2006)(first published in 1990), which consists of an axiom *problem* that enters a three-part process of *evaluation-analysis-synthesis*, which proceeds to a *solution* to the problem. The looping nature between the three design activities takes part in shaping a central characteristic, that of iterative processes. The iterative process is additionally argued to increase the level of novel design decisions within a project, and not only the quantity of design proposals (Akin & Lin, 1995), which serves to cover a field of solutions by the making of design variations. Aligning this structure closely with a *problem-based-learning* idea, Mary-Ann Knudstrup (2004) illustrates a similar diagram starting with a *problem*/*idea*, which constructs the basis for *analysis*, then *sketching*, *synthesis* and lastly *presentation*. Each phase has return loops to the previous phase, just as *synthesis* can return to *analysis*. The design process organisation resembles that illustrated by Lawson.

Seemingly, rather than unveiling the mechanisms of design process actions in the proposed diagrams, as attempted by Alexander, these general design schemes appear to become idealised organisations to decrease and capture a more nuanced and less problem-oriented approach among designers. Nigel Cross states that, from his studies of expert designers, successful design outcomes are not driven by extensive problem analysis, hence providing another perspective than that of the axiom problem within the above schemes being the initial starting point (Cross, 2004, p. 439). Kees Dorst argues more unambiguously that a design problem is not knowable at any specific point and that, in principle, it is irrelevant in defining a problem (Dorst & Cross, 2001; Dorst, 2006, p. 16).

This intuitively challenges our understanding of working from a problem-based axiom that is defined within a problem formulation. This is when a project is initiated and directed in response to the formulation of a specific problem to be solved, specifically in the tradition of and studies conducted based on the PBL-method. However, it may also offer the possibility of reconceptualising what the problem *is* and how the problem is *understood* and *instrumentalised* as a vehicle for an idea and project to progress. Such considerations point to two conceptual frameworks for working with creative processes, wherein implicit and explicit problem framing and solution search processes are entangled. These are *systems-thinking* and *co-evolution* processes, as discussed below.

While the specific characterisation of a problem may be omitted in creative processes, such as within a more artistic and subjective-based design approach, certain instrumental structures are utilised in these processes. Cross suggests from his studies that expert designers attempt to apply a *systems-thinking* approach, which helps them to construct a *problem framing,* wherein they can apply the solution methods of *first principle*. This in turn allows them to employ a fast and progressive approach (Cross, 2002, p. 18). This indicates that *systems-thinking* is instrumental in the understanding of potential problem frame identification and its creative and artistic design solution conjectures.

Aligned with these propositions, Birger Sevaldson (2013) argues for the strategic integration of systems-thinking towards meeting real-world complexities, which inherently become part of design processes, rather than the implicit design activity that expert designers have posited. Consequently, Sevaldson states that systems-oriented designers are predominantly interested in looking at patterns of relations across vast fields, rather than creating hierarchical and boundary-based design processes, through methods such as GIGA-mapping that expose a multitude of design-influencing parameters (Sevaldson, 2011; 2013, p. 3). However, even if the intention of systems-thinking is not to construct hierarchies, it may nevertheless help to identify design aspects that are of central concern, and what their relations and boundaries are.

Even if designers generally do not apply systems-thinking consciously, this aligns with the notion that expert designers apply parallel processes of thought to explore different preliminary solution paths (Cross, 2004) and evaluate these continuously through mental simulations (Dogan & Nersessian, 2010) to better understand a design context. The structure of these cognitive design processes seems then to form the underlying design progression enabled by what Lawson (2004a) terms *design schemas*. These are patterns of organisation representing both design-specific elements, which could be of a physical and metaphysical nature, and their relations. Whereas structuring processes in a systems-thinking approach, as presented and discussed by Sevaldson and others., search and map a very large number of existing aspects, design schemas seem to search and map 'non-existing' aspects, or the output of the design cognition process. These are then reinstated as means for further design thinking. The relative structured process of both systems-thinking mapping and design-progression mapping support then the four design modes of *solution-*, *problem-*, *information-* and *knowledge-*oriented approaches (Cross, 2002; 2004; Kruger & Cross, 2006), with the former two being prevalent.

Cross' studies suggest that designers apply various forms of design cognition and that a solution-oriented approach increases creativity, while a problem-oriented, or problem-based, approach increases quality. It is, however, less unambiguous which orientation can be considered more favourable when looking across different design tasks. A singular focus on either of the two dominant design activities appears thus to reduce the design process quality, which is supported by the statement that expert designers apply *co-evolution* processes (Dorst, 2007) that alternate between problem- and solution-based techniques.

The idea of co-evolution was originally described by Mary Lou Maher and Josiah Poon (1995, 1996) as a way to explore the parallel development of a problem- and solution-space through genetic algorithms, and its successful computational implementation can be meaningfully transferred to the nature of design-cognitive strategies.

Thus, problem-solution by co-evolution as a process marks itself as a 'natural' cognitive procedure in creative design processes. Nevertheless, both propositions of systems-thinking and co-evolution can immediately be understood as in contrast to the findings of *primary generators* in design recorded by Jane Darke, who published her paper, *The Primary Generator and the Design Process*, in 1978. In it, she outlines the relative singularity that expert designers apply within their process. This argument has been supported by the aforementioned Lawson (2004b, 2006) and Cross (2004) positing the apparently opposite behaviours in terms of vast non-targeted field searches as a creative and artistic approach to making. These approaches found among expert designers are singular design focal points towards a solution. However, the application of focal aspects, *primary generators*, are, as discussed by Cross above, based on a preliminary systems-thinking approach that filters and selects those factors that are primary for the creative design evolution.

From the above, a set of expert design processes appears essential. These processes apply both a problem- and solution-based approach (co-evolution) and are not necessarily focused on a given problem but rather on the exploration of aspects that frame a problem field. This appears paradoxically to be achieved through solution-based fast iterative processes of versioning, rather than the making of a large series of very different proposals. This points back to Alexander's notions of *structured transformational morphologies*. Concerning the iterative design process, Michael Speaks (2002; 2006) argues that such procedures do not only advance a design proposal, as stated above, but equally increase processes of learning, what he refers to as *design intelligence*. This is central as making becomes a fundamental method of learning, which exceeds design fields into how humans generally develop deep knowledge, according to anthropologist Tim Ingold (2013). The objectives of iterative design procedures become therefore both to advance a specific creative design conjecture and to develop the ability to increase learning to construct other proposals in future design tasks. Speaks reciprocally problematises creative processes that are not based on iterative design, as these will lead to a lack of competence growth that prohibits future advancement and proficiency in solving similar creative design tasks.

From the literature discussed above, the creative design process applying both scientific and artistic modes of working, and which aims to create novel design contributions and extend design intelligence, is based on:

- Rapid iterative versioning procedures
- Co-evolution processes
- Primary generators to drive the process
- Design schemas structured potentially in the form of systems-thinking methods to capture complexity

A THREE-PHASED SEQUENTIAL PRIMARY GENERATORS DESIGN METHOD

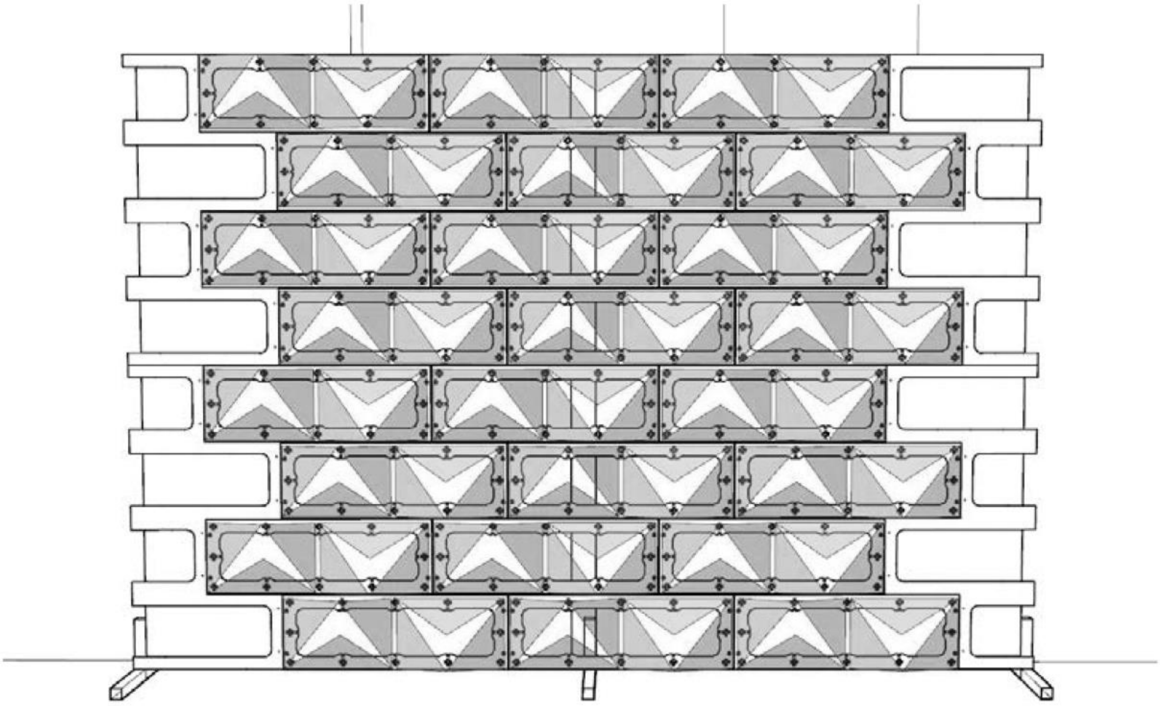
The background for a potential solution in advancing a new integrative design method is based on the four design process aspects listed above. In the educational setting of a university, where the objective of the course or project is open, such as the design of a large sustainable housing complex with a multitude of parameters, all four design strategies seem instrumental. In a more narrowly defined project, it can be proposed that an initial filtering of primary aspects to integrate may have taken place, omitting the vast search through systems-oriented methods. This, however, does not necessitate the exclusion of systems-thinking and design schemas in the iterative co-evolution processes driven by preselected (i.e. by the teacher in a pedagogical context) primary generators. The latter approach is the focus here and suggests integrated design processes through the application of *sequential primary generators*. From this, it is hypothesised that primary generators can be a strategic didactic approach to balance between the artistic conceptual clarity and building science integrative necessities in contemporary and future architecture and design while increasing design knowledge and design intelligence.

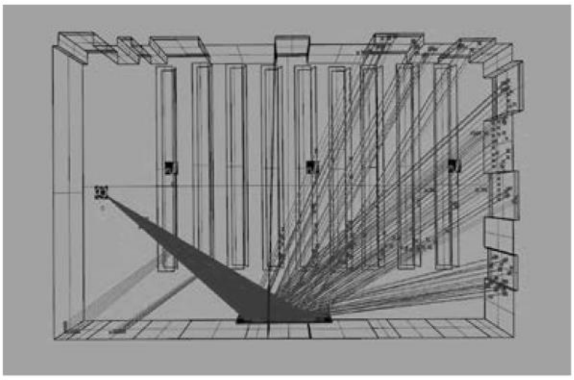
What is distinctively new is the idea and method of a sequential integration of primary generators, rather than the primary generator being maintained throughout the creative conjecture. In the case studies presented below, primary generators are based on a topic, that being tectonic-based architecture, aerodynamic tectonic-based architecture or acoustic tectonic based-architecture. Key aspects within these topics are then sequentially addressed in a three-phase design model, starting from a bottom-up approach, where an *Element* is developed, organised into a *System*, which then allows for the processes of *Formations*.

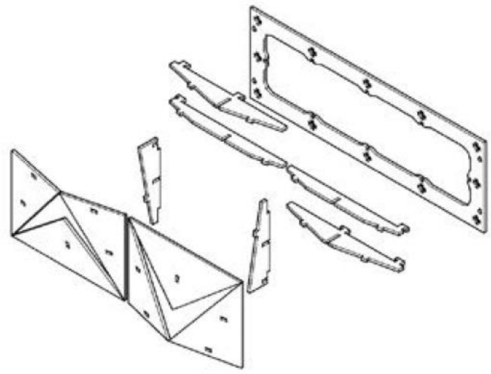
In the case studies presented, the attempt was made to apply the proposed fast iterative design process method, which is based on a sequential integration of primary generators. The context of the implementation was a university bachelor's and master's programme in architecture and engineering. The three design projects presented were three to four weeks in length, amounting to 13 to 18 working days. The period was separated into the above-mentioned design phases, and students were asked to create design proposals based upon a narrow set of primary generators related to the subject studied. Students were asked to develop three to five design proposals in each phase, thereby promoting the concept of a rapid succession of design development. Each design version was registered in a design schema (Figure 1), including artistic-, design- and science-oriented representations, such as hand drawings, physical models, textual descriptions and computational models and simulations if applied in the specific project.

Tectonic Studies and Experimentation // Sheet 2 // System ***2016***

Student: [redacted]







Since the last sheet the design has now been placed in a modular system, which reveals a horizontal repetitiveness and a subtle directional seriality along the vertical axis. The left and right sides of the panel are flipped in relation to each other, which makes it hard to determine each specific panel from the one next to it.

The concept behind the support structure is similar to the model pictured in Sheet 1, but it has since been modelled in Grasshopper, making it parametric. Each acoustic panel connects to the support structure through one or two mortise and tenon joints but are not otherwise connected attached to one another.

To make for a bit simpler analyzes, the variation of the panels has been limited to two factors – the protrusion of the triangles and the size of the gaps between them. Each half of the panel protrudes and shows as much as the other. The geometry allows the panels to spread sound and / or absorb it.

The aim of the acoustic simulations has been to analyze the results of different combinations between protrusion and opening. The result of the ray tracing shows an agreeable spreading to rows in the back of the lecture room.

The nature of the geometry makes it difficult to control the direction in which the sound is spread out.

Figure 1. A design schema showing different forms of documentation, representation and communication. The schema also serves to encourage students to reflect on the work produced through the 'reproduction' within the schemas.

Each phase was initiated with a short brief presenting the primary generators, followed by a short evaluation of each phase, discussing and concluding with design propositions. This served to clarify the necessity to stay within the prescribed theme and the primary generators applied to the specific design phase.

Furthermore, switching between design media, design modes and design focal points (primary generators) within the proposed design method strategically attempted to avoid *circumscribed thinking* ('A serious problem may be that the design ideas were limited not only to what is possible with a given tool, but what is easiest. In the case study, time pressures often forced the designers to generate intended designs in the easiest way possible'), *premature fixation* ('A resistance developed to ideas that would lead to too many changes to the model itself or to its underlying structure') and *bounded ideation* ('It seems that the mundane nature of drafting on a computer, exacerbated by technical problems and software bugs, is a distraction from the actual process of designing, and especially from idea generation and creative problem solving'), which have been detected as potential problematic issues when applying the computer as a design instrument (Robertson & Radcliffe, 2009, p. 137). It should be noted, however, in the critique presented by Robertson and Radcliffe, that such problems related to computation may be rooted in lack of experience with creative computational design processes and the requisite fluency for application in the creative processes of making. This discussion is further addressed later in the results and conclusion sections.

DESIGN METHOD APPLICATION

Following the introductory discussion and a partial conclusion on the four aspects that form the proposed integrated design process, and the general description of the proposed design method, the three design projects subjected to the method are briefly presented below. Of particular interest is the latter project, a survey conducted among students to obtain feedback on the creative process to determine design knowledge and design competencies growth based upon the proposed didactic model applied in all three projects.

The common design process model used was based on the above-mentioned three phases: *Element, System* and *Formation*. The intention was to segregate aspects to allow integration. This contradictory approach was based on the need to understand the separate aspects (differentiation) before they could be meaningfully combined (integration). And, importantly, it allowed one or a small number of primary generators, which gradually increased in number throughout the phases, thereby increasing the integration systematically.

An *element* can be, but is not limited to, a single geometric/material entity. It constitutes an elementary module. It is termed an *element* despite its potential multi-entity constellation, because any element, in principle, can be broken down into smaller entities. The primary generators for an *element* are typically material properties, geometrical definition and assembly logic (if comprising multiple entities).

A *system* is a cluster/assembly of *elements*. It describes how elements are combined and nested as a non-hierarchical or hierarchical system. The clustering of two *elements* is the minimum configuration, whereas the maximum depends on the constellation of the *element* to form potential complex *system*-level assemblies. The primary generators for a *system* are typically geometric definition, assembly logic and boundary conditions.

A *formation* is an organisation of *elements*, enabled by the *systems* definitions. A *formation* constitutes the entire organisation and is defined by the properties of the *element* and *system*. A *formation* is typically perceived in the architectural scale. The primary generators for a *formation* are typically environmental constructions and boundary conditions.

In essence, the *element*, *system* and *formation* structure is a nested organisation with different primary aspects situated within each level that, when combined, offers a creative mode, within a systematic and goal-oriented integration of aspects that define the architectural solution conjecture. It often follows a modular organisation, but is not limited to visual perceived modularity.

Case 1: Tectonic Studio

The *Tectonic Studio* is a master's programme studio carried out over four weeks, focusing on tectonics in architecture from a structural and joint detailing perspective. The design task was to propose a pedestrian bridge. It should be noted that structural integrity and exploration does not equal structural optimisation in this project. Students were not asked to perform calculations/simulations of the structural behaviour, but rather to work from *first principle* when freely generating proposals (Figure 2). The primary generators for the three phases were:

Element: Wood joint, wood material properties, rod material properties, geometric definition
Systems: Assembly logic, wood joints, structural force transfer
Formation: Bridge boundary conditions (landing), environmental influence (views and wind loads)

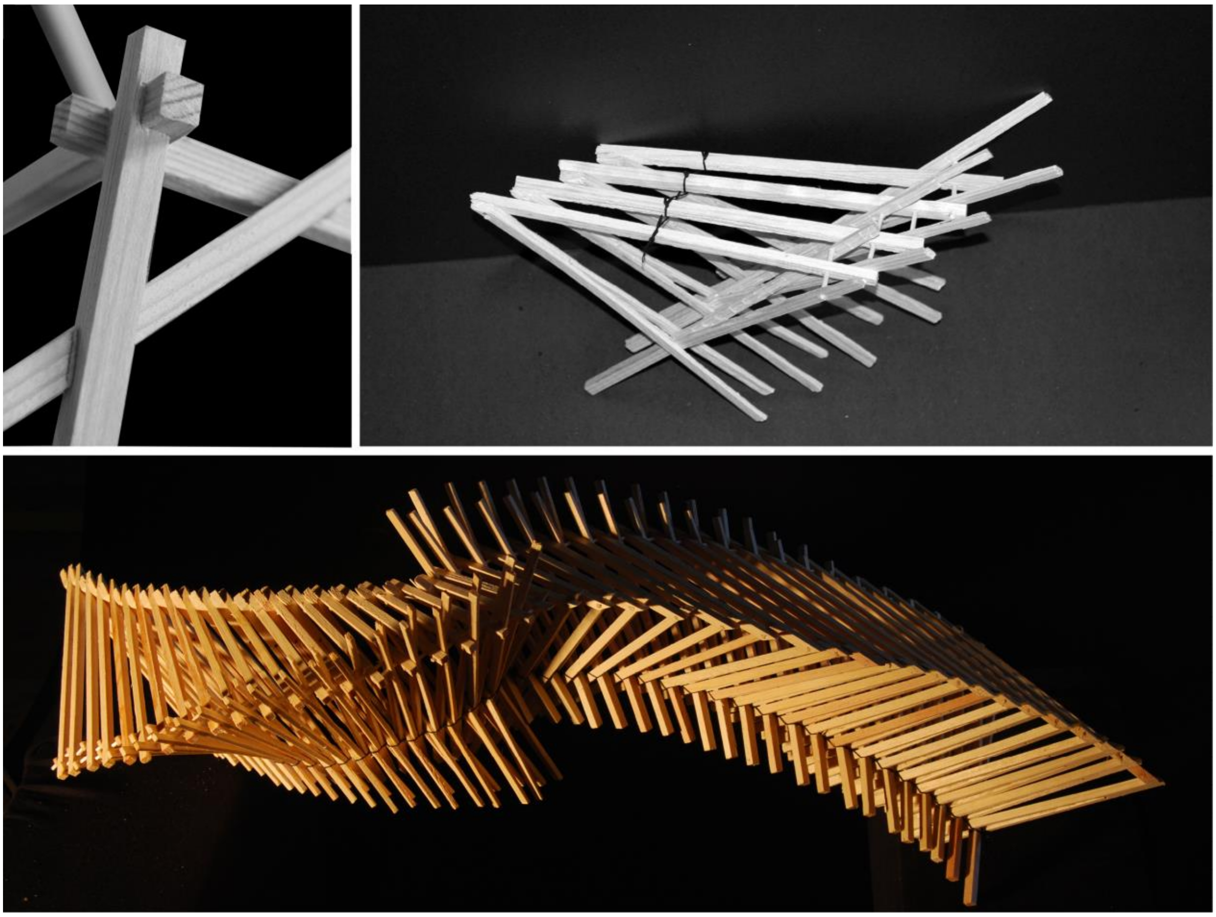


Figure 2. Three phases of the Tectonic Studio design process, moving from element *design, to* system *design, to full* formation *design. Photographs by student A and author.*

Case 2: Aero Tectonic Studio

The *Aero Tectonic Studio* is a bachelor's programme studio carried out over four weeks, focusing on tectonics in architecture from an aerodynamic and assembly logic perspective. The design task was to create a small shelter. Aerodynamic assessment was conducted in elementary physical experiments and in a wind tunnel constructed for the specific course, allowing studies in a 1:100 scale. The physical experiments served to increase the understanding of the aerodynamic complex phenomena, which in turn allowed informed design proposals (Figure 3). The primary generators for the three phases were:

Element: Geometric definition of planar wooden entities, local aerodynamic behaviour
Systems: Wood assembly logic, wood joints, structural force transfer, aerodynamic regional behaviour
Formation: Shelter boundary conditions (foundation), environmental influence (aerodynamic global behaviour)

Figure 3. Three phases of the Aero Tectonic Studio design process, gradually integrating primary generators that allow a final understanding and design proposal of complex aerodynamic behaviour in a fabricated planar plate with interlocking wood construction. Photographs by student B and author.

Case 3: Acoustic Tectonic Studio

The *Acoustic Tectonic Studio* is a master's programme studio carried out over three weeks, focusing on the tectonics in architecture from an acoustic and assembly logic perspective. The design task was to create an acoustic spatial enclosure with a student-defined acoustical phenomenon. Acoustic assessment was done through computational simulation and assembly logic was studied through physical 1:2 and 1:1 scale prototypes (Figure 4) and digital parametric modelling. The shift between media (physical and digital design making) was intended to circumscribe the issues that may arise in the singular computational-oriented design processes described (Robertson & Radcliffe, 2009). The primary generators for the three phases were:

Element: Wood joint, wood material properties, acoustic behaviour, geometric definition
Systems: Assembly logic, wood joints, structural force transfer
Formation: Space proportions, environmental influence (acoustic phenomena)

Figure 4. Acoustic Tectonics project pavilion derived from the proposed design process. The structure of elements, *which are organised in a* system *that allows* formations, *are detectable, yet the structure allows a plethora of design outcomes despite or due to its structured explorative process. Photographs by author.*

RESULTS

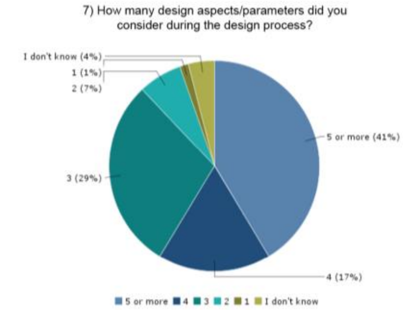
The design proposals and knowledge growth as a result of the proposed design method can be evaluated based on final design propositions, on the iterative processes and applied media registered in the design schemas and through the questionnaire survey.

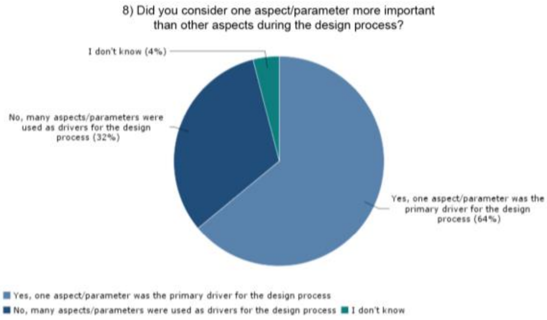
From the survey (Figure 5a, b, c), strong suggestions were registered concerning the relevance of the design method used and the use of integrating performance-based engineering aspects in early creative and artistic-oriented design phases. The number of students (74/95) responding to the survey amounted to 76 per cent. It shows that the use of parametric modelling and computational simulation techniques are key resources for achieving this. Only 1 per cent of students did not find it relevant to use digital parametric modelling in the creative architectural design process integrating engineering aspects and 85 per cent responded that the use of the techniques supported the creative process, with 32 per cent ranking 'high support'. A high percentage, 78 per cent, stated that the difficulties with applying and integrating the techniques were based on lack of experience or knowledge of digital parametric modelling. This challenges the suggestions in the literature that computational design processes limit the creative process. It points towards the limitation perhaps being found in the lack of skills, knowledge and competencies in digital design processes, which would otherwise enable a similar fluency in the generation of creative conjectures to that of more common artistic methods of sketching/drafting and physical model building.

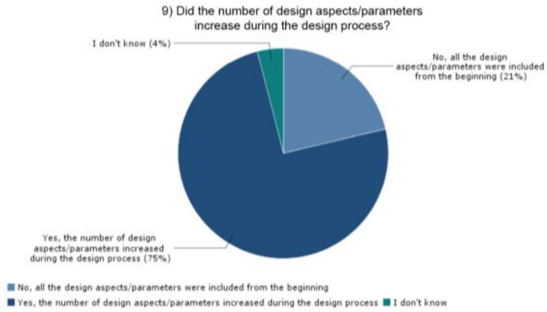
One problematic aspect associated with integrating complex phenomena into early iterative design phases, such as architectural acoustics, is the large set of parameters that simultaneously influence the design. In the literature, expert designers have been reported to immediately apply primary generators, limiting the large set, which directs the design process, based on an earlier systems-thinking approach. The integration of aspects is thus based on a rapid preselection of key parameters that, in turn, provides the basis for iterative versioning processes. The preselection of key aspects for the projects is intended to allow this iterative versioning procedure for novel design conjectures. With 86 per cent of the students following the prescribed design method of three phases, *Element*, *System* and *Formation*, and the use of the proposed primary generators in each of the three design phases, the design method applied appears to have supported this approach. Of the students surveyed, 69 per cent stated that early design iterations were increased, with 17 per cent reporting a 'greatly increased' number of design iterations towards design solutions. This number should be compared with the students' prior experience with design processes at university that strongly focused on integrated creative design processes that emphasise upfront informed iterative design progression. This means that 58 per cent of the students created a minimum of seven design iterations, looping between physical sketching/model building, digital simulation and synthesis, in 12 working days. Also, it can be noted that 75 per cent responded that the design aspects/parameters (integration) increased throughout the design process. While this integration increased, 45 per cent maintained the same aspects as the primary generator.

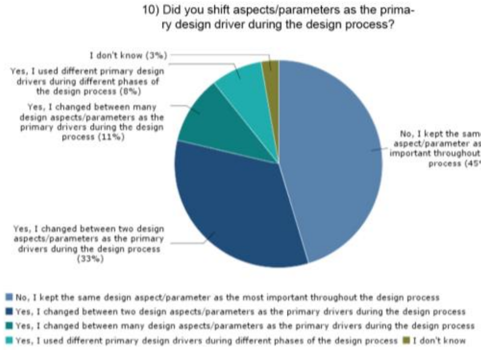
The sequential three-phased design process appears moreover to have increased knowledge, competence and skill level. Of the students surveyed, 90 per cent reported that their knowledge of parametric modelling had increased, and 91 per cent reported increasing their competences with parametric modelling. Knowledge of architectural acoustics increased for 83 per cent, and 96 per cent reported having increased their competences with acoustic simulations.

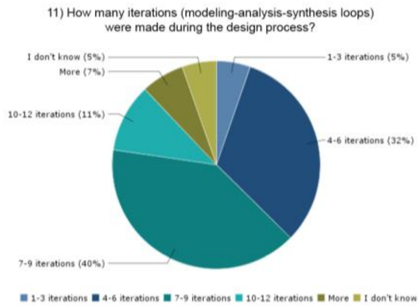
Design Process

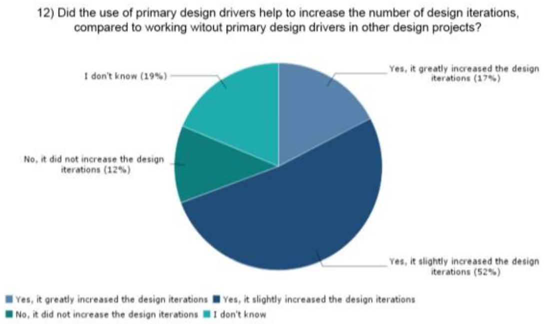


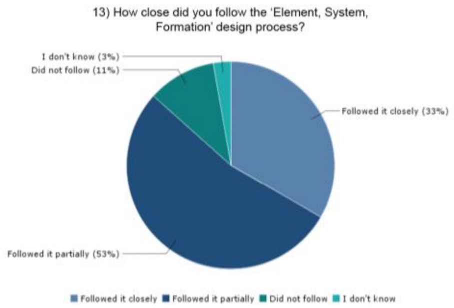












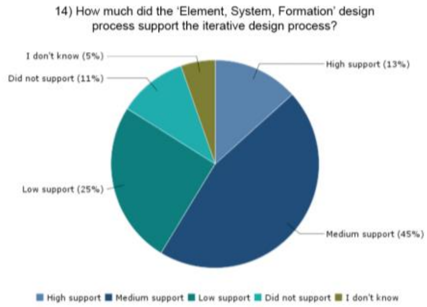


Figure 5a, b, c. Pie charts of the survey responses within the three questionnaire topics of Parametric Modelling, Design Process and Design Knowledge. Survey and graph figures by author.

DISCUSSION

Based on the responses obtained from the survey and the registered iterative processes in the design schemas, it can be concluded that the proposed design method: a) supports the complex integrative design process; b) increases the creative/artistic capacity in the design process; and c) increases the number of iterations towards novel design conjectures. Equally important in the learning context, the method appears to have d) significantly increased the design knowledge and design intelligence of the topics studied within the very short time frame of three to four weeks, lifting the students one to two levels on the Dreyfus scale. This suggests also that the described and tested method for creative processes is a possible approach to teaching practices in which both artistic and scientific aspects are part of the curricula as a cross-disciplinary and cross-methodological study, including PBL environments.

However, it is also noted that non-expert designers (such as students) appear to have difficulty in concentrating the creative process around a small set of primary generators, despite such an approach potentially reducing the initial complexity for design progression. This observation is particularly visible when the primary generators are not visually based, such as aerodynamics, acoustics or thermal factors. The design approach of primary generators is therefore not intuitively used in non-expert creative (design) processes, but arrives from either substantial experiences, as observed in the literature, or potentially through strategic training and didactics, as attempted in the three projects presented in this paper.

Accordingly, while the numbers from the survey clearly illustrate a measured positive impact on the students' work, merging problem- and solution-oriented creative processes, it was possible to identify through observations that students often struggled to adapt to a process in which they only were to focus on a few aspects at a time. Invariable, students occasionally lost focus and started considering many aspects irrelevant to the design task, leaving the design method, which reduced the ability to follow the design conjecture towards solutions, which in turn are used as a platform to identify new problems. As the numbers show, students grew accustomed to focusing on a few primary drivers, and with training increased the iterative design procedure towards better design propositions.

Also, the use of multi-method techniques (sketching, physical models, digital models, digital simulations, physical simulations, diagramming) appears to enable a better basis for creative exploration and design iterations. The identification of both solutions and problems appears to be more tangible when a design is assessed and generated. However, it also requires a focus on the development of different techniques that complement each other, as the lack of experience reduces the usefulness of a method that would enable new design insight for further design progression.

When evaluating the design schemas of the students, it became evident that visual aspects were dominant from the outset. A large majority of the first design iteration was based on the construct of multiple subelements that had little or no acoustic effect and were near impossible to build. However, as students started to study and apply acoustic and construction aspects based on the prescribed three-phase design method, the number of iterations grew and the quality of their design increased with respect to the subject studied.

While the greater number of iterations, compared with common, less-structured creative processes, raised the quality of the design, it was also noted that the focus on increased iterations induced a lack of thorough and critical design thinking during iterations. With respect to this observation, a focus on increased iteration processes must ensure an adequate time frame for assessment in the sketch-analyse-synthesise process, while maintaining focus on the progressive and relatively fast looping process between creative activities.

CONCLUSION

The context of the study and the results produced should be considered and ideally be applied and tested elsewhere to promote further conclusions on the design method. It speaks to the support of the studies conducted that the design method has been applied across several singularly defined projects, with different scientific thematic aspects, such as structural, acoustical, manufacturing and aerodynamic parameters, integrated into the creative design process model. The number of students, between 90 and 100 for each project, working from the method proposed is also considered high; moreover, the group of students comprises both local and international visiting students with prior educational training in architecture, design and engineering, representing a versatile population of students.

The research presented suggests a design method for creative integrated design processes and argues for its qualities and capacities additionally as a pedagogical method. Questions that may be addressed in future work include, but are not limited to, the following: Is there a conceptual limit to how many evidence-based aspects should (and could) be integrated in the early creative design process towards a design proposal? Are aspects/parameters ideally integrated in parallel or as serial-influencing generators? Is formal (visual) language always bi-primary to other primary integrated aspects? How instrumental are secondary and tertiary generators? What other creative methods could be sought to balance between artistic clarity in a design proposal and the increasing parameters that must be part of the design process?

Acknowledgements

The author would like to thank the students taking part in the course modules presented, which are based on the developed didactic method, and from where the surveys are made from. I would also like to thank Mads Brath Jensen, a colleague at the department for ongoing discussions on how to develop the teaching method and the problem-based approach towards creative, science based experiments.

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APPENDIX

Survey Questions

Parametric Modelling:
Q1: How many times have you used parametric modelling, such as Grasshopper, for a design task?
Q2: How difficult is it to use parametric modelling for a design task compared with hand sketching?
Q3: How difficult is it to use parametric modelling for a design task compared with physical model making?
Q4: Why do you find it is difficult to work with parametric modelling, such as Grasshopper?
Q5: How relevant is parametric modelling to the architectural-engineering design processes?
Q6: How much does parametric design support creative architectural-engineering design processes?

Design Process:
Q7: How many design aspects did you consider during the design process?
Q8: Did you consider one aspect more important than other aspects during the design process?
Q9: Did the number of design aspects increase during the design process?
Q10: Did you shift aspects as the primary design driver during the design process?
Q11: How many design iterations (modelling-analysis-synthesis loops) were made during the design process?
Q12: Did the use of primary design drivers help to increase the number of design iterations, compared with working without primary design drivers?
Q13: How closely did you follow the Element, System, Formation design process?
Q14: How much did the Element, System, Formation design process support the iterative design process?

Design Knowledge:
Q15: How much has your knowledge of architectural acoustics increased during the project?
Q16: How much have your skills in acoustic simulation increased during the project?
Q17: How much has your knowledge of parametric modelling increased during the project?
Q18: How much have your skills in parametric modelling increased during the project?
Q19: How much has your knowledge of experimental design processes increased during the project?
Q20: How much have your skills in architectural detailing increased during the project?

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Bisociation of artistic and academic approaches in problem-based projects

*Falk Heinrich**

ABSTRACT

The article presents a theoretical elaboration of the potential relationship between the academic and artistic approaches within a problem-based educational setting. The investigation is based on Koestler's idea of the "bisociation" (blending) of dissimilar thinking and action matrices as the foundational mechanism of human creation in academic discovering, artistic creation, and humour, respectively. On the basis of my own experiences with higher education pedagogy exemplified by a concrete workshop held with students from two different educational programmes at Aalborg University, the article investigates the bisociation of artistic and academic matrices and codes by scrutinising how these apparent incompatibilities could be functions of a blending mechanism. The article proposes that the bisociation of the artistic and academic approaches should be understood as mutual inscriptions leading to an emphasised correspondence between academic abstractions and associative-emotional experiences leading to an increase in complexity, specifically, a multifaceted understanding including an emotional perception of today's societal challenges.

INTRODUCTION

This article deals with artistic approaches as being a part of academic education and research. It is not about artistic research (e.g., Borgdorff, 2010) or art-informed research (e.g. Savin-Baden & Wimpenny, 2014) (albeit there are many affinities, especially with the latter category), but about the meeting between (or even integration of) artistic and academic approaches in academic project work. During the past decades, artistic approaches have become more important for academic problem-based work that promise creativity and lateral thinking. However, these rather lofty

* Falk Heinrich, Department of Communication and Psychology, Aalborg University, Denmark.
Email: falk@hum.aau.dk

ambitions lack methodical and theoretical elaborations. The article aims at establishing a theoretical foundation for this field of convergence, acknowledging the historically determined distinction between art and academia (in Western culture). Thus, the article endeavours to theoretically describe possible meeting points.

The article is speculative to the extent that it rethinks an existing conceptualisation within a new context. Concretely, the article takes its point of departure from Koestler's notion of "bisociation", elaborated in his book, *The Act of Creation* (Koestler, 1977). For Koestler, any act of creation presupposes a contact of a kind of two different matrices of understanding and experience. His notion of creation, defined as the resolution or simultaneity of seemingly incommensurable matrices of understanding, urges me to ask whether I can use Koestler's theory of bisociation to conceive of a (theoretical) integration of artistic and academic approaches. There is an increasing body of publications and artistic research projects that is taking up this challenge, which Borgdorff describes as "an uneasy relationship" (Borgdorff, 2008). The underlying premise is that art and academia constitute epistemologically incommensurable frameworks (creating different matrices in Koestler's wording). At least, this is the underlying assumption of the societal institutions and many stakeholders representing these two domains. This situation makes Koestler's approach interesting.

Admittedly, thinking within Koestler's conceptualisation made up of matrix and code inevitably excludes not only other concepts of creation, but also other dimensions of the integration of artistic and academic approaches that cannot be subsumed under the notion of creation (such as documentation or dissemination). This means that only a certain type and certain parts of artistic-academic project can be captured and not others.

THE EDUCATIONAL CONTEXT

The academic and educational context for this article is Aalborg University's bachelor programme of Art and Technology, which is based on the pedagogical form of problem-based learning. Problem-based learning has two main features relevant for my thinking: group work and problem orientation (see, for example, Holgaard, Ryberg, Stegeager, Stentoft, & Thomassen, 2014; Kolmos, Fink, & Krogh, 2004; Qvist, 2004). For my purposes, project-related group work specifies that the incorporation of artistic approaches into academic work does not aim for the emergence of a new all-encompassing method, but rather that academic and artistic discourses are in constant dialogue, challenging each other towards the creation of 'responses' to a posed problem. In fact, this could be done by one person; in most cases, however, group members represent different positions and thinking and action matrices. Introducing artistic approaches to problem-based group work poses a lot of questions. For example, is the artistic approach linked to specified persons within a group and how does the group evaluate artistic ideas and methods in relation to problem-based processes? This article will propose a theoretical model that can be used to elaborate on these and similar questions, but it does not specifically deal with such issues. The second feature —investigative work is based on a defined or definable problem—stipulates that project work takes its starting point in existing, often societal challenges. This does not mean that the only objective is implementable solutions; rather, it means that the project must be reflective about the envisioned outcome in relation to the problem posed, regardless of whether this is a realistic solution or an investigation into the very nature of the challenge. The article will elaborate on how artistic approaches can further processes of problem elaboration and solution finding by adding methodologically and epistemologically very different dimensions to academic inquiry.

The concrete experiential and pedagogical contexts framing my theoretical elaborations are a workshop, which a colleague from engineering (Professor Lone Kørnøv) and I developed and held for students of Art and Technology (ArT) and Environmental Management and Sustainability Science (EMSS), the latter being an engineering programme and the former part of the humanities. Both are interdisciplinary programmes. ArT is working with both artistic approaches and methods form the humanities, EMSS with methods from engineering and social sciences. The incipient idea of the conducted 1-day workshop was to orchestrate a meeting between two different research discourses around a specific societal challenge: What to do with 30 tons of PVC waste left after a major week-long music festival? Every year, the festival participants of Roskilde Festival in Denmark leave approximately 30 tons of worn-out airbeds that cannot be recycled, but only disposed of in a landfill. The workshop included an evaluation session at the end and a questionnaire handed out to the students. I will mainly focus on the resulting concept of one group. My experiences and observations of the workshop and the resulting student ideas serve as a concrete manifestation that my theoretical investigation uses as a kind of sounding board. But my investigation is not an empirical one, it is not a case study, rather the student projects form a thinking platform, a kind of interlocutor constantly questioning my theoretical advancements.

THE SOCIETAL FUNCTIONS OF ART AND SICENCE

The cultural distinction between artistic and academic endeavours seems to be a result of *a priori* laws of human epistemology. To put it boldly, only the objectives of science and academia appear to be epistemological ones, namely, the gaining of knowledge qua cognisance, whereas the arts seem to be characterised by the production of human aesthetic expressions that are primarily aimed at stimulating the imaginative and emotional experiences, serving various purposes ranging from mere entertainment to cleansing (catharsis) and edification. The distinction between art and academia[1] is epitomised by the establishment of different societal institutions. In Western societies,

[1] My usage of the term academia entails all sciences including the human sciences and liberal arts (humanities). From the renaissance on, the liberal arts became an analytical study and no longer a practical one. The fact that the arts in

there are universities, research departments and ministries of science and innovation, and then there are art museums, theatres, art academies and galleries.

However, the aforementioned difference is a historical one, and thus, a contingent one. The distinction between art and academia has emerged in nascent modernity, in which art and academia came to serve distinct societal functions.

This development reached its culmination during the 18th and 19th centuries, in which aestheticism and romanticism were understood as a reaction to science, which relied on rationalist, generalisable methods and modes of argumentation, and also to industrialisation being an outcome of this scientific discourse (see, for example, Bourdieu, 1996). During this period, the societal function of the arts was to create an (aesthetic) counterbalance to the industrial revolution and scientific approaches characterised by increasing methodological rigour in terms of experimental validation, causal-logical argumentations and general applicability.

Concurrently, merchants, bankers, and manufacturers took over economic and societal powers, resulting in the proliferation of a labour rationale that valued productive work (well supported by Protestant morality). In his book *The Rules of Art* (1996), Bourdieu describes the social conditions necessary for the rise of the arts as an autonomous aesthetic domain. The arts took on compensatory, aesthetic functions such as the production and representation of beauty and the sublime, and the creation of fictitious realms on the basis of imagination. System theorist Luhmann (1997) describes this as a functional differentiation of the system of art, which occurred in the 17th and 18th centuries. Art, he claims, became more and more self-reflective and established its own code and communication form. During idealism and romanticism, art focused on beauty as a subjective judgement and as an expression of the feeling of an unachievable ideal that yields both pleasure and the feeling of loss (Luhmann, 1997, p. 286).

During that period, the separation between the humanities and natural science also became more distinct. The humanities found themselves in a difficult position, because they needed and wanted to adhere to scientific standards of, for example, categorisation and systematisation, and at the same time, elaborate on topics that defy systematisations. Kant's *Critique of Judgement* is a splendid example of a systematic elaboration of the human faculty of aesthetic judgements, which by his own account, are immediate and intrinsically subjective and thus seem to evade any systematisation. When talking about art, the philosopher Kant takes a reflective, descriptive stance by asserting that beautiful (aesthetic) art is the result of a transcendence of human intentionality. The act itself cannot be described or planned. Up to today, many disciplines of the humanities have become more and more scientific in terms of the application of standard methods of investigation, data collection, and

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many countries have come part of the university system, can be seen as an indicative for the reverse development, sustaining an ongoing integration of the arts within research institution and methodologies.

data interpretation, and argumentation and dissemination formats. Speculative investigations á la Nietzsche’s writings are no longer possible (or are not counted as part of academia).

My short introductory, genealogical spotlight is meant to prepare the discursive grounds for an envisioned integration of artistic and academic methods. I claim that the distinction between what we today call artistic practice and academic discourses is a historically constructed one, more precisely, a modern one. That means that there are no logical reasons why artistic and academic approaches cannot be combined.

RECIPROCAL RAPPROCHEMENTS

Over the course of the 20th and the beginning of the 21st centuries, the humanities and social sciences (and increasingly also the natural sciences and engineering) not only have embraced the heterogeneity of their subject fields and the unavoidability of the researcher’s subjectivity as a part of the research findings, they also have acknowledged that science generates its research fields. Knowledge is no longer only the result of discoveries, but is (also) seen as constructions: not only conceptual constructions (theories), but more and more, the constructions of materials and intelligence as well (see, for example, Latour’s (1999) elaborations and the field of artificial intelligence and robotics). In contrast, art in modernity has never claimed to produce anything other than overt and communicated constructions in the form of artistic creations (literary or filmic fictions, installations, pictorial representations, drama, etc.). Furthermore, works of art in modernity have never claimed to capture reality per se, but instead to say something about the variety of human sensations and perceptions of life, and more and more, about the possibility of variations and the mere potentiality that lies within creation as well. Here, I am thinking about the different avant-garde movements and their legacies.

Today, the scientification of the humanities is counteracted by a growing expansion of permissible methods, thus allowing art and artistic approaches to also play a role in the academic community. There is an increasing number of publications advocating for artistic research, arts-based research or arts-informed research (e.g., Sullivan, 2010).

Nevertheless, due to the momentary socio-functional distinction between art and academia, the methodical— and thus also epistemological—expansion of academia will not come easy. A brief handhold semiotic investigation of often-cited texts dealing with artistic research and art-based research shows a classificatory scheme in which certain keywords are used to characterise artistic approaches and academic discourses, respectively. Words describing the arts are, for example, “subjective”, “particular”, “unique”, “tacit knowledge”, “materiality and immateriality”, “emotion”, “intuition”, and “evocative”. On the other hand, terms describing academia are “reason”, "normative", "explanatory", "validity", "verification" "exact knowledge", "formal statements", "evidence", and "generalization". These terms are used by Borgdorff (2008), Eisner (1981) and Wilson (2002). From academia (especially the sciences), we expect a formalised investigation through agreed upon methods leading to an (at its best) exclusive interpretation of the found data. On the other hand, art allows for inherently subjective and singular expressions that favour complexity and heterogeneity in its investigation and reception, which in principle is purposeless. Art is not obliged to come up with solutions to defined problems. On the contrary, art, at its best, creates problems. To mention an often-uttered expression: Art pieces produce non-trivial questions. The described historical development has created a sense of incompatibility between art and academia, despite the fact that both academia and art show a huge variety of forms, methods, objectives and results. Even in the branches of the humanities dealing with art and aesthetics (art history, dramaturgy, music, etc.), the demarcation line between academic scholar and artist has been upheld for a long time, thus favouring hermeneutical research. However, during the last decades (depending on the particular national policies for science and art), there has been a call for inter- and even transdisciplinary collaboration. The "crisis of representation" (Adams, Jones, & Ellis, 2015) and the subsequent surfacing of explicitly subject-based methods of enquiry, such as autoethnography, which takes the researcher's lived experiences as the empirical starting point for critical analysis, obviously have made this collaboration thinkable and operational. On the other hand, this incipient collaboration is also one outcome of the demand for additional research methods, satisfying new societal demands posed to and by academia. These demands are, for example, implementable solutions to societal problems, which necessitates that the mutual influences of multiple facets, such as the cultural, physical, technological, emotional and subjective ones, be addressed in order to create sustainable solutions. Artistic processes and artefacts can be one means to operationalise the subjective and emotional aspects of data collection and solution design and implementation. Evidently, this necessitates different types of research and educational projects compared to mono-disciplinary ones, for example, projects that address the public or certain groups of people in an effort to turn them into participants.

THE CONCEPT OF BISOCIATION

Koestler investigates the nature of creation. Written more than 50 years ago, he claims that creation is an act of bisociation brought about by the meeting of two different conceptual spaces. Creation is an event of clashing, blending or oscillating. He investigates three forms of creation: humour, science, and art. Hence, he follows the socio-cultural divide between art and science, contending that these human endeavours of creation are different in their processes and objectives. In this article, I will only deal with his conceptualisation of science and art as occurrences of bisociation.

Koestler's (1977) basic idea is the existence of different conceptual spaces defined by codes and matrixes. Conceptual fields are unified "formulas" or "matrices of thoughts (and matrices of behaviour)" (p. 39). "The matrix is the patterns before you, representing the ensemble of permissible moves. […] The code is the fixed, invariable factor of the skill or habit; the matrix its variable aspect" (p. 40). He makes metaphoric use of a game as a confined possibility space framed by rules in order to be able to work with different matrices and sets of rules. This allows him to theoretically play with the possibility of new emergent conceptual spaces or conceptualisations. Examples of matrices of thoughts are mathematics, which conceptualises the world through numbers and operational formulas; or materialism, which sees the world as acts of matter. Koestler's starting point recalls Kuhn's scientific paradigms (Kuhn, 1996, p. 44), albeit Kuhn's notion is more open, in that it is not entirely dependent on rules and assumptions. On the other hand, Koestler's notion also bears similarities with Bourdieu's habitus, as the bodily incorporation of disposition; in Bourdieu's case, social dispositions, and in Koestler's case, the dispositions of domains. For Koestler, dispositions are codes as "hidden persuaders" (Koestler, 1977, p. 42), shaping perception, muscular skills and visceral activities.

SCIENTIFIC CREATION

Koestler claims that scientific discoveries are the outcomes of the fusion of two different matrices. Parts of a scientific problem of one matrix are suddenly seen as part of another matrix (which is not necessarily a scientific one). The scientific problem is seen in the light of another domain. Koestler proposes that bisociation as fusion occurs as an unconscious process on a "lower level of mental hierarchy" (Koestler, 1977, p. 168), where pictorial similarities constitute the field of convergence. Aesthetic vagueness forms the bridge between the matrices. Sudden recognitions of similarities (analogies) are experienced as epiphanies. One of Koestler's examples is the invention of the printing press: "'The ray of light' was the bisociation of wine-press and seal—which added together become the letter-press" (Koestler, 1977, p. 122). The underlying point of bridging similarity was the very picture of pressing.

Koestler's theory captures a certain type of research that is characterised by discovery as a solution to a defined problem. Some scholars emphasise the occurrence of bisociation as epiphany or leap. Koestler describes this as "the spontaneous flash of insight, which […] connects the previously unconnected frames of reference and makes us experience reality at several planes at once." (Koestler, 1964, p. 45). Creation is here seen as recognition encapsulated in the solution of an (often technical) problem. In my opinion, this is a romanticising view of academic creation. However, Koestler himself writes in a more differentiated way that, "it [the discovery] may emerge suddenly, sparked of by an individual discovery; or gradually, as on the history of electromagnetism, where a series of individual discoveries acted as 'links'" (Ibid, p. 253). Today, however, academic creation also contains activities such as mapping, simulation and the production of methods, as well as action research and critical theory, which aim at empowering groups of people towards changing an oppressive or unfortunate situation. Does the concept of "hidden analogies" only address a very narrow range of academic challenges? Obviously, this is a question for a more general discussion of academic methods and creations.

Here, I want to concentrate on the possibility of using artistic approaches in an academic, problem-based setting. There is a difference between historic scientific insights on a global level and insights that might have a big personal impact. What interests me here, is the personal significance of bisociation, those rather small flashes of insight. As already referenced, Koestler explains that scientific bisocation (fusion) necessitates a lower level of abstraction in which concrete pictorial (and dynamic, I would add) representations dominate. This is the realm of aesthetics and day dreaming, in which (scientific) reason regresses to older forms of ideation, allowing for a combinatory play of and with vague pictures. If a new combination suddenly rises to a higher level of abstraction, a new idea, comprehension, or even discovery is surfacing. Undoubtedly, the development of aesthetic competences has an impact on learning and on intellectual and creative work, as many studies claim and document. For example, a study on the benefits of music for learning in this very journal (Lindvang and Beck, 2015). Further, there are anecdotal accounts of prominent scholars who are highly interested in art or even in playing the violin (Einstein).

What is of interest here, though, is not the educational or inspirational effects of aesthetics within academia, but the description of an altered framework for university teaching and research that supports the emergence of novel types of research projects. To express this as questions: What kind of theoretical basis does the bisociation of academic discourses and artistic approaches generate? And what kind of research projects could this theory support? I am aware that the last question is posed upside down, because we normally do not ask what theories could prospectively yield, but how we can theoretically understand the existing world and its phenomenon. Still, theories are always world constructions that open up thinkable realms and practices, which can possibly change our lifeworld. My hope is precisely that artistic approaches within problem-based academia can contribute to solutions and elaborations that can elucidate some of the black holes of academia. Here one can turn to what Koestler has to say about artistic creation.

ARTISTIC CREATION

The backdrop for his elaborations on artistic creation seems to be an art that distinctively positions the audience as contemplating recipients. Recipients are not active agents in the unfolding or creation of a work of art. Koestler never refers to interactive or participatory forms of art (that has only gained currency in recent decades). However, Koestler claims that the recipient is psychologically (emotionally and intellectually) participating. Koestler understands the creation of art not through the *poietic* act of the artist, but through the *aisthetic* act of the recipient.

Additionally, Koestler bases his enquiry of artistic creation on a fundamental scheme of thought, which comprises what he identifies as natural hierarchy: At the bottom, there is the individual (human being, cell, or other entities), and at the top, there is a social constellation (society, body, or material) comprised of these individuals or smaller units of individuals (e.g., families, organs) (Koestler, 1977, p. 288). Thus, the individual is both an autonomous entity and a functional unit, a "sub-whole" in a bigger system. Koestler takes this double existence as the very foundation of artistic bisociation: Art exhibits self-asserting and participatory tendencies (Koestler, 1977, p. 307). On the one hand, the recipients are projecting themselves into the social realm, a work of art emanates (by means of, for example, empathy with a dramatic hero or identification with a Greek statue), hence being a part of a community and its rules, costumes, etc. On the other hand, the recipients exert a self-asserting tendency allowing them to interpret and also judge the work of art as individuals. In his conceptualisation, a work of art creates a cognitive and perceptual distance, because it points to its own fictional and illusionary being, which is the requirement for this kind of bisociation to be played out. Not surprisingly, Koestler sees the very foundation of bisociation, namely the distinction between matrix and code, unfolding in art reception. The matrix constitutes the self-asserting dimension, in which the recipients find their own perceptual and interpretative way through the work of art; the code is the fixed framework that allows the recipients to experience being part of something bigger. Koestler calls the latter "symbiotic communion" (299). This recalls Nietzsche's elaboration of the Dionysian force in Greek tragedy, in which the members of the chorus become part of the initial force behind the dramatic manifestations on stage and all "real" life occurrences as a dreamlike illusion. "Tragedy in the Greek sense, is the school of self-transcendence" (Koestler, 1977, p. 307).

For Koestler, the fictional and illusionary character of art initiates the bisociation of the two matrices. It contrasts the bodily felt reality of the recipient, and its occasional dissociation of reason (on occasions of immediate engendered reaction) with the lightness of "self-transcending emotions" (p. 305); this removes the recipients from themselves and provides space for contemplation. This form of bisociation, which Koestler characterised as revealing fate as variability, contains the potentiality of catharsis, which shows itself as complex emotions such as awe or internal, relieving and sympathetic "weeping".

> "Thus the act of participating in an illusion has an inhibiting effect on the self-asserting tendencies and facilitates the unfolding of the self-transcending tendencies. In other words illusion had a cathartic effect—as all ancient and moderns civilizations recognized by incorporating various forms of magic into their purification-rites and abreaction therapies" (Koestler, 1977, p. 303).

CONVERGENCE POINTS

My condensed presentation of (some aspects of) Koestler's artistic bisociation shows two things: First, his elaborations focus on art's internal composition in light of its reception and effect on the recipient, not in light of production and art's poietic aspects. Second, his writings seem to advocate one type of art, which positions the recipient in very distinct way as a contemplative participant, who is sensing and interpreting a piece of art. I am, on the contrary, interested in the creational artistic act, in the conception and formulation of an idea and the material unfolding of a piece of art. Moreover, I am interested in the cross-field in which art conception and academic problem-solving meet.

This does not mean that I cannot make use of Koestler's conceptualisation. There are at least two important points that will help me in formulating a bisociation of the artistic and academic approaches. First, it is important to remember that artistic approaches work with the creation of fiction (and sometimes also illusions), thereby instigating a distinction between everyday reality, and what I, like Luhmann (2000), call imaginary reality. In my understanding, the notion of imaginary reality spans over illusions and fictions presented by, for example, novels, theatre plays, science fiction movies, and materialised ideas in the form of art installations and participatory events. Of course, there is a huge difference between computer-generated movies and participatory art events, but both work with the conception of "worlds of Then and There" (Koestler, 1977, p. 306). A first approach could be that academic-artistic projects—within a problem-based setting—work with or through the conception of changed/changeable realities. The term reality could entail the human life-world in its entirety, but in most cases connotes a situation, a setting, the context of a specific problem, etc. I will come back to this.

The second point is more difficult. Koestler claims that the blending mechanism of scientific discoverings is mediated by more basic, aesthetic forms of human ideation, for example, pictorial representation. When talking about artistic revelations, he makes the contrary move. The contemplative distance of the recipient of a work of art allows not only aesthetic partaking, but also interpretation and reflection ("higher mental activities", Koestler, 1977, p.305), thus combining primary emotions with reasoning. It seems that one meeting point between the artistic and academic matrices could be the regression of higher mental discourse to aesthetic forms, where the aesthetic dimensions of artistic expressions hypothetically act as the catalyst and trigger for academic discovery. The other meeting point could be found in the act of the sublimation of the art recipient's immediate impulses to act, generating an aesthetic tension between "self-asserting" and "self-transcending" forces. In this tension, the higher faculty of reasoning could play a bridging role in academic discourses by adding dimensions of feeling oneself as part of a system or even as an organism yielding emotional understanding and even compassion (all possible effects of "symbiotic communion").

Above, I have identified possible points of contact between academia and art within the framework of Koestler's conceptualisation. Remember, the overarching objective of PBL is the creation of knowledge, artefacts or events as elaborations of (not necessarily solutions to) societal challenges. My next step will be to consult the student project briefly described in the introductory sections of this article and to consider whether my theoretical extrapolations are promising. My application of Koestler's bisociation concept is the prism through which I will analyse the students' artefacts and projects. Because I have not chosen an empirical method, my personal unstructured observations—supported by my own experiences with artistic-academic projects—serve as a form of clarification of my theoretical claims, hopefully eliciting modifications and refinements of my theoretical claims. Hence, my examples could seem chosen to fit my theoretical claims. And indeed, this is true. However, I am not aiming for an all-encompassing model of possible integrations of artistic and academic approaches in learning environments (which is impossible); I am trying to find some theoretical and methodological meeting points between the two matrices that might allow the prospective formation of didactic and pedagogical measures for a fruitful integration of artistic and academic approaches.

A GRAVEYARD OF AIRBEDS

The one-day workshop brought together students from Art and Technology and students from the engineering programme, Environmental Management and Sustainability Science. The main part of the workshop consisted of interdisciplinary group work. All the groups included students from both programmes. The students were given the task of discussing and devising potential solutions to or somehow tackle the problem of the 30 tonnes of airbeds. The framework of the workshop included an introduction to the two programmes and their overall aims and a set of dogmas specifying, first, that the aim of the workshop is the production of solution concepts and, second, that the concepts should be based on synergies of both programmes' DNA. There were no directives given determining the kind or form of solution nor the process as such. In order to be able to discuss and negotiate possible concepts, the students had to find a common language. This was the main objective of my research interest in the workshop. How will the students deal with the assumed incommensurability of the two approaches?

Both groups of students were familiar and experienced with problem-based group work, albeit not in this interdisciplinary setting. Problem-based group work, as a learning situation, constituted a known framework supporting the process and possible collaborations between the group members, stipulating the expectations and possible outcomes (see, for example, Holgaard et al., 2014). Furthermore, the workshop was not directly linked to any examination, which allowed a playful attitude and conceptual and pedagogical freedom. Yet, the workshop could not harbour a full-fledged material realisation of the resulting concepts. At least artistic research paradigms (and many design and engineering projects) focus on the perpetual learning and discovery process during the production and material realisation of incipient ideas (see, for example, Scrivener, 2000). In this case, the bisociation process occurred (if at all) in the ideation phase.

For me, the most intriguing concept produced by one of the groups was the idea of a circularly arranged graveyard somewhere in the festival area consisting of a smaller number of graves. The graves would be covered with glass plates showing the airbeds in open coffins. The inscription would show the date of birth and death of the airbeds (often only several days of use) and the expected decomposition times ("PVC does not readily degrade and when it does it gives off a number of toxic materials"[2]). As such, the idea is rather simple. Seen from an artistic perspective, the idea alludes to works of art that present processes of decay (for example, Lemmerz' work *Scene* (1994) showing decaying pigs in exhibition cases) or, on the contrary, processes of preservation (for example, Hirst's *The Physical Impossibility of Death in the Mind of Someone Living* (1991) showing a tiger shark in formaldehyde. The concept theatrically and anthropomorphically stages the fate of this material, which is to be dumped in a landfill. The idea simultaneously works on an emotional, associative level and on a factual, documentary level. Graveyards and mausoleums are associated with funerals and grief. The airbeds are re-contextualised, estranging both airbeds—normally useful leisure objects— and human graveyards as sacred places of passage and transcendence. Everyday goods are shrouded with an atmosphere of human loss and holy transcendence. The staged situation is both ridiculous and sad. Seen from a purely scientific, engineering perspective, the idea does not contribute much to the solution of this problem, if we understand this as the development of new materials that could replace PCV or the formulation of laws and rules the prohibit the use of PCV in the fabrication of goods. The graveyard concept 'only' states that at this moment in time, PVC products cannot be decomposed, but can only be buried.

[2] http://www.brighthub.com/environment/green-living/articles/107380.aspx

NEXUS POINTS

Once again, it is important to recognize that the problem-based learning environment is a distinct setting that shaped the workshop, my educational experience, and therefore, also my theoretical assertions. Problem-based (or problem-elaborating) projects are fruitful arenas for the nexus between the artistic and academic approaches, because such projects are aimed at tackling societal challenges (that are surfacing independently of academic or artistic disciplines) and therefore often embrace the elaboration and operationalisation of multiple perspectives. Experiences with other settings would possibly change my theoretical elaborations.
So, back to my intermediate questions: Do the students' workshop projects confirm the theoretically identified linkages between artistic and academic matrices and how could those meeting processes be characterised?

During the evaluation session of the workshop (and in the questionnaires handed out after the workshop), the students expressed their surprise that the collaboration between the different students was not as difficult as expected, but that their respective approaches differed extensively. The Art and Technology students confirmed that the other students took their factual knowledge (about PVC as a material, its processes, advantages, and environmental disadvantages) as their starting point. The Engineering students characterised the Art and Technology students as persons spitting out—sometimes "crazy"[3]—ideas about how to use, transform, and decontextualise airbeds as products with distinct purposes: ideas such as huge clouds of airbeds sewed together hovering above the festival area as a sunshade, rain cover, or just as a strange, menacing object, or as tents and clothes fabricated out of used airbeds. These ideas are the upshots of associative, quite pictorial encounters with the material and the context that, in one way or another, provide unknown applications and bodily experiences. In imagining the idea of PVC suits, I do not think it would feel very pleasant, but rather heavy and sweaty on one's body.

The point of nexus is the concrete idea or the aspects of this idea that produce concrete impressions (for example, conceptual images, events, or even sounds). On the one hand, a concrete pictorial concept can be considered to function as a mutual inscription into the two different, but intersecting matrices. The academic matrix interprets the conceptual image as a representation of facts or the result of a scientific investigation. In the case of the above-described airbed graveyard, the graves illustrate known facts, such as decomposition time and disposal. On the other hand, a concrete conceptual image always elicits tactile and/or proprioceptive and emotional reverberations. As already mentioned, the graveyard will most likely be associated with funerals, grief, transcendence, etc. The associative images function as a kind of passage that allows either the artistic or academic features to be conveyed. Now, academic facts are associated with aesthetic reactions, and vice versa, complex, aesthetic emotions enclose academic knowledge. The bisociation of the artistic and

[3] As stated in one of the questionnaires.

academic matrices does not necessarily yield aesthetic tensions and ambiguous emotions such as awe, beauty, nostalgia, etc. (as in the case of art), nor does it necessarily yield a new conceptual space as the resolution of bisociative differences (as in the case of science). But it creates multiple––associative—linkages that constitute a category proper. Again, this category does not refer to a specific art form or artwork, nor does it supposedly lead to new scientific discoveries. Instead, it should be considered a particular creative practice within problem-based project work.

During the oral evaluation session of the workshop with the students, some reported one incident that, for them, was noteworthy. An engineering student referred to one finding within decision-making theory, namely that in order to be effective in terms of behavioural change, it is important to relate the constituents of a desired change to the everyday context of people, i.e., to something that is close. One Art and Technology student took up the notion of closeness and associated a dress made out of the airbeds, simply because a dress is very close to a person's body. The incident is not spectacular, but rather modest: the notion of closeness. However, it was a point of nexus between the two different matrices: a transformation of an academic generalisation to a concrete creative idea. For my elaboration, it is not important to judge whether this particular idea is of artistic value or not. I am solely interested in the meeting point, which must be able to harbour dimensions of both matrices or connect various points of both matrices.

SYMBOL OPERATIONS – EMOTIONS

Bisociations of artistic and academic matrices are a methodical practice that combines concepts with emotions and vice versa. Deacon, in his article "The Aesthetic Faculty" (2006), elaborates on Koestler's notion of bisociation by asking how two different conceptual matrices can blend and, moreover, how the blending can link cognition and emotions. Deacon's argumentative prerequisite is his assertion that humans have developed the capacity of play. Play is possible because we have learned to act and communicate by means of symbols. Symbols are not only indexes, they are potentially polyvalent and can refer to more than one object and also refer to other symbols. The usage of symbols brought about an emergent capacity. This "synergistic" (Deacon, 2006, p. 33) capacity of symbolic tokens is precisely the nexus between two conceptual planes (matrices). Deacon's approach presupposes that the matrices in question consist of representative symbols that are linked to "perceptual-emotional gestalt" (p. 34) and are part of a network of associated terms enabling the network's combinatorial possibilities. To link or blend two matrices, one needs to establish a re-presentation of this blend, a re-representation involving symbols (and not iconic or indexical mappings). According to Deacon, symbolic re-representations (blends) allow for a taxonomy of relations that eventually elicit Koestler's three basic emergent emotions (release (humour), catharsis (art), and eureka (science)).

Deacon's theoretical ambition is to incorporate emotions into the concept of bisociation (and also to the successive conceptual blending theory of Fauconnier and Turner (2002)). Deacon (2006) presupposes that

> "[e]motion cannot be dissociated from cognition. It is the attached index of attention relevance in every percept, memory, or stored motor subroutine. Emotional tone is the *prioritizing marker* attached to every cognitive object that enables an independent sorting of it with respect to other competing cognitive objects, irrespective of pattern-matching processes" (p. 37).

According to the psychologist Frijda (2006), emotions are states of "action readiness" (p. 38) within an always actual context composed of perceptual impulses and incorporated meaning structures. For Deacon, cognitive processes, such as the interpretation of symbols or any semantic entity, are linked to emotional states and experiences. That is the way bisociated or blended conceptual spaces have the capacity to amalgamate different emotions into complex, composite emotional experiences such as beauty, awe, nostalgia, etc. This "is clearly one of art's great attractions. It is literally an exercise in expanding the space of consciousness" (Deacon, 2006, p. 51).

Something analogous occurs in the integration of artistic and academic approaches that is in the bisociation of different conceptual spaces (such as the generality of academic notions and the concreteness of images and artefacts). The benefits of this form of bisociation are perhaps not the complexity of the resulting emotions (although this might emerge), but rather the emphasised conjunction between higher cognitive abstractions and their multiple and polyvalent correlations with emotional experiences, in other words, the expansion of emotional-cognitive states.

Above, I identified the notion of "closeness" as the nexus point between one concrete academic theory and a concrete-artistic idea. Closeness is not a symbol, but a semantic marker. Yet in the perception of the conceptual idea, a PCV suit becomes both a concrete token for an imagined experience (hot, heavy, and squeaking) and a symbol for unsustainability, pollution, unintelligent consumption, festival life and fun, etc. The emotional experience of the PVC suit combines a more or less abstract concept (e.g., sustainability and its challenges) and personal recollections, which have their own correlated bodily sentiments and emotional values.

CLOSING REMARKS

In this article, I have ventured to expand Koestler's bisociation theory to describe the integration processes of artistic and academic methods. As indicated in the opening section, my elaborations are mainly of a theoretical nature with the inherent objective of making my elaboration operational in respect to didactic and pedagogical forms. I also consider the problem-based project format to be beneficial for the meeting of the artistic and academic approaches. As closing remarks, I want to outline some possible requirements that might support the aforementioned integration. The focal point of this article does not allow for a more thorough elaboration of the practical implications of my theoretical claims.

First, it is pointless to consider a whole problem-based project as one long meeting between academic discourse and artistic practice. The meeting points must be chosen, framed and staged. Evidently, this depends to a great extent on the character of the project and its objectives. Does the project in question aim towards realisable solutions or towards an elaboration of a problem or a complex of problems? Is the project based mainly on academic approaches, and if yes, what disciplines and methods are predominant, or is the project's outcome driven mainly by artistic investigations? Depending on these characteristics, the meeting between the two different approaches must be prepared and staged. For example, one must decide about the point in the process at which the meeting is most promising: in the beginning of the entire process supporting the idea generation stage, or rather, during the concretisation phase, in which particular implementations must be created. Several meeting sessions would secure an integrated process. More importantly, the meeting sessions must be orchestrated properly. Artistic approaches are often based on fictionalisation (or in Iser's (1993) term, irrealisation), which allows a much more unlimited unfolding of associative and subjective ideas and material elaborations than those allowed by the much stricter application of academic methods and validations. This irrealisation space must be created, its beginning and end determined and secured by all the participants. The same goes for academic validity, which must be dealt with in this irrealisation space. Facts cannot be neglected, but should be discussed, contextualised, materialised, visualised, opposed, etc.

Second, the expansion of abstract academic notions with emotional and associative content as a result of the simultaneity of the academic and artistic matrices necessitates a willingness to allow and explore novel forms of research and educational projects, whose resulting forms are not necessarily aligned with either works of art or academic forms of presentation and dissemination (books, articles). Therefore, the ongoing reflection on and final choice of suitable presentation formats and venues should be a part of the process from the very beginning.

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