

Problem Orientation in Art and Technology

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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.

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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 paper's 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. Therefore 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 happens 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 supports 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 be 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 led 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 matches 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 consists 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 focuses on sculpture and installations, then moves 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 Avaerness	5 Projects Keywords: Big data Urban transformation Wearables Internet of things

III. 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.

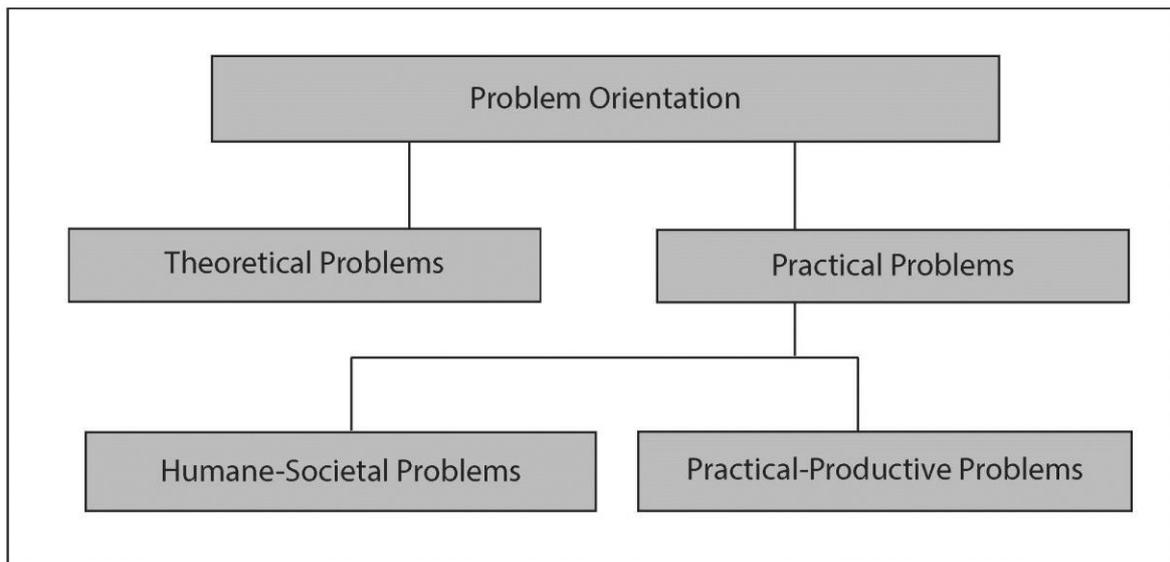
Praxis-productive problems deal with situations that can be improved in terms of functionality or efficiency. This type of problems aims at improving or expanding existing methods, tools, techniques and the result is a translation of scientific knowledge into e.g. New technologies. According to Pahuus 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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