Jens Sjöberg

- Critical Making -

as a design process learning method

Master Thesis, 15 credits, advanced level
ME604A
Media Technology, Malmö University
Primary supervisor: Maria Engberg
Second supervisor: Sara Leckner
Examinator: Daniel Spikol
2016-05-25
Abstract

This study is a case study within Media Technology at Malmö University that explores the gap between design and technology in the Graphic Design course. The study uses the concept of Critical Making and how that can be used to develop a design process learning method in higher education programs, where designing and making artifacts are in focus. The aim is to implement Critical Making in order to allow students to gain deeper understanding and evaluate their material choices and their own reflections in the design process. To achieve the implementation of Critical Making the study uses didactics as a pedagogical approach. The key elements in Critical Making as a design process learning method build on context, reflection, material choice and design process that all form a common design language between students and teachers to exchange knowledge and experiences in future media productions. The common design language is shaped through open assignments, supervision and reflection from the students' material choices and context of the media production they work with during the design process. The findings in the study are also presented as a digitally interactive poster that uses Augmented Reality to show videos and images for the user.

Keywords: critical, making, design, process, learning, method, media, technology, education, graphic design, common design language
“It became a good and giving day today, as well.”

My grandfather, Bertil Sjöberg (1930 - 2013)
Acknowledgments

I want to thank my head supervisor Maria Engberg for good support, feedback and discussions for this thesis, and my second supervisor Sara Leckner for good support, feedback and motivation. And thank you to my family Bo, Kerstin, Johanna and Sebastian for their tremendous support and motivation during this study. Also to my friends and classmates for motivation, giving discussions, sharing ideas and knowledge with each other, during the thesis process. And I will also show my gratitude to Anja Böttcher and Therése Johansson for helping me with the English language. Thank you to my colleagues Carina Ström Hylén and Pär Jakobsson for their interesting and giving answers and information from our interview discussions for this study.

I also want to say thank you to the students from bachelor program Project Management within Publishing 2015, and from the course ME136A Graphic Design, for their contribution and sharing of knowledge, ideas, thoughts and feedback about design process, reflection, Graphic Design and Critical Making to this study.

Thank you!
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1. Introduction

This chapter will introduce the research questions and discuss further the project’s main areas of study.

1.1 Introduction to Media Technology

Media Technology (ME) is an interdisciplinary field, which means that ME takes inspiration from several other fields and is also depending on which university offers the education. The Swedish Higher Education Authority’s (UKÄ) has listed educations in Sweden and the universities that educate in the field of ME are Blekinge Institute of Technology that leans to Media and Design, KTH Royal Institute of Technology, Linnaeus University, Malmö University, Linköping University and Södertörn University these educations leans to Computer Science, IT and ME and (UKÄ, 2016). In the field of ME there are courses that use the term design to allow students to explore the combination of aesthetics, technology and media to create different media productions and innovative solutions. Different universities use the term design differently depending on the educational philosophy they have. Important to understand within the field of ME is that it is not design education, but instead uses design processes and courses where students produce artifacts. To better understand the field, the study will focus on how ME can move and grow as an interdisciplinary field with perspective of media, technology and society in education where design is in focus.

1.2 Reflective criteria

It is an important role of this study to understand how reflections form a pedagogical approach as a part of the Swedish system of higher education within the bachelor programs.
Critical thinking and knowledge based learning are important sections of Swedish Higher Educational laws in bachelor programs for example in ME. To achieve a bachelor degree from a Swedish university, students shall demonstrate the following skills and abilities. The reflective criteria focus on the learning aspects and primarily use reflections in practical work and empirical knowledge from Schön (1983) and Molander (1996), who refer to learning by doing and how to reflect, which in turn correlates with the Swedish Higher Educational law.

It is important to encourage students to use their own experiences in their learning process and to find their own methods to let them achieve their goals. The teachers in their roles have specific learning methods, which contributes to deeper knowledge for the students in their learning processes (Dewey, 1997a, pp.214-216). People learn from their experiences and Kolb (1984) argues that the process of experiential learning can be a way to create a critical link between education, work and personal development from their experiences. By using knowledge and experiences from ourselves and others, reflections once again becomes important to navigate and use the knowledge and experiences in learning situations (Dewey, 1997a, p.217; Molander, 1996). An important aspect of these reflection is that the students need to discover their consequences and implications of their reflections to find new insights and meanings of their design and learning processes by asking “what if and why?” (Schön, 1983, p.103).

• Demonstrate the ability to search, collect, evaluate and critically interpret relevant information in a problem and to critically discuss phenomena, issues and situations,
• The ability to independently identify, formulate and solve problems and to perform tasks within specified time frames,
• Demonstrate ability to orally and in writing account for and discuss information, problems and solutions in dialogue with different groups, and
• Demonstrate the skills required to work independently within the field of study,

[Author’s translation from Swedish to English (Utbildningsdepartementet, 2015).]
1.3 Social and design process

This thesis is within the field of ME, but moves more to the social, society, design context, design process, reflection, the role of technology and educations, which correlates to Schön's (1983) philosophy about the reflective practitioner. To better understand the gap between different technologies and the surrounding designed artifacts we use in our daily lives, both in work life, in education and leisure time. We need to understand the context we are in to be able to develop criticism and meaning as an understanding language between things (Dewey, 2005). Within ME different aspects of technology, media and design processes are explored in order to contribute interdisciplinary artifacts and perception of our society. Does ME focus on the social and design process in the making of artifacts? Ratto’s definition and formulation of Critical Making arises how Critical Making can be used to within the field ME:

Briefly put, the issue I want to understand is the seeming disconnect between deterministic, conceptual understandings of the role of technology in social life, and the more material and nuanced understanding of how one relates to them. Our goal is therefore to use material forms of engagement with technologies to supplement and extend critical reflection and, in doing so, to reconnect our lived experiences with technologies to social and conceptual critique. (Ratto, 2011)

A difficult but also exciting question that has no simple answer - without going too deep in philosophical debate - is that everything we do as humans are different processes. In this case the social and the design processes have a lot in common and use our experiences in knowledge for purposes (Dewey, 1997b). To get a deeper meaning about the importance of
the design process, the concept of Critical Making has been an important one to explore and
to define if it can be used as a design learning method in courses where making artifacts and
design processes are important learning goals. This correlates to the big spectrum and variety
of media, technology, society science educational and research areas that ME operates and
educates in.

1.4 Introduction of Critical Making

The concept Critical Making has been defined in different ways. For this study the concept
Critical Making will be explained by using Ratto’s articles have been involved in (Ratto, 2011;
Record et al., 2013; Ratto et al., 2014; Wylie et al., 2014). The Rhode Island School of
Design on Creative Practice (RISD) uses and discusses the concept Critical Making in their
educational philosophy, curriculum and pedagogical work with their students. Ratto (2011)
explains the concept as a way to combine technology and society together in the process of
making an artifact, in an open design process (Ratto, 2011). Some of the key elements of
Critical Making that Ratto highlights are open design, prototype, the process, participants
and making of artifacts. Ratto (2011) argues that the materially productive engagement will
create a bridge between the gap of creative physical and conceptual exploration. There are
similarities in how RISD defines the concept by arguing about the close connection to critical
thinking. As the pedagogical philosophy and structure of RISD’s curriculum shows, there are
no simple definitions of the concept. However, they refer to four major elements: process,
context, material knowledge and questioning to explain Critical Making (Somerson &
Hermano, 2013). Bauhaus-Universität Weimar, Konstfack University of Arts, Crafts &
Design and RISD to mention a few design universities, where the practical expression lies in
combining design thinking with practical and theoretical approaches through workshops,
seminars and individual project plans for the students (Bauhaus-Universität Weimar, 2012, Konstfack University of Arts, Crafts and Design, 2016, Somerson & Hermano, 2013). The ideas of combining design thinking with practical and theoretical approaches through workshops, seminars and individual project plans are also present within ME educations. Somerson and Hermano (2013) argue that art and design play a critical role in technology and science: ”I believe that art and design have critical roles to play in innovation in this next century, much like science and technology did in the last” (p.9). Somerson and Hermano (2013) also claim that Critical Making has a value in fields outside design/centered education, such as courses and programs that include design as one component among others, like technology, example ME.

1.5 Purpose

The purpose of the thesis is to explore how the concept of Critical Making can be used to develop a design process learning method in higher education programs. The study will also focus on the analogue and digital materials as a part of the learning process it has in the making of media productions.

1.6 Aim

The overall aim of this study is to explore how the concept Critical Making can be implemented as a design process learning method, for courses that focus on working with artifacts and the learning design process, and for students to get a deeper understanding of the design context. More specifically, the aim is to implement Critical Making in the course ME136A Graphic Design in the field of Media Technology at Malmö University, in order to allow students to gain deeper understanding and evaluate their material choice and reflection.
in the design process. The study includes a prototype in which the design process and artifacts are presented in a digitally interactive poster with videos, images and notes. The prototype is aimed for teachers in ME as a pedagogical tool to inform them how they can develop a deeper understanding of materials choice, context, reflection and design process for students in their learning approach.

1.7 Research questions

How can Critical Making be explored as a design process and a learning concept to be integrated in artifact-producing courses? More specifically, how can Critical Making fill the gap between technology and design in Media Technology at Malmö University as a pedagogical design process learning method?

1.8 Limitations

The study does not intend to define different design processes outside of Critical Making or to analyze the concept of Critical Making in a deeper philosophical way. Further, it is outside the scope of this thesis going to present a survey of what and how ME is educated at different universities, and definitions of design for their students. The part of the study that deals with discourses pedagogy does not include descriptions of other pedagogical methods or didactical methods within ME. The interactions with the students in an ongoing course will also affect my role as a teacher or researcher depending on different phases in the course.
2. Background

The background section of the study summarizes Media Technology at Malmö University, the course Graphic Design ME136A and the author’s prior knowledge.

2.1 Media Technology at Malmö University

ME at Malmö University (MAH) is an interdisciplinary subject that combine interest from fields like Computer Science, Interaction Design, Education, Media Management, and Media and Communication studies, in close collaboration with industry and society (Malmö University, n.d). One aspect of working and studying in the field of ME is the combination of theory and practice. MAH has two directions for their bachelor programs: the first is Project Management within Publishing and the second is Media Production and Process Design. According to the self evaluation section of the quality report from the Swedish National Agency for Higher Education (Leckner et al., 2013), part of ME at MAH uses scientific and methodology aspects of Hermeneutics and Humboldtian “Bildung” to allow for individual educational improvement. Hermeneutic approach can be described as a way to interpreted collected data with an empirical understanding of the data (Harboe, 2013). “Bildung” on the other hand focus on formation and learning through experience (Davey, 2007). The educations in ME connects to different parts of theory and practice as learning methods within the bachelor programs, where design processes, marketing, organization, leadership and business development in media (Leckner et al., 2013).
2.2 Course Graphic Design ME136A

This leads the study to question what students in ME do, what happens in the design process and how to evaluate the artifact from a technological and social perspective in Graphic Design. Critical Making mainly focuses on how to create artifacts and the process of making prototypes within programming, interaction design and open design. In this study Critical Making is used in the context of graphic design instead and specifically it can be applied in the course Graphic Design ME136A at MAH where bachelor students create artifacts in the field of graphic design. The course is a 15 credits course focusing on the basics within the field of Graphic Design. The main aspects of the course content are to teach the basics in graphic design, methods for creative and constructive feedback, exercises from sketches to complete layout, methods for graphic communications, research methods and time planning (Malmö University, 2016). The course is practical and students use different theories from seminars, lectures, workshops to create different graphic design artifacts. Problem-Based learning (PBL) is based on motivating students to seek out and learn whatever knowledge is needed to solve the problem well (Svinicki & McKeachie, 2013). PBL is a pedagogical approach that the course ME136A use for the assignments that students working with. An important goal of the course is the students’ ability to create different graphic design artifacts and understand the creative process. To understand the process the students have to do reflections on different assignments they works with in the course (Malmö University, 2016). The course ME136A is to understand different graphic design perspective and why the field has developed in the direction it is today. That is why it is important for the students to understand graphic design history and different design epochs, which is a major part in the course. The students work with the following periods like the Arts and Crafts movement, Art Nouveau, Jugend style, Art deco, Bauhaus, De Stijl, Russian Constructivism, Suprematism,
Pop Art and Post Modernism. These design epochs are important for the students’ assignments in the course.

2.3 Author’s prior knowledge in the field

My prior knowledge arises from my experiences in ME and as a teacher comes from my time at Blekinge Institute of Technology (BTH), where I worked as an adjunct lecturer at the bachelor program Digital Visual Production 180 credits. During this time, I held workshops, lectures, and supervised different courses where the process, choice of design, technology and problem-based learning where in focus as the pedagogical perspective. My empirical knowledge and experiences as a teacher made me more curious about how we educate by creating media productions like games, films, posters, graphic design, photos and web applications. How can we become more critical in the design process, but also to open up the design process and therefore contribute to a more openly learning approach, that includes creatively and technical processes to share and solve problems and to fix new or modified design solutions in the field of ME? During my time at BTH, I started to learn about the concept Critical Making. My prior experience guides the exploration the concept of Critical Making further and I build my prior knowledge of the design process, making artifacts, reflecting and supervising to study Critical Making as a design process learning method to the field of ME.
3. Theory

In this chapter theories of prior research are presented to allow a deeper understanding of relevant fields and terms for this present study. The studies mentioned correlate with the design process which is a major part of Critical Making.

3.1 Learning process and didactic

Within pedagogics there are several learning models and in different disciplines (Molander, 1996; Bigg & Tang, 2011; Svinicki, Mckeachie, 2013; Brånberg, Gulliksson & Holmberg, 2013). The pedagogical and didactic aspects in this study explore the interaction between teacher, students and assignments to correlate with learning outcomes, which can help to form an understanding of how design processes works. Engineers and pedagogy researchers’ Brånberg, Gulliksson and Holmberg (2013) argues that there are differences between pedagogy and didactics, and they define pedagogy as how individuals, groups, organizations and society develop, form and how we learn (p.23). Didactics on the other hand describes as the ways in which the teacher creates learning situations for the students, instead of how students learn (Brånberg, Gulliksson & Holmberg, 2013). Didactics is focusing on purpose, learning outcomes and learning activity. Pedagogical researchers Elmgren and Henriksson (2010) point out the interaction between student, content and the subject in creating learning opportunities, which can be adjusted to fit different fields depending on the content that the students need to learn and work with. Brånberg, Gulliksson and Holmberg (2013) argues that an important part in didactics is asking and working with the why-question in all the steps.

2 List of different pedagogical methods that connects to didactics:
- Problem-Based Learning (PBL) (Svinicki, Mckeachie, 2013)
- Case-based learning CBL (Bigg & Tang, 2011)
- Group work (Brånberg, Gulliksson & Holmberg, 2013)
- Workplace learning TLA (Bigg & Tang, 2011)
- Reflective learning (Bigg & Tang, 2011; Molander, 1996)
questions like: Why will this course be given? Why do students need this? Why will they want to know this?

Another important part of the learning process is the communication both in the groups of students as well as teachers. It is in this situation where we humans learn from each other and see situations from a different perspective (Pramling Samuelsson & Pramling, 2008). To connect the learning process in the context of design, Somerson and Hermano (2013) refer to the nonlinear pedagogical approach that happens in design process where meaning and testing ideas becomes important for the student in their making of artifacts and understanding feedback. This didactical perspective leads this study to empirical knowledge and that grows within reflections. The educational environment plays a major role in student’s learning, which in turn is created to allow students to learn in a positive space (Dewey, 1997a, pp.54-55). In this study didactics and learning methods are used interchangeably following Bränberg, Gulliksson & Holmberg (2013).

3.1.1 Design critique

Krippendorff (2005) explains that when computers became popular and a regular computer user had a chance to do their own design, it was necessary for the professional designers to start to be critical of their own work and be aware of the importance of inviting the stakeholders to be a part of their design process. It is the same when it comes to how the teacher plan and structure their courses from design didactics where standards, evaluations, assessments and economic limitations create a framework for how the teachers can use design critique in their pedagogical work (Selander & Kress, 2010). Design didactics correlates to the designers’ design process and how they cannot exist without stakeholders and therefore it is important to be open to what other designers think and design critique makes it reliable.
Krippendorff (2005) states it is important to ask questions from a critical point of view since it is a new way to explore the way designers are thinking about their work, by doing so critical making can be a natural part in the design new world. By asking questions it can lead to awareness and that is an essential brick for the teacher, student and the designer to make conscious steps in their working process from the given limitations and resources, they have to work with (Selander & Kress, 2010, p.139). Design critique in this case formulates how teachers need to think and work with artifact designing and making courses to use the learning situation for the students in a pedagogical approach.

3.2 Definitions of Design

In this study the word design has several meanings and understanding in our society and in which context it is used in. In different fields design is defined in varies ways, for example production design, graphic design, interaction design, critical design, environmental design and political design to mention different areas that use the term design. The study focuses on the following design definitions: Graphic design at RISD is a way to explore art and design making by focusing on behavior, creativity and innovation as terms to define and talk about design (Somerson & Hermano, 2013, pp.231-232). Heskett argues that design is a way to form and to solve a problem by using ideas, technology, process and function for a client or a user (2006, p.16). Design is not only dependent on the designer’s choice and ideas, but also on how the design is conducted by experimentation in their design process, and how the artifact can be evaluated (Heskett, 2006, p.18; Krippendorff, 2007). Production design is a way to design products which combine form, finish and the technical functions to create a functional artifact (Heskett, 2006). The importance of understanding the history of design to see how design has managed to solve problems that sciences claimed impossible (Krippendorff, 2007).
Interaction design work to design for everyday uses and life, by using technology and then design for humans and their experiences and means for the users. Moggridge (2006) states that if we only design the function in product, then the design might lose its communication and the design can be misinterpreted. Interaction design is a combination of designing, hardware, software to form a symbiosis for the user (Moggridge, 2006). The aesthetically and ethically qualities states Löwgren (n.d) that it will never be ignored within interaction design, and can be understood as shaping digital objects for people’s use. Graphic design can be defined by its aesthetic, visual narrative and elements to form a graphical artifact and are influenced by history, cultural, technologies and designs choice, experiences and from clients (Drucker & McVarish, 2012). Meggs and Purvis (2012) argue that the graphic design field includes illustrations, photographs, printing and digital media as a common area of and inspiration sources. The field of graphic design however consists of different disciplines today like motion graphic, environmental communications and new media. To understand graphic design, Meggs and Purvis (2012) state that the design history and famous designers and their choices become important to be aware of when developing new visual messages. Design definitions from production design, interaction design and digital media correlate with how ME at MAH works by using technology, target groups to define the design process and the learning outcomes in by focusing on behavior, creativity and innovations the students struggle with in their design assignments.

3.2.1 Designer and the design process

This study will refer to different perspectives of designing and understanding artifacts. The starting point will be modernism and early avant-garde movements, moving to design in the present day. The designers' role has evolved since modernism and early avant-garde
movement in the role of education, technology and what society demands today. Moggridge (2006) highlight the designers role as problem solver because they use design language to make things clear, create expectations and to surprise. The authors Dunne and Raby (2001, 2007), DiSalvo (2009, 2012, 2014), Ratto (2011, 2014), Auger (2013) and Malpass (2013, 2015) argue the important to be critical in the design process and designing objects. Being critical in the design process correlate with ME and not take anything for granted during the process. Examples of this is to explore the political, speculative and open design. The formalism where it is more important to use the historical role to be reflected in their design and thru the medium itself. Immanuel Kant\(^3\) can be seen as the father of formalism. Painters like Mark Rothko, Barnett Newman, and Adolph Gottlieb are associated with aesthetics formalism (Wolf, 2016). Stolterman and Löwgren have shown that in order to understand and respect the design process the designer needs to be critical and have a reflective mind towards the process and see it from several perspectives (2007). This is needed in order to understand how professional designers work and what their aim is when they create artifacts which are focusing on creating new or improved solutions (Krippendorff, 2007, p.3). Within the designer's process there are several aspects that explain how to solve a problem by using sketches and to use reflection as a tool or method. An important aspect to be aware of is the balance and contrast in creating a new or improving an artifact. Designers needs to work with possible futures, how desirable these futures are, experiment with what is variable or could be changed, work out realistic paths and make proposals and to include stakeholders into a

\(^3\) "According to Kant, to say that a pleasure is interested is not to say that it is self-interested in the Hobbesian sense, but rather that it stands in a certain relation to the faculty of desire. The pleasure involved in judging an action to be morally good is interested because such a judgment issues in a desire to bring the action into existence, i.e., to perform it. To judge an action to be morally good is to become aware that one has a duty to perform the action, and to become so aware is to gain a desire to perform it. By contrast, the pleasure involved in judging an object to be beautiful is disinterested because such a judgment issues in no desire to do anything in particular. If we can be said to have a duty with regard to beautiful things, it appears to be exhausted in our judging them aesthetically to be beautiful. That is what Kant means when he says that the judgment of taste is not practical but rather "merely contemplative" (Kant 1790, 95)." (Shelley, 2013)
designer’s project (Krippendorff, 2007, pp.4-5). There are quite significant differences between the researcher and the designer. The researcher searches for a truth or a trustworthy explanation at the given time and uses a broader perspective (Krippendorff, 2007). “In doing so, the interaction design researcher should not be part of the design team as an outside observer, first and foremost a researcher, but rather be part of the design team as a designer” (Fallman, 2008, p.6). For a designer the truth is not necessarily needed, instead designers are focusing on decisions that needs to be made to create a solution for a particular problem, and work with the limitations within that task (Krippendorff, 2007, p.31). This makes it possible to explore the designer’s process and in this case in graphic design where you as a designer value the process to create new or improved solutions for the visual perspective. According to Schön (1983), a good process of design reflects in action is needed to create conversation with yourself as a designer. This connects to the following quote from Mazé and Redström (2005):

While ‘use’ is central in interaction design practice and pedagogy, it is necessary to recognize a difference between the problem of form in design, which is what we have addressed here, and the use of objects that come about as people make them a part of their activities (p.17).

As the quote reveals there are differences between problems of form in design and the use of the object, which goes back to the design process. Another aspect that Hevner (2007, p.90) argues for is the evaluation aspect during a design process by using subsequent feedback to refine the design further.
In Maeda’s (2007) Ted talk “Designing for Simplicity”, he talks about how it is important to work with enjoyment and less pain during the design process. Maeda suggests ten laws to obtain enjoyment in design making: Reduce, Organize, Time, Learn, Different, Context, Emotion, Trust, Failure and The One (Simplicity), and three keys: Away, Open and Power (Maeda, 2007). These laws and keys become important for designers in different fields to use because they form a ground to stand on. As Latour (2008) suggests, in the design process it becomes difficult to delineate between form and function, purpose and meaning of the thing that is going to be designed. Maeda (2012) also refers to this by saying that art open up questions and that different meanings are reflected in different forms, scales and content in the design process of designing things. The aesthetic philosophies connect to the postmodernism ideas which according to Somerson and Hermano (2013) and Maeda (2008) lose its purpose without first understanding the design history and the context in design. The designer needs to understand design history as well as technology to define meaning and context in the design process, which will be reflected in the material the designer choose to work with (Somerson & Hermano, 2013). The importance when designing objects is to have fun during the design process, to accept differences and to trust the choice of materials in the design process (Maeda, 2004, 2008). Technology will both help and fail you during the design process, so be prepared for that (Maeda, 2004).

3.2.2 Digital media and design

It is important to use and define the concept Critical Making for the field ME in this study. There are several academic disciplines and commercial fields that educate and do research within digital media and design. Example of these disciplines are Computer Science, Human-Computer Interaction (HCI), Interaction Design (ID), Digital Media, Media production,
Media Technology and Production Design. These different disciplines have common technologies, processes and different angles of solving problems by working with research questions and doing reflections, Fallman (2008) also states the importance to reflect in the design work:

But interaction design researchers also should have an appropriate design research question, reflecting on the work in which they are currently deeply involved. If successful, such reflection becomes an existential act that will help the field develop a kind of engaged knowledge that may be inaccessible from an outside perspective. (p.7)

Malpass (2013) highlights in his study about different design disciplines, that elements of analysis, satire and narrative are needed to define and develop different aspects of the design field and critical practices in design. This also connects to Ratto’s (2011) understanding of Critical Making: “[…] critical making has much in common with conceptual art and design practice, as well as recent work in the area of human-computer interaction (HCI)” (Ratto, 2011, p.253). According to interaction designers Mazé and Redström (2005) critical issues emerge when humans and artifact objects interacts with each others and it happens a form of transformation between us humans and the object.

### 3.3 Criticality Design

Latour (2008) argues about the functions of objects in design. There are two different ways to grasp an object, one is the intrinsic materiality and the other is described as more aesthetic or “symbolic” (Latour, 2008). In other words, the object and its function become important to
work with and to understand critical design, challenges are needed when it comes to ideas, choice of material, context, society and how are the users (Malpass, 2013). The function is something that Malpass (2015) argues about in critical design practices, which in ME at MAH also struggle with. When it comes to design practice and which function and mean is needed to be used, and this will come to life when function is a dynamic, immaterial, situation and social property it is in (Malpass, 2015). This is what students’ works are struggling with and during the process function, meaning and questions, it will become important for them and their understanding of design choice. Designers like Dunne and Raby (2001) argue that the design needs to challenge our belief and not only accept things they are.

3.3.1 Political Design

DiSalvo (2014) argues that critical making suggests new form of design through political qualities when it comes to participatory means of material. He means that political influences are actively projected onto and through artifacts by the participants that is designing the artifacts. “By creating these artifacts, the participants enacted a novel mode of “doing” political design as a collaborative and public endeavor of articulation” (DiSalvo, 2014, p.96). DiSalvo highlights the values and practices when it comes to the importance of the participants and how they treat information that reveals desires and commitments through technological forms (DiSalvo, 2014).

According to DiSalvo (2009) the making of visible and known complex situations of contemporary societies, might react people to take actions in design situations and leads to awareness how design can be more public. Which in he highlights the public as a player when it comes to construction, products and process of design, that can provide valuable information to conceptualize, describe and criticize projects. DiSalvo (2009) refers to two
things and the first one is about the scholars in design studies and the relationship between
design and collective political action. The second is to give the opportunity to contribute to
the public in different scientific fields, that will express intimate knowledge of making things
(DiSalvo, 2009). The importance of evoking and engaging in political issues through design
is something that DiSalvo (2012) also highlights. In this study the value of participants and to
share design process with others have been used. “The object domain of the social sciences
encompasses everything that falls under the description 'element of lifeworld'” (Habermas,
1984, p.108). The following quote refers to the physical objects role in the society, which
correlate to the concept of Political Design.

3.3.2 Speculative Design

Auger (2013) claims that Critical Design uses Speculative Design ideas to challenge narrow
assumptions and preconceptions about products that play an important role in our everyday
life. Vital factors as technology, aesthetics, behavior, interaction and function of the designed
artifact are also important in the success of a Speculative Design proposal (Auger, 2013).
Dunne and Rabys Speculative Design also aims at designing things and making artifacts, with
speculative focus in the making. “Naming it Critical Design is simply a useful way of making
this activity more visible and subject to discussion and debate. Its opposite is affirmative
design: design that reinforces the status quo” (Dunne and Raby, 2007). This quote can be
connected to what Critical Making and Political Design strive to achieve. In the book Designing
Interactions from Bill Moggridge (2006), Dunne and Raby’s highlight that design can be used as
a medium to ask questions, to provoke, stimulate people as well as designers and the industry,
but also to explore ideas and things that are in between our reality and fiction (Moggridge,
2006, p.593). The major idea about narrowing down the making of the artifact, is according
to Dunne and Raby (2004) that speculative design forms a critical perspective so it can provoke the users which Malpass (2013) also highlights.

3.4 Critical Making

Critical Making is going to be explained in more detailed here to understand and define the concept as a phenomenon in the design field for this study. The concept Critical Making builds on Ratto’s and RISD’s definitions. According to Ratto (2011) Critical Making is an understanding of how you as a designer can be more critical in your process to create artifacts. It is an interplay between technology and society. To get a better understanding of Critical Making, Ratto’s concept of Critical Making relies on as a grounding early research as Marcuse (1941, 1964), Ellul (1964) social studies of technological:

Studying the relationship between technologies and social life has proven to be a somewhat difficult task. On the one hand, critical social scholars have long argued that technological developments inhibit human action, “technicizing the life-world” and causing the diversity of human behaviors to be reduced to

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4 The bookends of Marcuse’s literary, philosophical, and political life are both works on aesthetics. In 1922 he completed a doctoral dissertation entitled Der deutsche Künstlerroman (The German Artist-Novel). In 1978, one year before his death he published The Aesthetic Dimension: Toward A Critique of Marxist Aesthetics. Between these two works are several small works on aesthetics. However, even the works that do not deal directly with aesthetics still contain (we might say) an aesthetic dimension. It is not possible to discuss the role of aesthetics in all of Marcuse’s works. Therefore, the role of aesthetics in Marcuse’s critical theory in general will be discussed. There are three key works on aesthetics which were written at different times that reveal the overall point of Marcuse’s aesthetic theory (Farr, 2013).

5 Significantly it is only the academic outsider Ellul who has, in his idiosyncratic way, recognized in technology the emergent single dominant way of answering all questions concerning human action, comparable to science as the single dominant way of answering all questions concerning human knowledge (Ellul 1964). But Ellul was not so much interested in investigating this relationship as in emphasizing and denouncing the social and cultural consequences as he saw them. It is all the more important to point out that humanities philosophy of technology cannot be differentiated from analytic philosophy of technology by claiming that only the former is interested in the social environment of technology (Franssen, Lokhorst & Van De Poel, 2013).
A way to reflect on Critical Making at this point in the study is to ask the following questions: what is and what was difficult in your prototype construction? Critical Making has connections to Critical Design and to Speculative Design. It is important in the study not go to deeply in the direction of the public and political design. Instead explore how Critical Making can be used in the design context as a learning method.

Critical making is a definition that Ratto is working on and he has established it as a method to focus not only on the final result, but on the open design process. “This way of design doing politics connects with the notion of “critical making,” as a concomitantly applied and analytical means for “reconnect[ing] the material/conceptual domains necessary to connect technical and social work” (Ratto 2011, p.259). Ratto argues that the final prototypes are not intended to speak for themselves, but instead they create value when the processes are shared and in addition, conversation and reflection are made about the it (Ratto 2011). It is interesting to use the ideas from Ratto about making things as practical elaboration with social and technology perspective in a graphic design perspective. Once again while Ratto and his co-authors describe the conceptual and material exploration, they also states the importance of reflection and participants (Record et al., 2013). In another study Ratto that is involved in, he and Wylie et al. (2014) argue about critical making practices in different disciplinary contexts both inside and outside the academy. The definition of Critical Making should be a research field because of its engagement in critical making practice and therefore better developed and expanded the relevance, which connects to critical technoscience (Ratto et al., 2014). By exploring the dynamic material, literacy and
social technologies for scientific research, civic technoscience can be created for citizens which means that they are able to question expert knowledge production via Critical Making, which in return can generate credible public science (Wylie et al., 2014). This is an argument that can be referred to Latour’s quote meaning of design:

> When things are taken has having been well or badly designed then they no longer appear as matters of fact. So as their appearance as matters of fact weakens, their place among the many matters of concern that are at issue is strengthened. (Latour 2008, p.4)

Another aspect of the critical making comes from RISD and is described in the book The Art of Critical Making (2013). Somerson and Hermano (2013) explains that the essential needs in contemporary times, highlight the learning perspectives that include hands-on practice, the perception, by using all elements to understand Critical Making. This perception of Critical Making that RISD focuses on art and design which should have close connections to the postmodernism way of working. This is differs from Ratto’s way to use Critical Making. There are still elements or functions that are the same such as critical thinking, process, material, context and reflection. This argument can be linked to a quote from Habermas: “The interpreter can in turn accept the challenge or, form a standpoint sceptical values, dismiss it as senseless” (Habermas, 1984, p.104). Somerson and Hermano (2013) RISD have developed Critical Making through critical thinking, to value and be in the design process and iterative process in the making of artifacts.
RISD in 1877. Their early mission was three-fold. First, to teach “artisans in drawing, painting, modeling, and designing, that they may successfully apply the principles of Art to the requirements of trade and manufacture.” Second, they wanted to train “students in the practice of Art, in order that they may understand its principles, give instruction to others, or become artists.” Third, they intended to advance “public Art Education, by the exhibition of works of Art and of Art school studies, and by lectures on Art.” RISD’s current mission reflects all of these goals, with an expanded emphasis on discovering and transmitting knowledge to make “lasting contributions to a global society through critical thinking, scholarship, and innovation.” (Somerson & Hermano, 2013, p.29)

Another important aspect of their design and pedagogical philosophy is to understand and explore history and put that in a new context in the design process. The material and experiences to understand and use different materials are also important to understand how Critical Making can be defined. The importance of knowledge in the design processes in the use of different material (Somerson & Hermano, 2013). Maeda (2007) states the importance of asking questions and learning the rules before you “break them” when it comes to technology and design. According to Somerson and Hermano (2013) always come back to the importance of the design process as means to show and understand the creative way in the making of artifacts. It is significant to find the context and purpose of the design process and the artifact and not only to focus on the final artifact first (Somerson & Hermano, 2013). “In critical making, the very process itself opens up new possibilities for deep, expansive thinking and the serious inquiry stimulates discovery” (Somerson & Hermano, 2013, p.98).
The Rhode Island School of Design educates their students to be confident, creative and critical thinkers in their design process by using reflections as a method when they navigate in the complex field that ME and Graphic Design are in (Somerson & Hermano, 2013, pp. 28-29).

The following parts from Critical Making are particularly interesting for my study to use: practical elaboration, open design, process, participants, reflections, technology and innovation by designing objects with a pedagogical aspect. This allow me as a researcher to define my understanding of the concept Critical Making from Rattos articles and to create my own definition to correlate with ME at MAH, as a future learning method and pedagogical ground to use when students are making and designing media productions. Somerson and Hermano (2013) highlight their concept of Critical Making as a framework of process, context, material knowledge and continually asks question. This understanding has allowed me to formulate my own understanding of the concept of Critical Making by using and focusing on context, material choice, reflection and design process as a ground for the design process learning method.

For me as researcher, media technologist and educator, the key elements are both to define and to understand Critical Making as a design process learning process method. By focusing on context, material choice design, reflection and design process these key elements combine experience and prior knowledge as a guideline for producing and designing media productions. For me the design process is the overall element where reflection becomes maybe the most important step to really understand what I have learned from my work. As both Schön (1983) and Molander (1996) state, we get deeper insights and learn constantly from ourselves when we reflect during the practical process. These key elements are a starting point
for me to define how Critical Making can bridge the gap between design, technology and society in the education of ME.

3.5 Reflections

The importance of reflection as a learning approach in this study originates from how Schön (1983) and Molander (1996) refer to the reflective practitioner and how learning by doing and reflection of the practical work are ways to get deeper insights about yourself. Reflection as method allows students to be in an environment where practice is an important part of the learning (Dewey, 1997a, p.213). The goal is to define how students answer and understand the concept Critical Making. This allows students to learn from themselves and their process which is an important learning perspective that Molander (1996) points out. Reflections are an examining part in the course ME136A and in the assessments where their process and learning outcome is graded. Reflections at MAH and in ME are defined differently depending on the course. These aims form the bachelor program Project Management within Publishing, which correlate with the reflections the students need to do during their education. The students’ reflections in the creative process are important in the process of examination and to understand the learning outcomes. Reflections are an important function in Critical Making as both Ratto (2011) as well as Somerson and Hermano (2013) highlight in their study as well.

Experiential learning theory also states that ideas are not fixed, instead they are formed and re-formed through experience (Kolb, 1984). Kolb’s statement also states that you as human will develop when you reflect on tasks, assignments or other moments in life. Reflection is a key element I have defined and found to form Critical Making as a design process learning method, because in reflection you have the ability to reflect and honestly
think about what you have designed, formed and been a part of. Kolb (1984) once again means that experience leads to self-identification and can be seen as a dialect in our process of learning we humans will be in (p.159).
4. Methodology

The study has an inductive approach (Yin, 2013), and builds on the hermeneutic understanding. The methods choices in the thesis are workshops, focus groups and interviews. The following chapter includes methodology presentations and discussions, ethical concerns, weakness, reliability and validation.

4.1 Scientific approach

According to Ekström and Larsson (2011) argue that the interpretation of subjects needs to be open for alternative interpretations and to be able to be critical about to your own opinion, by allowing new ways to understand a subject. The hermeneutic perspective focuses on interpretation and the empirical understanding of data and how that can be relevant for the specific study and research (Harboe, 2013; Yin, 2013). Habermas (1984) argues that interpretation is always needed to understand the objective and subjective approach by combining given knowledge and experiences of the communicative meanings. There is an interdependence between the basic concepts of social action and the methodology in understanding social actions where interpretation declare different values in what we take with us from our own experiences and knowledge (Habermas, 1984). The empirical approach becomes relevant knowledge when systematical observations and interpretations of information are used, which connects to the inductive approach (Elmgren & Henriksson, 2010). The empirical research focus on how data will be interpreted and to show reliable results through open inspections of references and methods (Yin, 2013, p.294).

In the following section the methods that are used will be presented in the following order: Workshops and observations, interviews and focus groups.
4.2 Workshops and observations

The first method in this study have been to conduct workshops. Workshops methods are a way to create students activity by letting them work together with a specific assignment to manage and solve the assignments and by interacting with each other (Biggs & Tang, 2011). Biggs and Tang (2011) argue that there are several ways for students to learn and social learning is one way to learn form, by being active with other students. The teacher can help and guide the students but the students need to working individual or together to solve their assignments (Elmgren & Henriksson, 2011, p.175). In order to maximize the learning outcomes in a group project, the students should not focus on what they already know, but instead contribute and share their ideas with others and therefore let the learning process guide them in their work (Biggs & Tang, 2011).

The second method is observations and it is important to collect enough data from the observations, which helps to minimize wrong understandings of how the data has been interpreted and used from the observations, which can later develop into a deeper discussion about the findings (Yin, 2013). To achieve a more complete observation, analyze what happens and what to document during the observations. It is important to use paper, pencil, camera for video reordering, images and talking with the participants for documentation (Krippendorff, 2005).

4.2.1 Workshop in Critical Making

The workshops that were conducted in this study were aimed at exploring how to use the concept Critical Making as a method for learning about design, between students and teacher to students. The workshop had the same structure and planning, but was held three times with three different groups of students in the course ME136A. The workshops were
scheduled for two hours per session and to have 20 - 25 participants students for every
workshop. The purpose was to get a wide and different result from the students understanding
and interpretation of Critical Making. The students were asked to use theoretical content
with practical material during the workshop to understand Critical Making and the design
process. The workshop started with a short presentation of what Critical Making is and then
the students were planned to work in small groups of three to four persons to create a
graphical poster about Critical Making. Svinicki and Mckeachie (2013) highlight that PBL is
an important step to work and create solutions during workshops. The students used Ratto’s
article “Critical Making: Conceptual and Material Studies in Technology and Social Life” (2011) as a guideline for their work during the workshop. One important limitation of
the workshop was not affected of how many participants participate in the workshop about
Critical Making. The workshops focused on elaborations, reflection and material choice for a
design process to create a poster that reflected upon their understanding and meaning of
Critical Making, graphic design and design process.

4.2.2 Posters

The students have during the workshops created posters which allowed the students to reflect
through discussions among the participants that works together. On their interpretation and
understanding of design process, graphic design, design epochs and Critical Making. Students
worked two to three persons together instead of three to four which where the exercise
description plan form the beginning. The students worked and created a poster of their
understanding of the concept Critical Making, Graphic Design, design process and their own
experiences about their graphic design making, under one hour. The workshop task the
students worked with, focused on what is graphic design, how do you understand Critical
Making and what is the meaning in a design process? To get the student to start designing their posters. The task was also connected to the assignment about design epochs the students had in the course, so they had to combine theory and practice in the workshop too. The students were allowed to work analogue, digital or a mix between analogue and digital material during the workshops. The aim with the workshop was not to design a final graphical poster, but instead testing how the students worked in the design process and with the choice of material instead, in making of their posters. The material choice was based on the field of ME, where material, technology and context merge together and form a design and learning process within ME. Another important aspect of the workshops was the classroom where the workshops were conducted in, the students were not allowed to leave the classroom during the workshop, but they were allowed to refurnish the room to suit them in their elaboration. That is something Svinicki and Mckeachie (2013) argue that the environment is important for the students learning outcomes and in their learning process as well. To see the workshop exercise description, it is explained in more detail in the Appendix: 10.3 WS-Exercise description.

4.2.3 Extra workshop with participants from the focus groups

The planned workshops consisted of 27 participants out of 76 students participated. Furthermore, four students that were asked to participate in the focus groups showed up during the original workshops. Because of the lack of participants from the students one extra workshop was held for the participants from the two focus groups. More data give the study higher reliability and a wider perspective of Critical Making as a design process learning method. For that reason, one extra workshop was conducted about Critical Making, to have deeper discussions in the focus groups about Critical Making, graphic design, design process and their own experiences about their graphic design process and making.
4.2.4 Workshop observations

The workshop observations focused on gathering data how the students acted during the four workshops about Critical Making through taking photos and video recording. The purpose of the method has been to get insights in how the students works with their subjects and to form and understanding of the different solutions and steps the students take (Dewey, 1997a, p. 212). It is important to allow opened discussions to a deeper understanding of the concept and definition of how Critical Making can be implemented as a design process learning method in artifact courses in ME at MAH. Observation from workshops can be interesting for other fields within design, technology and society educations, where students create artifacts and reflection on their learning processes and learning outcomes (Molander, 1996, p. 13).

4.3 Qualitative interviews

The qualitative interviews primarily focus on the interviews with the two teachers of practical knowledge of the media industry and are working with the course nowadays, but also worked with the course in the past. The idea with the interviews were to have open conversations with the researcher (Yin, 2013). Krippendorff (2005) and Häger (2007) argue that interviews that are recorded and then transcribed make it easier to refer to problems, solutions and ideas about the topic the interviews focused on. According to Bell (2010), it is important to have a common ground and a theme to create focused interviews. One way to conduct interviews are open-structured interviews which allow a more open dialogue between the interviewer and the researcher (Bell, 2010). Open structured interviews have been conducted in both single interviews and with the focus groups. During the meetings with these focus groups the agenda was semi structured interviews. It allows the participant to speak freely about their
thoughts and understanding of a subject (Ekström & Larsson, 2011). This method has focused on how the course is nowadays and how the course has been in the past when it comes to making artifacts, reflections, design and learning process.

4.3.1 Interview structure and questions with the teachers

The aim of the interviews is to develop an understanding of how the teachers see and understands graphic design within the field of ME has, and what they think about graphic design, design process, learning aspects and Critical Making in the course Graphic Design ME136A and for the future. Before the interview the participants were asked to read Ratto’s article “Critical Making: Conceptual and Material Studies in Technology and Social Life” (2011). The purpose with that was to establish a common ground of the concept Critical Making that could be used in the interviews. In the interviews Pär and Carina were informed and asked about Critical Making and how it connects to students’ reflections they make in the course. Why it is important for this course to implement Critical Making and how it is going to allow the students to become more involved in their design process, by understanding and value the design process and to use reflections as a learning while using empirical method for their own progress as media technologist. The interviews where recorded with an iPhone 5 and Sony A7S to record audio and video. The interview structure and the questions focused on the following subjects graphic design, design process, reflection, student learning and Critical Making. The questions are designed to allow for an open interview structure and dialogue. The questions are available in the Appendix: 10.4 Interview questions.
4.4 Focus groups

Further this study used two focus groups which is a qualitative method, where the aim is to have open discussions about concepts like: Critical Making, design process, graphic design and reflection. To guide the focus groups, the researcher needs to become a moderator to maintain the conversations in the right path during the meeting (Krippendorff, 2005, p.225). Ekström and Larsson (2011) explain that discussions, attitudes, thoughts and perceptions can be the aims when it comes to interaction between people by using focus groups as a method. The meetings with these focus groups were recorded by sounds and video. These two focus groups consist of five students in every group from the course ME136A Graphic Design, ten students in total.

4.4.1 Recruiting students to focus groups

The students in the focus groups were selected and depending on their interest in graphic design as an area and ME. Eight out of ten participants were also participated in the workshops, because they were interested to bring their insights for the study. They were asked to participate in the study and improve the education within ME at MAH (Ekström & Larsson, 2011). They were asked to sign a consent form which explained what their role in the project consisted of. The students were allowed to withdraw their consent anytime during the study if they wanted. For confidentiality reasons, the students are referred to letters in the study, instead of their names to ensure anonymity (Bell, 2010). These two focus groups can all be compared with each other with the goal to find common and uncommon understanding about Critical Making, graphic design, learning, process and reflection. An important notification when it comes to the participants that participated in this study were...
compensated by getting a coffee, cookies, a printed version of the study where the prototype and the thesis are included, as a way to show gratitude for their participation.

4.4.2 Open interview structure within the focus groups

The questions that were used in the meetings with the focus groups have been constructed to allow an open dialogue. Therefore, have open interview structure has been conducted here too. Questions that the students have discussed are: Their thoughts about graphic design, material choice and evaluation, reflection as pedagogical approach, design process, their understanding of Critical Making and how that can be used in ME at MAH as a design process learning method. The questions are also available in the Appendix: 10.5 Questions for the focus groups.

4.5 Reliability and validation

Reliability and validation are important within research and science to show how and evaluated methods, technics and instrument that are used, need to be useable and suitable in the study to show the reliability and validity of show trustworthiness (Ejvegård, 2003; Bell, 2010). Therefore, it is importance to think about if other students or researchers can get similar or same result, by using the same instrument and methods as in my study (Bell, 2010, p.118). The empirical alignment is something that Ekström and Larsson (2011) refer to in science, which describes the result of empirical data from text, document, interviews and observations needs to show enough reliability and validation in the methods, in order to be scientifically valid. With qualitative research methods it is harder to define reliability and validation because of how the interpretation of the interview data’s have been done (Ekström & Larsson, 2011). Data from interview questions can have high reliability according to Bell...
(2010, p. 118), but does not need to show high validity within the study. It is important to be critical during the research (Ekström & Larsson, 2011). As researcher you need to be observant of how the measurement is going to be conducted, which Bell (2010) and Ejvegård (2003) states that you should use control questions or alternative formulation to be used to allow a high reliability in the study. In this study alternative formulations were conducted in the interviews and during the focus groups to allow open discussions within the areas of graphic design, design process, reflection and Critical Making.

Validation needs to have clear and precise measurement methods to find a trustworthy value from the collected data (Ejvegård, 2003, p.73). The interviews and meetings with the focus groups in this study was focused about graphic design, design process, reflection and the concept Critical Making were used, to formulate an understanding of how the design process learning method can be formulated. Bell (2010) prefers to use open interview questions to allow the focus groups and participant to formulate their own opinion and understand how of a subject, in this case how Critical Making as a learning design method can be formulated for artifact courses in ME. To make this happen evaluations have played a major part in this study, by using the interviews and artifacts to ultimately find a pattern how Critical Making works in the course ME136A.

4.6 Ethical and weakness

The ethical dilemma in this study is that my role was both as researcher and teacher, which was a challenge in this study. To minimize the ethical problem with having two roles in the course ME136. I did not participate in the assessments of the student’s assignments from the course, that is because I wanted to create trust with the students to complete the study. Bell (2010) explains that it has benefits by conduct a study at a working place, where you will have
two roles, which she calls it “insider researcher”. Important for me that have these two roles is not to make any promises to the students just because they are participating in the study will give them better grades or change my role as a teacher when I meet them in supervision or gave them feedback. Another ethical problem with the study was how to include but at the same time not include the students in the design process of the prototype. The solution was by talking and emailing information about how the materials from the workshops were going to be used in the study. The participants were also informed that they are welcome to see the prototype before the examination if they wanted.

A potential weakness of the study was that there was threat that students dropped out. Without the participants the study would have then needed to be focused on the conceptual perspectives of Critical Making, rather then the planned empirical study. That has to do with the participants’ confidentiality and ethicality reasons, to not be identified by others than the researcher (Bell, 2010). This is an important element of the ethical aspect in any study according to Bell (2010).
5. Prototype

The prototype is a cross media production which describes how Critical Making can be used as a design learning method in courses, where creating artifacts and design processes is important. To make the prototype pedagogical and informative, a cross media production felt like a natural choice and an interactive poster that included images, videos and text form the study seemed to be an appropriate format. To visualize and describe how Critical Making can be used, the prototype uses the course ME136A Graphic Design as a pedagogical and experimental platform. Important functions of the prototype were to explore how Critical Making can be used as a learning design process method. This was achieved by combing videos, images, text and graphic in a pedagogical way and by using augmented reality as narrative tool. The use of Augmented Reality connects to ME, which is characterized by a mix different media and which allows teachers, students and designers to engage with Critical Making in a visual interactive way. The prototype uses empirical understanding from the workshops, interviews and meetings with the focus groups, which create a multimedia pedagogical tool that describes how to implement Critical Making in other courses.

5.1 Different phases in the making of the prototype

The prototype started with an analog drawing to see how and what the prototype could look like. After a lot of thinking the prototype it developed into an interactive poster that illustrates how Critical Making can be used to engaged students and teachers to use Critical Making in their educations.
5.1.1 Phase: Poster

The making and designing of the poster started with analogue sketches using pen and paper. When the main ideas for the prototype were visualized on a paper, the process moved from analogue to digital environment by making a refined sketch in Adobe Illustrator CC, in order to create a more detailed overview over the prototype and how it was supposed to work.

FIGURE 1. THE FIRST SKETCH OF THE INTERACTIVE POSTER - CRITICAL MAKING AS DESIGN PROCESS LEARNING METHOD. PHOTO AND SKETCH MADE BY THE AUTHOR.
The decision to make the poster interactive and combine both physical and digital objects lead to the decision to use Augmented Reality (AR), which also makes the information in the prototype pedagogical to use. According to Billinghurst (2015) the AR aims to create an illusion that virtual images are seamlessly integrated in the real world. AR technology can be explained in the following way according to Billinghurst (2015), “AR is one of the most recent developments in human computer interaction technology” (p.75). The argument of using AR as a prototype and how information can be perceived by the users understanding, is something that Barba and MacIntyre (2011) discuss about when using AR as a medium. The main function in this prototype is the focus on image recognition. The software to make the
poster interactive is called Aurasma, which enables users to make videos and images able to be visible and interactive with help of the user’s smartphone.

5.1.2 Phase: Video

The videos in the prototype were filmed with a Sony A7S, Sony 20mm F2 lens and with a Rode microphone and the editing for the video was made in Adobe Premiere Pro CC. The following pictures shows the work flow of making the video. The reason to use videos in the prototype allows the users to get deeper insights and an understanding of how they can implement Critical Making as a design process learning method in their courses or work.
5.2 The final prototype

The final prototype contains video material, images and text that describe how to use Critical Making as a design process learning method for media students, teachers, designers or media technologist. The target group for the prototype is mainly teachers that want to develop their artifact making courses and especially combining physical and digital objects in assignments. The mix of physical and digital objects connects to ME and the course ME136A Graphic Design in which the students use different objects to solve their design assignments. The connections between the uses of physical and digital objects that the thesis explores are reflected in the prototype as a multimedia pedagogical poster. The visual poster was finalized in Adobe Indesign CC and the AR functions were made in Aurasma, the medium choices are related to ME and with a pedagogical perspective in mind. Purpose of using AR was to
combines real and virtual, interactive in real time and registered in 3D, which are the first of Azuma’s criteria for AR (Barba, MacIntyre, 2011).
The insights from the prototype making by using different mediums has close connections in the field of ME, but also to Critical Making. The material choice, context and the design process have been key elements in the making of the prototype to design the poster and then use AR for the interactive part. The mix of using different media in the prototype allow the prototype to be informative and pedagogical how to implement Critical Making in other courses or work. Barba and MacIntyre, 2011 argues that, “Practically, this means treating MR technologies as part of a larger socio-technical system that both affects, and is affected by, human experience in a multitude of ways” (p.119). We as humans are also materials and it renders us in the mix with our experiences (Somerson & Hermano, 2013), which can be argued as an understanding to use AR as an informative and pedagogical prototype to represent Critical Making as a design process learning method. The choice of making the prototype as an interactive poster is something that Drucker and McVarish (2012) argues is a
A way of using graphic design which aims at disturbing information’s by mixing virtual digital world with the real world.

The high resolution interactive poster will be found in: Appendix 10. Prototype. The triggers will also be visual presented separate in the Appendix: 10.2.1 Triggers. Along with an AR-link for the poster and instructions how to use the software Aurasma.
6. Findings and results

The findings and the data from the methods are presented in this part of the study to formulate the result about Critical Making as a design process learning method for the field of ME, and this case at the artifact courses at MAH.

6.1 Workshops about Critical Making

The workshops about Critical Making were conducted in the course ME136A Graphic Design MAH, and focused on the choice of analogue or digital material in the making of posters and students vision of Critical Making. The students discussed, made drawings, cuts and formed papers to shape their ideas during the one hour they worked with the assignment. The findings from the workshops are presented in the following pictures which show how the students tackled and designed their understanding of Critical Making and correlation to graphic design. The students that participated in the workshops found it both interesting, relaxing and joyful to make something that did not needed to be necessarily finished and presented at the end of the workshop.

6.1.1 Workshop group 1

The first workshop group was the largest group of participants of 11 students, nine women and two men. The participants worked in small groups of two or three students in each group, which formed five groups total. The students discussed with each other in their groups how to describe and design their poster and understanding of Critical Making, and the groups worked together really well. All of the groups worked with analogue materials for their poster design, but three of the groups used computers for research, inspirations, definitions
and printed out some icons and picture for their posters. One of the group listened to music during the workshop as an inspiration source and made drawings with the feelings they got from the music. One group used post-its with words on it as components for their poster design.

The results from the first workshop shows that colors, crayons, papers, shapes were design and material choices that these five groups all had in common. Other then that the participants designed their understanding of Critical Making, by focusing on forms and shapes from their discussions in their groups.
The discussions among the students were short and concisely about the design process and word definitions for the posters. The groups did not talk with each other during the workshop. The one hour they had for their design in the workshop these five groups made one poster each of their understanding of Critical Making.

6.1.2 Workshop group 2

In the second workshop there were only four students two women and two men, and they formed two groups with two women in one group and two men in the other group. The two...
groups worked with analogue material for their design and used computers for inspiration search. The students discussed with each other in their groups about how they would visually describe Critical Making. Both of the two groups were silent during the most of the workshop and focused on their poster design. The group that only consisted of women worked completely analog, but the group of men used analogue materials and their computers for inspiration research. Both groups focused very much on making their poster lively by using post-its, reform papers in different shapes for 3D feelings in their posters.

**FIGURE 9. COLLAGE FROM THE SECOND WORKSHOP GROUP DAY ONE ABOUT CRITICAL MAKING, IN THE COURSE GRAPHIC DESIGN ME136A. PHOTOS MADE BY THE AUTHOR.**
The results from the second workshop showed that post-its, paper shapes and words were common in their designs and material choices from the groups. They reformed papers for their visual styles by cutting, folding and gluing paper together to form, which formed 3D feelings in their posters about Critical Making. The discussions about the design process and word definitions for the posters were short and concise. The groups did not talk to each other during the design process. During the workshop both of the two groups made one poster each of their understanding about Critical Making. When they showed their poster for each other they asked each other about their material choices and if they focused more on some aspects then others during the design processes.

6.1.3 Workshop group 3

The third workshop group consisted of nine students, eight women and one man. They worked in small groups of two or three students in each group, which formed four groups in total. All of the students worked with analogue material in their designs, but one group used a
computer for inspiration search and word definitions. The students discussed with each other in their groups how to describe Critical Making during the time they worked. One of the group played music during the workshop and used the music as inspiration source. The music was played so the rest of the groups could hear it. One group had printed out the article from Ratto (2011) and used quotes from the article in their design. Post-its with words on it as components were also something that was included in the design process for two of the groups.

FIGURE 11. COLLAGE FROM THE SECOND WORKSHOP DAY ABOUT CRITICAL MAKING, IN THE COURSE GRAPHIC DESIGN ME136A. PHOTOS MADE BY THE AUTHOR.

Cutting and reshaped paper were something that three of the groups used for their designs. Another group discussed a lot with each other during the workshops about their design choices and about the purpose of their poster. One group focused a lot on cutting and painting objects as their design choices for the poster.
The results from the third workshop showed that colors, words, post-its and reformed paper shapes were common choices in their design and materials in the four posters. The posters combine words and illustrations to for their understanding about Critical Making. The groups did not talk to each other during the design process. During the one hour they had for their design in the workshop both of the two groups made one poster each. Another interesting aspect with the third group was how the four groups used the space in the classroom through by not sitting close to the other groups.
6.1.4 Workshop group 4

The fourth workshop group was the smallest group which only included two participants, women from one of the focus groups. They started by making a mood board of word definition by using post-its with different words they discussed and focused on during their process, and worked only with crayons, papers and color pens for their poster design.
In the design process they focused much on colorful patterns and how the word Graphic Design was drawn. The result from the forth group used the word Graphic Design as a sample term for their understanding of Critical Making. They focused on colors and discussed with each other about design choices like colors, forms and visual styles for their poster. They made two different posters.

The first poster was a sketch of their understanding of the workshop exercise, and the other one was a refined version of how they understood Critical Making and the connection to graphic design and the assignment in the course ME136A.
6.1.5 Key elements from the workshops

The key functions that all of the group had in common during the workshops are listed below in a table.

<table>
<thead>
<tr>
<th>Create feelings</th>
<th>Creativity</th>
<th>Collaboration</th>
<th>Design process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphic Design</td>
<td>Having fun</td>
<td>Material choice</td>
<td>Thinking</td>
</tr>
</tbody>
</table>

TABLE 1. SHOWS KEY ELEMENTS FROM THE WORKSHOPS.

6.2 Findings from the interviews

The interview structure allowed the teachers Pär and Carina to give openly answer questions about graphic design, design process, reflections and Critical Making. Both Pär and Carina have work experience from the media industry and Carina is also the course coordinator for ME136A. The interviews with Pär and Carina were between 20 to 26 minutes long and conducted in Malmö at MAH 2016 March 22 and 23, and was in Swedish. The answers from both Pär and Carina’s interviews have been translated to English by the author.

6.2.1 About the course ME136A

Pär’s starts the interview by describing how the course used to work earlier years. That he was involved in the course, which focused more on drawings, feedback and revision by doing new drawings. The course had no defined design or thinking processes, but today the course has more focus on the design process structures. Pär moves on to discuss the positive perspective with the course:

I only see benefits, the students be able to compare their design with each other, and there is no-one that takes the course to become a graphic designer.
It is not why the students are here, but I believe it is very useful experience for many of our students to know about.

Carina starts by describing that theory from design history and literature seminars have been given more space in the course nowadays:

Last year we added theory about design history and literature seminars about it. It was appreciated from the students, so this year we increased the focus on design history by developing an assignment that focused on that perspective. The assignment lets the students worked and explored an assigned design epoch.

Carina continues and describes how the course ME136A works today:

If we talk about the course, it has a different focus area so to say. It is not only graphic forms, which other courses in the field of graphic design might do. This course focuses more on the production of design processes, and how planning and structures in different phases in a design process.

Pär continues to discussing the field graphic design and argues that:

Graphic design is not that easy as it first looks. It takes a lot of groundwork to make a good design. I believe that many of our students think it is just to start
making drawings on the computer and it is finished. They don’t understand the value of the whole design process, there are many that takes shortcuts.

6.2.2 Reflections

In the course reflections the students need to reflect on most of the assignments they do in the course. Pär describes his way of reflecting and the concept of reflections in the course. He talks about reflection as a problem as well:

Reflection is very important but we force them to reflect too much, how I see it. They must be so tired that they need to reflect on everything. So I think our students do not care about it. Do not think it helps and I believe that many of our students do not really reflect because that we force them to do it all the time, if I going to be honest.

Carina highlights that awareness and reflection in the design process does not necessarily happens when you are working in a project: “To be noticed that the design did not work as I first thought, can happens when you are away from your work or thinking in other directions.”

6.2.3 About design process

The interview moves on and Carina talks about the design process and how important they are for the students in their learning situations:
In some assignments we force the students to relate to a customer or company they need to adapt to their image, but the students still the possibility to work with their own visual language in some way. If we talk about the assignment about design epochs, the students need to write a brief, they need to relate to their design epochs specific style. It was interesting to see the development and the limitations, but now I cannot only do what I like. It can absolutely be tough and maybe some of my visual language might be added in the design.

Carina also highlights the importance by taking design processes seriously:

It is something to relate to and you need to start somewhere, in short. It can be desk research, or the brief is not complete, but it is noticeable quite quickly if the students have not done a solid groundwork they needed to do before designing. I think that the students become aware of the importance of the groundwork when we have different seminars.

6.2.4 Material choice

Pär maintains that the material choice definitive could affect the student’s in their design process, but unfortunately most of the courses here at ME focus on Adobe Photoshop, Illustrator and InDesign as material choice. “There are some students that change to better paper quality, but it would absolutely be good idea to combine different materials more.”

Carina talks about material choices and the steps within the design process. The students still needed to put energy on solid groundwork and research to be able to design a graphic design product to be used.
6.2.5 Critical Making

That leads the interview on to Critical Making and Pär argues that: “[…] in someway everything is a form of critical making. It does not matter if it is within graphic design or if it is, whatever makes and are designed. We are in that field anyway.”

Carina continues to talk about material choice and connect it to discuss Critical Making, and saying: “It is easier to be critical in your design when you have something to relate to.” The interview continues and talks more about Critical Making for the students:

Critical Making in this case is my thoughts that it can be something the students do. Maybe not in the making phase but afterwards when they reflect on and give time to think and maybe evaluate what they have designed. Critical Making for me is something that is alive during the design process the whole time, but that the students stop during the process and look at it from a critical angle afterwards.

The discussion proceeds to discuss Critical Making as a design process learning method, about which Pär comments:

As I see it from a personal standpoint, it would be very nice. I think critical making is a part of everything, but I do not know how to implement it because how the whole ME education is structured here at MAH. It is not much room for design, the course has a larger focus on technology instead.

Carina talks about Critical Making as a design process learning method and says:
I think that it absolutely makes sense. It summarizes what I have talked about before, that critical making is present but not pronounced fully. We should use that term from day one for the students and explains, this is how we work here and which impact it has in your learning.

Pär rounds the interview up by telling a way Critical Making as a design process learning method could be used: “Maybe even force the process on the students to participate. So you not only go home and do what you need to complete the assignment, but instead participate in the process and take it further steps in the design.” The interviews with Pär and Carina have helped the study to understand how the teachers works with the course graphic design, design process, reflection and Critical Making.

6.2.6 Keywords from the interviews

The results from the interviews with Pär and Carina are summarized of keywords they mentioned to define Critical Making as Design Process Learning Method.

<table>
<thead>
<tr>
<th>Aware/Awareness</th>
<th>Critical</th>
<th>Critical Making</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design History</td>
<td>Design Process</td>
<td>Feedback</td>
<td>Graphic Design</td>
</tr>
<tr>
<td>Limitation</td>
<td>Learning</td>
<td>Material Choice</td>
<td>Planing and Strucutre</td>
</tr>
<tr>
<td>Participate</td>
<td>Reflection</td>
<td>Revision</td>
<td>Research and Groundwork</td>
</tr>
<tr>
<td>Thinking</td>
<td>Technology</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 2. SHOWS KEYWORDS FROM THE INTERVIEWS FROM THE TEACHERS WITH PRACTICAL EXPERIENCE FROM THE MEDIA INDUSTRY.
6.3 Results from the focus groups

In the discussions with the two focus groups the students discussed graphic design, design process, material choice, reflection and Critical Making. Eight out of ten participants that were participated in the focus groups were also participated in the workshops. The first group (group 1) had all of the participants participated in the workshops. The discussion second group (group 2) had three out of five participated in the workshops, the reason for that were to see difference in their answers. The discussions were around 92 minutes long for both of the discussions and the meetings were conducted in Malmö at MAH 2016-03-30 in Swedish. The answers have been translated to English by the author. Both groups started to discuss their understanding and experiences about graphic design.

6.3.1 About Graphic Design

In group 1 participant A highlighted: “It should be easy to read and the typography is another thing that I have not thought so much about before.” Participant B continued with in the discussions and argued that: “It is a matter of balance and contrast too understand graphic design.”

In the group 2 participant E says: “I think that graphic design is a way to reach different people whit a message of form and colors.” Participant F continues with: “Sketches and drawing by hand is a very large part in the process of creating.” Participant G argues that: “The preliminary work is the base in the process of creating.” Which participant E comes back to and once again argues that: “For me the sketches are very important and without them I don’t know where I am in the process?” Participant G says that: “I feel safe with my sketches. When I have my idea on a paper I can go forward.”
6.3.2 Material choice and value

The two focus groups discussed what they thinking about choice of materials when they are working in different media productions. In group 1, participant A says that:

For me there has been a problem to work creatively in my laptop. For me it is easier if I can work on paper, paper in different colors and pencils in different colors. If I don’t work in this way.

Which participant C follows up with: “It is the same for me and I feel that I am a part of the project.” The discussion continues and participant B says:

And then I discovered something and find another way to do things. Now I use layer mask in one way and then I see how it is in one way. I feel it is one way to start a project and I can discover new facilities since I learn that there can be new ways to do things.

Participant C argues about inspirations sources as materials: “I use music as inspiration all the time and this way to work helps me a lot and it is a very good way for me to get the right feeling in the project.” Participant A follows up with: “I still like to work with paper and colors, For me it is a way to get more creative.”

In the discussion that the second group had Participant G explains: “Before I work with my PC I would like to do more advanced sketches. It is a way to be creative.” Participant E continues to talk about materials and the relation to a project: “What kind of material your
use later in the project is related to what kind of result you want.” Participant F highlights that: “If you are creative in the beginning the final result will be more creative.”

Both focus groups continue to discuss the value of what different materials have. In group 1 Participant C explains that:

I think it can be important to see ability in both ways to work, both in a laptop and on paper. I think both ways to are important and that’s why they still is a way to work in graphic design and the process in graphic design.

Participant D agrees with this statement and says that it depends how deep you are involved in an ongoing project:

It can be easy to start with paper and pencil and if it is like this you can be more creative. Digital tools can when a project starts be a more difficult way use since it can take longer time to draw digital sketches.

Participant A continues to talk about analogues versus digitalized objects: “Some elements does not need to be digitalized. You can mix instead.” Participant B argues as long as you have a purpose to work with both analogue or digital elements.

In the second focus group and their discussion about material value, Participant E argues about: “You must have some kind of feeling.” Which participant F follows up with: “For me it is very important what kind of material you use. It can be wrong if it looks like a children drawing.” Participant H does not agree and says: “For me it is the other way around. The material you use when you start a project is a way to work physically.”
6.3.3 Design process

The discussions in the both focus groups continually focused on how do define the design process in the education. In the group 1 participant C starts by saying:

I did the sketches my way. I felt that they were a part of the project and I tried to find inspiration, make ideas, find something out, do testing, get feedback and return to my first sketch. You knew how important it is to brainstorm your ideas so that they can develop.

Participant D continues with:

Especially since the design process we work in now is created around a way to start with a concept and then write a brief. This is not only a way to be creative. It is a way to start a design concept and it is also a way to start a new trademark.

The discussion continues and participant C says: “What is a sketch and why do I have to think about sketches when I working with design. It happens here and now.” Which participant D follows up with and explained that: “Maybe design process should be crazy!” Participant B ends the discussion by saying that: “Inspiration can also be very abstract and it is important to remember to motivate how to work.”

In group 2 and their discussion about how do define the design process in the education, Participant F says that: “I think that the design and the idea process is more important.” Participant H continues with: “You have to know what you are doing. You can go
to an aesthetics way of thinking and than you have to go one or two steps back and reflect of “What am I doing?” Participant E highlights importance of doing research and says:

One way to work with this is to make a mood board over, for example, about a design epoch. You can google on different designs over time and epochs, you can collect pictures. This could be one way to find answers to questions like, what was in this time that I find most interesting.

In group 2, participant G talks about target groups and purpose: “Which group is my work for? Which is my target group? If you don’t decide that you appointed a target group there is a risk that you will never be finished.” Participant F says: “Important and fun to be a part in the design process. It is also important to know how much time there is in a design process.” Participant G continues with: “I have learned to evaluate the design.” Participant F argues:

If you look at the design process, you will see that it brings many decisions that are thought through. You must be ready to argue for your work if the client starts to ask questions. Why is that line there? You have to ask yourself question about your design.

The discussion ends by participant H says that: “You should be able to see your decisions in all parts of the process.”
6.3.4 Reflections

Both focus groups continue to talk about reflections, which are a part of the design process. They discuss what they think about reflection and the learning process of it? In group 1 participant C argues that: “I think it is important to have a plan to follow but it is also a moment of concern and stress in all media projects.” Participant B explains: “A lot of things happens in a project and for me it is important to write down my thoughts.” Participant C continues and argues about the importance to have a starting points:

It is good to start your process from one point. If you do not work from a starting point, it can be difficult to find out where to start the project. I always think a lot about the purpose in my work and who is the receiver.

In group 2 participant G starts by discussing reflection and how that can help you to find out what was important from the process and where you are in the design process, if more time needed, who the client is and what needs to be done differently. Participant F follows up with: “I have to find out how my private and personal design process should be, for it to be perfect. Now I have a chance to test my individual design process and compare it to others.”

6.3.5 Critical Making

The discussions in the focus groups continues how they understand the concept Critical Making? In group 1 participant C starts by says:

I think it is good way to work. It is important to have critically reflection about yourself and it is important to reflect about your work. If you don’t work like
this, you will never be able to develop in your work. I think this way to work is important when you will be a part of larger project.

Participant A claims: “It is important to be aware about critical making, and for me a conscious creation nearly is the same as creative creation. You ask yourself about what you are doing. Does it work and will it be good?” Participant C continues by saying: “When I hear critical making I hear development. I think it is necessary there are some problems when a project starts and after that thing is getting better.” Participant B highlights the importance of purpose during your work and argues: “It is important to remember what the purpose is and be creative and critical since there are other people that will be affected by the project.” The discussion ends about Critical Making and participant C highlights the importance of failing: “You have to fail more. Everyone is so afraid of failing and it affects your own creative thinking.”

In group 2 the discussion about understanding the concept Critical Making, Participant G starts with: “I have learned that it is important to be critical about what I am doing and also dare to question why I am doing so.” Participant F continues in the discussion and says that: “In some way when I hear critical making I hear limits in making.” In the conversation participant E argues: “You have to make a positive demarcation” Participant H highlights sketches as a part of Critical Making and says: “I can feel that sketches are a way of critical making. You have control over your work and it gives you a chance to be more self-critical.” Participant G follows up with: “It gives you a chance to take conscious steps.” Participant F talks about connections with critical thinking and Critical Making:
If you think critical and you have been a part of critical making, then I will have a ground for my idea and argument for the design choices I made, even if I do not like the design 100 percent myself.

Participant E explains how important it is to ask questions instead of limitations, and says: “That probably goes hand in hand, like delimitations. It is important to ask questions through the whole process. Why am I doing this and what is the meaning of it. Questions that might be through the whole process.” Participant F continues to say: “To be critical creative can be limited. You should look on the question in another way. You have to be critical on what you create.” Participant I and F talks about awareness and says: “I think it is important to feel some awareness in your way to be creative.” Participant I also says:

If it is about creative making and to take in others feedback or is it about my own thoughts? Or can it be about what a target group wants or should it be a new way of thoughts and innovations?

Participant E says: “It must depend on the situation.” Participant F talks about the process and it can be difficult depending on the project, Critical Making can be a way to make the process more real. Participant E continues and talks about target groups and that those are making the design process easier, by saying: “It must be easier if you find your target group and then you can make your process and critical making from them” Participant I ends the discussion in group 2 by talking about limitations and creativity by saying: “Limits can kill creativity and also increase creativity if it is linked to the right issue.”
6.3.6 Critical Making as a Design Process Learning Method

The final question that the focus groups discussed were if Critical Making would be something that could be useful as a design process learning method in the educations of ME at MAH. In group 1 participant A starts by telling: “You must have a goal and do not be afraid to dare to challenge yourself.” Participant D continues by saying: “That was how we did in the Critical Making workshop, where you told us that it was not important be finished and for me that was important to see the process more than a final product.” Participant A talks about feedback as a part of Critical Making: “It is important for me to develop and I have to have feedback.” Participant D follows up by saying:

It was the same for me and I mean it was a way to be more critical to myself. It never turned to a way of we don’t have time to think about that because we have to be finished with our project.

Participant B ends the discussions and the meeting with group 1, by saying that: “I find sketch seminarian important and they are practical involved with critical making. It is a way to get feedback from all participants, not only from the teachers.”

Group 2’s discussions follow up from what group 1 as highlighted and participant G says: “In any chase the student learns to know their own thinking and I think that this is very important.” Participant H argues: “If there is no critical thinking in the process here is no function in the process and it does not fill any sentence.” Both of the focus groups have discussed material choice, design process, reflections, critical thinking as understanding elements to define Critical Making.
6.3.7 Keywords from the focus groups

The results from the discussions with the two focus groups are summarized in a table below with keywords that the participants highlighted and expressed as important in their understanding of Critical Making.

<table>
<thead>
<tr>
<th>Awareness</th>
<th>Analogue</th>
<th>Challenge yourself</th>
<th>Critical/Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Making</td>
<td>Critical thinking</td>
<td>Concept</td>
<td>Creative/Creativity</td>
</tr>
<tr>
<td>Design</td>
<td>Design Choice</td>
<td>Design Process</td>
<td>Digital</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Feedback</td>
<td>Feel/Feeling</td>
<td>Forms and Colors</td>
</tr>
<tr>
<td>Fun</td>
<td>Graphic Design</td>
<td>Limitations</td>
<td>Material choice</td>
</tr>
<tr>
<td>Matter of balance and contrast</td>
<td>Process</td>
<td>Purpose</td>
<td>Reflection/Reflect</td>
</tr>
<tr>
<td>Research</td>
<td>Sketches</td>
<td>Think/Thinking</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 3. SHOWS KEYWORDS FROM THE INTERVIEWS AND DISCUSSIONS FROM THE FOCUS GROUPS.**

6.4 Summarize of the findings and keywords

The findings from the qualitative methods that have been used and conducted in the thesis, can be summarized with a series of keywords. The keywords come from the observations from the workshops, interviews with Carina and Pär, and discussions with the two focus groups and from about a common language in discussions about design, design process, content, context and reflection as learning functions for courses within ME at MAH.

<table>
<thead>
<tr>
<th>Awareness</th>
<th>Analogue</th>
<th>Create Feelings</th>
<th>Creative/Creativity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Making</td>
<td>Critical Thinking</td>
<td>Collaboration</td>
<td>Colors and Form</td>
</tr>
<tr>
<td>Decisions</td>
<td>Design</td>
<td>Design Process</td>
<td>Digital</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Feel/Feelings</td>
<td>Fun</td>
<td>Limitations</td>
</tr>
<tr>
<td>Learning</td>
<td>Material choice</td>
<td>Matter of balance and contrast</td>
<td>Participate</td>
</tr>
<tr>
<td>Process</td>
<td>Purpose</td>
<td>Reflection/Reflect</td>
<td>Research and Groundwork</td>
</tr>
</tbody>
</table>
TABLE 4. SHOWS KEYWORDS FROM THE INTERVIEWS AND DISCUSSIONS FROM THE FOCUS GROUPS.

These keywords lead the findings from the study how Critical Making can be developed as a design process learning method. By combining these keywords with how students understands and uses context, material choice, reflection and design process in their education and learning processes in designing and making media productions.

6.5 The prototype as result

The making of the prototype is based on the theory and findings from the results to define Critical Making as a Design Process Learning Method. The key elements in the making of the prototype have been to focus on the context, the material choice of combining a digital and a printed poster, videos, images and AR to make it interactive, which all form the design process for the prototype. The steps that have been taken in the design process have been to work with keywords like limitations, awareness, creativity, materials, informative and pedagogical functions in correlation with my prior knowledge and experiences from media productions. Kolb (1984) states that learning is a lifelong process, which connects to Critical Making and the role of the design process and the choices that are made in the authors opinion.
7. Discussion

The combinations of empirical and qualitative data needs to form a narrative and understandable structure for the readers (Yin, 2013). According to Bell (2010), it is important not only to discuss how the results formulates answers for the research questions, but also how the data has been interpreted and indicates what could be different.

7.1 Methods discussion

The interviews, discussions with the focus groups and workshops with the students were to get the participants point of view in how they work and understand concepts like graphic design, design process, reflections, material choice becomes important to work and understand the concept of Critical Making. Critical Making as a design process learning method can allow the students to develop a deeper understanding, meaning and more conscious choices in their studies and learning aspects, but also enable a common language between students and teachers. Ratto (2011), Somerson and Hermano (2013) also argues about the importance of the participants to be and act in a design process and see it as a learning method that is a non linear process. Dewey (1997b) explains that observations and knowledge from others and that your own experience will help to define the purpose in your work.

The workshops were developed within in this study and aimed to try out how Critical Making could be developed as a design process learning method, with the help of the students and getting their understanding of the concept Critical Making from the workshops. The exercise (see Appendix 10.3 Exercise description, for more information) was a way to get information how to define Critical Making as a design process learning method and how the students especially worked with material choice in the design process to design a visual poster of their understanding of how they interpreted graphic design, design process, material
choice, reflection and how that correlate to Critical Making. Critical Making explores the gap between design, technology and society by focusing on the design process (Ratto, 2011; Record et al., 2013), in this case what materials the students chosen to work with when they designed their posters to minimize the gap between these areas.

The interviews that were conducted in this study were aimed to summarize the teachers understanding of graphic design, materials, their point of view about design process, reflection as learning methods and finally about Critical Making. The interview with Pär focused first on how the course ME136A Graphic Design has been structured in the past. The interesting part with the information was to find solutions or problems that Critical Making could solve as a design process learning method. Pär also shares his opinion and understanding of how he sees the term graphic design from his knowledge and experience in the field, and that it has a complex meaning. Especially for the students that think the course and the field is easy and it is just fun where they can make some graphics and then they are done. Fun is still important, but as Pär and Carina explains that it is different between having fun by achieving and learning about graphic design, instead of just having fun and do minimum requirement. Pär argues that Critical Making can be a way to combine design, technology and processes in ME education. A common language is something that is needed between teacher and students and students between students when it comes to design and artifact courses, which Pär, Carina and the students from ME136A have been stating. Critical Making could be a method to do that. To understand design in education Pär means that everything can be named Critical Making and that would allow ME educations not only to have a common language, but also to focus both on technology and design aspects together. Critical Making as a design process learning method could be a possible way to combine content, design process, material choice and reflection to give strength to the field of ME.
Carina explained how the course works nowadays and that it focuses on graphic design production processes, planning and structures rather than only focusing on forms and artistic expressions. Carina described how the course has been performed past years, and that one of the major developments for the course has been to add more theoretical material and seminars about design history. The design history has given the students a ground and a structure to work with and to use to understand different design epochs as limitations for assignments in the course ME136A Graphic Design. Carina discusses the second assignment that focuses on design epochs and force students to work with guidelines, clients and limitations to design their interpretation of a specific design epoch, which is something that needs a solid groundwork and research in the design process. This something that Krippendorff (2005), Ratto (2011), Drucker and McVarish (2012) and Somerson and Hermano (2013) argue that understanding previous occasions will guide you and make conscious choice in your design, which I as researcher, teacher and media technologist agree on is very important for students and designers. Material choice and reflections can be steps for the students to become critical in their design and learning processes, but also to define directions of feelings to materials and ME through reflection. Carina summarizes the interview by talking about awareness, which connects to decision making, material choice, reflection and purpose within a design process. Critical Making could make it possible as a design process learning method here at ME at MAH, and to be used as a common language between teacher to students and students to students from day one to minimize the gap between design, technology and social science in the education.

The findings that come from the meetings with the two focus groups were ideas, thoughts and understanding of each others knowledge and interpretation of graphic design, about material choice, reflections and the design process. Sketches were one element that both
of the groups discussed as a major part in a design process, but also that it had connections to Critical Making. The two focus groups discussed that Critical Making as a design process learning method would be very useful for students in their learning. One way to understand the answers from the focus groups about Critical Making has come from the students discussions to create awareness, work with limitations, combine reflection and the design process closer to each other and choice of materials matters in the design process. The participants in the focus groups talks about reflections as a method use for their learning but also how they see reflection as a part of design making. Schön (1983) means that drawing and talking are ways to design, which correlates to how participants discusses sketches. During the discussions with the focus groups the participants sees Critical Making as way to communicate their design process with others, yourself and for the receiver, as a common design language. The results from the workshops, interviews, and discussions from the two focus groups shows how Critical Making as a design process learning method can be used and developed in the education in ME at MAH as a common design language.

7.2 Common design language

Pär, Carina and the participants from the focus groups states the importance to have a common language within the education when technology, society and design. A common design language that combines design, design process, material choices and reflection with awareness, limitations, target group/groups to design media productions. The teachers and the students also highlights elements that like decision making, feedback and purpose within a design process are important within ME. Critical Making could shrink the gap between courses, teachers and students to form a common ground about the view of a design process learning method in ME at MAH and how it could be used. Somerson and Hermano (2013)
states that a common language is A - O in creative learning to form a solid ground for students to rely on. Critical Making as a design process learning method can be a way to form a common language within the educations of ME at MAH. As I see it a common design language is necessarily for ME to formulate a clear recognition what ME is and how it can be developed for further with the use of Critical Making.

7.2.1 Design process

One of the important participant highlight is to feel awareness in the design process and what you want to express. Dewey states in the following quote: “Expression as personal act and as objective result are organically connected with each other” (2005, p.86). Which correlates to material choice and the impact in the design process has within a media production. Several of the participant’s states that the material choice influences the design process and also depend if you are working alone and together with others with the assignments. Another thing that can affect what the design process is depending on is what target group and client the media production aims for. The participants also discussed that the design process never is linear, but a clear purpose comes from limitations and awareness about what media you are going to design. One of the participants said in the discussion about Critical Making that limitations can kill creativity but also increase the creativity in a design process. Another participant said that during the workshop it was not focus on the final result but on the design process which give a liberating feeling in the design process. Something that both Pär, Carina and the students highlighted are the importance to always asks questions in everything you do.
7.2.2 Reflection

Reflection is an important part of this study as a method for students to think about their process and learning approach within the course. Reflections will also allow the students to take more responsibility in their own learning outcomes by reflection on their problems, solutions and experiences (Schön, 1983). Pär states that when students are working in a design process, it is important to take the design process seriously. It is the same problem with reflections, that we force the students to reflection everything afterwards, but we should courage them to reflect meanwhile a project. This is something that Kolb (1984) states that there are two primary dimensions to the learning process, one as actor and reflect during the process and the second as observant that reflect after the process. The first dimension is something that should be more encouraging within ME and Critical Making as a design process learning method could be a way to do that. Critical Making can be something the students can use both in the design phase and also afterwards through reflection and evaluating of their media production is something that Carina states. Meggs and Purvis (2012) argues in the following quote: “We are continually confronted by new visual messages, and those that remain significant must be visually striking, intellectually stimulating, and deeply genuine” (p.7). The meanings of visual languages correlate to the design process and the importance to reflect during the design process, according to Ratto (2011). Reflections as well as design processes are based on nonlinear learning approaches when students are acting in a design learning process according to Molander (1996) and Somerson and Hermano (2013). The participants from the focus groups are united about the importance of reflection during and afterwards a design process to learn more about their experiences they used in the design process.
7.2.3 Prototype

For me as the author, teacher and the designer, the prototype is a reflection of how I interpret and define Critical Making as a design process learning method, focusing on context, material choice, reflection and design process as key elements in this study. The designing of the prototype has been through utilizing these key elements as a way to visually represent my understanding and how it can be used for other courses and programs in fields like ME. The reflection part is in this case the visual design structure that I have created. The design has been presented and discussed with friends and colleagues so the prototype is not simply a nicely designed poster, but a way to establish a common design language and using Critical Making as a design process learning method within ME. The idea with the prototype is to combine practical and theoretical knowledge with experiences that are needed in fields like ME, where students create and make artifacts in different ways by combining the disciplines design, technology and social science.

7.3 Learning design language

The findings from the methods correlates with the didactic approach that was mentioned earlier, to form a red thread how the teachers form learning situations for the students. Dewey points out in the following quote:

Now, the general conclusion I would draw is that control of individual actions is effected by the whole situation in which individuals are involved, in which they share and of which they are co-operative or interacting parts. For even in a competitive game there is a certain kind of participants, of sharing in a common experiences. (Dewey, 1997b, p.53)
The quote connects the discussions from the focus groups about learning experiences in a design process, by designing objects and how they learn from each other by getting feedback and asking questions. Once again it is important for the students and teachers to work with the *why*-questions in all the steps (Bränberg, Gulliksson & Holmberg, 2013). Once again a common design language is A-O to form a common ground for the students, teachers and assignments to rely on and to meet the world that is rapidly in changing and especially the media field. An important aspect about chapter 3.1 Learning process and didactic in this study, it is not the same as design research, instead didactic is used as a pedagogical approach for teachers to solve their work, which can be used in courses about design.

**7.4 Critical Making as a design process learning method**

The workshop was not only a way to test Critical Making, it was also left with a result of 12 posters about how the students understood Critical Making and how it could be developed to a design process learning method. The 12 posters represent how the students see, understand and want to use Critical Making as a method for design process and as a common language among students to students and teachers to students. It is noticed when the students ask each other about their poster design in the end of the workshops. The students argue about the importance of material choice during the design process. It is also noticed that they see the context along with reflection as a way of understanding and taking learning from outcome decisions. They also see Critical Making as a design process learning method. In this case for ME at MAH were students’ needs to use, understand technology, society and different medium to produce different media productions as a learning approach. Key elements that forms Critical Making as a design process learning method are Context, Design process, Reflection and Material choice. Context, Design process, Reflection and Material choice are
connected to same or different key words with the help from the interviews and focus groups to shape Critical Making as a design process learning method.

**Critical Making**
- design process learning method -

**Context**
Purpose, client, users, feedback, limitations, conscious steps

**Material Choice**
Awareness, knowledge, limitations, physical, digital and mixed objects,

**Reflection**
Learning outcomes, experiences, thinking, motivations, awareness, limitations

**Design Process**
Decision making, feedback, limitations, cooperation, research, conscious steps, thinking

**Common design language**

These four circles in figure 14 forms how Critical Making as a design process learning method can be used in interdisciplinary educations as a common design language. The model above is a result and a way for me to describe the key elements that form the study and a solid framework for a common design language within ME educations. For me as the author, teacher and media technologist, I see it as important to use these key elements and keywords as a summary that can be used to describe Critical Making as a design process learning.
method. Schön (1983), Kolb (1984), Molander (1996) and Dewey (1997b) argue that it is through reflection we reshape our experiences and knowledge as long as we live. Critical Making can be used as a design process learning method for reshaping the ideas in ME education.
8. Conclusion

Key components such as context, design process, reflection and material choice has formed the understanding of Critical Making by develop, observe and interact with students, teachers, workshops and the theoretical research. These key elements have been explored with the students’ help in the workshops, which opened up the lack of a missing language between teachers and students about design. A common design language when students and teachers discuss design, design process, material choices and technology as important aspects in the students learning in different assignments. The study has explored Critical Making as a design learning method in the field of ME.

One area for future development that might help to “stabilize” the publics created during these workshops would be to include a low-weight means of continuing the discussion beyond the workshop itself so that designers, artists and engineers could share ideas around this. (Record, et al., 2013, p.117)

This quote connects the theoretical framework and the methods used in the study and how Critical Making relies on the participant’s activity too. The findings from this study connects to the research questions: How can Critical Making be explored as a design process and a learning concept to be integrated in artifact-producing courses? More specifically, how can Critical Making fill the gap between technology and design in Media Technology at Malmö University as a pedagogical design process learning method?

The answer to the first research question is that Critical Making can fix the gap between design, technology and social science, as a design process learning method for higher educations like ME or other interdisciplinary educations. Ideas how that can be done are to
have clear learning goals in the course syllabus how students going to work with materials, reflections and context as key elements in a design process. But also how teachers can plan a course and assignments by using Critical Making to focus on context, design process, reflection and material choice as the design process learning method for deeper learning outcomes.

• Create assignments to allow students to choose materials they want to work with to solve the problem and their understanding of the assignment. PBL can be a method to implement Critical Making in creating assignments.

• Supervision thought out the whole design process.

• Force students to document their learning and design process and reflection on it.

The answer for the second research question is to develop an interactive poster to share how Critical Making can be used as a design process learning method for other teachers and design and media student’s.

• Critical Making as a common design language between students and teachers within in ME educations. The common design language will be shaped through opened assignments, supervision and force the students to reflect about their design choices during the design process. Not afterwards the assignments they have worked with. Examples can be to use physical or digital workbook, design notebooks or learning notepads.

• Redesign the course ME136A Graphic Design at ME at MAH to builds on the ideas about Critical Making as a design process learning method from scratch. To shrink the gap between technology and design in the education.
8.1 Further studies

To give an even deeper meaning and understanding about Critical Making as a design process learning method I recommend a study that follows students during their three years in a bachelor program in ME and other media fields to see a deeper learning progress. To develop a design process and learning method, further studies in Critical Making will be needed to define problematic and pedagogical approaches and use Critical Thinking in the media field, to form innovative educations. A way to do so is to use Critical Making from day one and till the last day of their education, which would give more insights how the students would work and tackle problems by using Critical Making as a design process learning method. To see how Critical Making would affect the education.
9. References


Critical Making as a Design Process Learning Method in the Field of Media Technology at Malmö University


10. Appendix

10.1 Prototype - How Aurasma works and how to launch the Aura

First download and open the Aurasma app on your phone or tablet and log in using the same
username and password as your Aurasma Studio account. After that go to the "Auras" tab
within the "Explore" section and drag the page downward to refresh the Auras. Choice to
follow the channel or the user and then select the app's viewfinder and point your device at
the Trigger image below to preview your Aura. More information about Aurasma will be
available on their website: https://www.aurasma.com/get-started/ and on App store.

10.2 The online prototype

The interactive poster is available on the following web address https://studio.aurasma.com
and will be fund by the Aura name: criticalmakingdesignposter
10.2.1 Triggers

Trigger 1: criticalmakingpart1video

![Workshop Critical Making Step 1: Introduction](image1)

FIGURE 17. TRIGGER IMAGE THAT WILL PLAY A VIDEO IF IT IS SCANNED WITH THE APP AURASMA. PHOTOS MADE BY THE AUTHOR.

Trigger 2: criticalmakingpart2video

![Workshop Critical Making Step 2: Result](image2)

FIGURE 18. TRIGGER IMAGE THAT WILL PLAY A VIDEO IF IT IS SCANNED WITH THE APP AURASMA. PHOTOS MADE BY THE AUTHOR.
Trigger 3: criticalmakingslideshow

FIGURE 19. TRIGGER IMAGE THAT WILL PLAY A VIDEO IF IT IS SCANNED WITH THE APP AURASMA. PHOTOS MADE BY THE AUTHOR.

Trigger 4: criticalmakingdesignposter

FIGURE 20. TRIGGER IMAGE THAT WILL SHOW A COLLAGE OF IMAGES IF IT IS SCANNED WITH THE APP AURASMA. PHOTOS MADE BY THE AUTHOR.
10.3 WS-Exercise description

Assignment description was in Swedish when the workshops were conducted about Critical Making, 20160314-15.

In groups three to four persons create your understanding for Critical Making by designing a poster. The poster need to show your insights of graphic design and Critical Making. Questions and information you can use and work with in the workshop are, what is graphic design for us? Design history, design process, material choice (analog, digital or mix media) and the context you work with in the assignment two (The salads bar). Use Ratto’s article from 2011 as well.

Important questions to think about during the workshop are:

- Your evaluation of the design process?
- How do we use prior knowledge in our design in the poster?
- Why do we choice specific material and how do that correlate to graphic design?

Document your design process during the workshop with at lest five pictures that show the beginning, the middle and the ending of your process. The poster will be presented in a physical form in the end of the workshop with a short reflection of the process. The aim with this workshop is to explore the importance of the design process not the final result.

10.4 Interview questions

How do you understand graphic design?

Can you describe the course ME136A Graphic Design?

How has the course been working before?

What is your thoughts about design process in the course ME136A?
How do you understand Critical Making, and can it be something to establish as design process learning method?

The role of material that the students work with in their design process?

### 10.5 Questions for the focus groups

What is your understanding and experiences about graphic design?

What do you thinking about choice of materials when you are working in different media productions?

What value does different materials have?

How do you define and understand the design process within your education?

What has that with the design process to do?

What do you think about reflection and the learning process of it?

How do you understand the concept Critical Making?

Would Critical Making be something that could be useful within the educations of ME at MAH?