POSTPRODUCTION AGENTS

AUDIOVISUAL DESIGN AND CONTEMPORARY CONSTRAINTS FOR CREATIVITY

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Abstract

Moving images and sounds are processed creatively after they have been recorded or computer generated. These processes consist of design activities carried out by workers that hold ‘agency’ through the crafts they exercise, because these crafts are defined by the Moving Image Industry and are employed in practically the same way regardless of company.

This thesis explores what material constraints there are for such creativity in contemporary Swedish professional moving image postproduction. The central aspects concern digital material, workflow and design work as distributed activities. These aspects are coupled to production quality and efficiency at the postproduction companies where production takes place.

The central concept developed in this thesis is ‘creative space’ which links quality and efficiency in moving image production to time for creativity, capacity of computer tools, user skills and constitution of digital moving image material. Creative spaces are inhabited by design agents, and might expand or shrink due to material factors. Those changes are coupled to parallel changes in quality and efficiency.
Dedication

I dedicate this Thesis to the memory of Mika Ojanen, dear friend, colleague, and dedicated moving image worker, with the highest appreciation for good storytelling and high image quality, alike.

The issues dealt with in this book were amongst his urgent professional concerns.
The work behind this thesis is part of my PhD studies, which is arranged as collaboration between Mälardalen University and Dalarna University. Dalarna University generously let me spend part time of my employment as a lecturer on these studies. The research projects that I have been involved in have been sponsored by Dalarna University as well as by Falun County and the European Regional Development Fund.

I am grateful to the companies participating in the research projects, foremost to the persons sharing their experiences.

I thank my dedicated supervisors, Professors Yvonne Eriksson (Mälardalen University) and Árni Sverrisson (Dalarna University and Stockholm University), for their coaching and guidance.

The research group, Design and Visualization at Mälardalen University have provided an intellectual milieu for constructive thinking and dialogue, with significant importance to my progress. I am particularly grateful to Anna-Lena Carlsson for constructive comments on the early outline of this thesis.

Teaching and researching colleagues, as well as technical/administrative support staff at Dalarna University, Image Production and Visual Culture seminars: You have been most supportive and encouraging. Especially, I thank PhD Maria Görts for critical readings of early versions of my texts.

I also want to credit my colleague and fellow doctoral student Per Erik Eriksson for valuable time spent on discussing moving image production as an intellectual endeavor.

Most of all, I am thankful to my wife, Susanna, who endures all the inconveniences that my studies bring, and shares the setbacks as well as the progresses. And for my children, I hope they will one day understand what kept their daddy so busy with the computer, as well as traveling so often. Perhaps they will also benefit from the content of this book, if they some time come to work with moving images.
List of Papers

This thesis is based on the following papers, which are referred to in the text by their Capitations.


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Abbreviations

A **Codec** is a specific way to organize the digital image information in a file. Usually a codec rationalizes this organization so that repetitions of information are reduced. This is called **Compression**. Every codec is unique and incompatible with others.

A **File Format** is a specific way to organize the digital information around sound and image data. The same file format may use different codecs, and the same codec may be employed by different file formats. Both file format and codec must be correct in order for computer software to read them properly, or at all.

**High End** moving image production refers to the most advanced modes of professional production, with the highest requirements on technical and aesthetical quality, such as Feature Film, Commercials and TV Drama.

**Low End** moving image production applies to the simplest and cheapest modes of professional production, with a minimum requirement on technical and aesthetical quality, such as Reality TV, TV News and some Documentaries.

**Middle Range** moving image production is here adopted to distinguish whatever modes of professional production that lie in between Low and High End production, e.g. Internet Commercials, Information Film and TV Entertainment.

A **Master** is the first unit of the completed audiovisual object (e.g. film or TV show) saved on some sort of medium, and from that numerous copies are made and spread.

**Production Value** is an aesthetic paradigm almost globally agreed upon among film and television production firms (Shamir 2007). Used as a concept, *Production Value* infers that those audiovisual objects with **High Production Value** look and sound exclusive, whereas others look and sound substandard or cheap, regardless of the innovative, or other, qualities.
1 Introduction

This thesis revolves around issues of creativity, workflow, and technical constraints in contemporary moving image postproduction. Shifts in technology bring new tools and new opportunities for creativity, but also new material and new workflows that may constrain work. Moving image production is in a transition period, where digital technology is applied more and more. In Postproduction it has been around since the 1990s. However, the introduction of digital ‘film cameras’ have brought new inputs into Postproduction, with digital material which constitution and configuration are no longer possible to predict (see Paper A).

The traditional way, to use celluloid film to record images, involved rather few technical choices, since there were three camera standards and a limited palette of film stocks to choose from during production. These choices were possible to overview for most people involved. Digital technology, however, offers hundreds of choices regarding technical standards and parameters. Only very few individuals within moving image production are capable to survey all these options (see Paper B). This is delicate, since every choice influences the image quality, and the effectiveness of the production workflow in postproduction. The wrong choices may cause technical bottle-necks and inferior image quality. They also constrain design creativity, when time must be spent on technical problem solving instead. In order to maintain the highest efficiency in postproduction, the desired aesthetic quality must be achieved within the time frame set for design work, which requires that the technical image parameters are correct from the start. This thesis will make these conditions understood, and suggests that maintaining quality in effective workflows when creativity is distributed must be considered a managerial issue.

Postproduction includes e.g. the merging of images into sequences, adding and removing objects such as insects, wallpapers or space shuttles, tweaking of colors, adding rain, snow or smoke, adjusting sounds, adding music, and other elements. When many individual crafts persons are involved, and they are spread out at different companies, creativity is distributed both in time and space. Each individual has assigned tasks to fulfill, and needs images with correct properties to be able to process them as desired. This situation is what is studied in this thesis.

The empirical data gathered in the projects behind this thesis are of three kinds:

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1 Hereafter, any use of the term ‘image’, refers to moving images.
literature from previous research as well as from the field of Media Production, interviews with mostly just-above-the-floor managers, and a production analysis of a TV show. The literature states the common knowledge about the field. The interviews gather qualitative data of phenomena, formulated by those who have encountered them, and allow for clarifications when needed. The production analysis gives thorough access to the complete result of a moving image production and its design.

1.1 Creativity and Organization in Moving Image Postproduction

Professions and crafts are many within the Moving Image Industry, and are spread out over a variety of instances within the production of film, TV, and elsewhere. In addition, many productions set up their own temporary organizations, not necessarily following a standard. Different parts of the production are carried out by different specialists, who frequently are located at different companies. Furthermore, the change from analogue to digital recording in High End productions can be expected to have effect on production methods and workflows, which in turn may require adaption from the production organizations and their staff. Here, the consequences of such effects on creative work in postproduction are studied.

Postproduction is the stages of professional moving image production after images and sounds have been recorded (or computer generated). Both audio and visuals are then altered in different processes by workers with different crafts, i.e. agents, who each master a production method and the associated computer tools. These properties are e.g. colors and contrasts of images or objects therein that could be removed or added, or simply several images merged together. In audio, layers of sounds are added to communicate things that are not visible, and atmosphere sounds add moods, and usually music is used the same way. Together, these audiovisual design processes lead to the completion of e.g. a film or a TV show, meant for mass communication. The individual agents have the task to act within their respective creative space, contributing in a collaborative design and production process of making an ‘audiovisual object’ with, usually, an intended meaning (see Paper C). Thus creativity is distributed amongst several agents with different crafts, and is often spread over different locations. Since all the instances in the production concerns one and the same audiovisual object, all audiovisual parts must fit together even though they are designed under these conditions, separated in time and space. In this context, creativity concerns the aesthetic problem: how to achieve a certain effect which is defined beforehand, although the end results of the appearances are not, and with the desired quality. These end results are only sketched. Reaching these end results entails an aesthetic search that needs creativity. The inevitable constraints for this creativity is to be found in the
immediate surroundings of the design agent, such as the capacity of a tool, the quality of a material or the time to spend on the creative activity (see Paper C).

In moving image postproduction, for every production the creative activities of design agents are organized as a step-by-step workflow, where production methods are employed in a certain order, to achieve the sound and image features wanted. The workflow decides what place each agent has in the organization. To make the design processes as effective and as fast as possible, and to keep the budget, smooth workflows are desired. Effectiveness considers whether the planned amount of time can be spent on creative work in order to achieve the sought for aesthetic quality, or not. Technical bottle-necks may constrain the workflows and cause needs for technical problem solving that occupy time and qualified equipment. It is a managerial issue to plan the organization of a production, so that images and sounds flow well between distributed creative agents. Hence, design agents are given opportunity to employ their skills, and enough space for their creativity, and technical bottle-necks are avoided. These are the core issues in this thesis.

1.2 Background

Traditionally moving image production has been linear. They have been produced using similar production chains and workflows, based on the celluloid film recording medium, from its industrialization in the 1910s up until the 1990s when computers were increasingly employed (Salt 2009). The original celluloid workflow followed one strict order from the camera, through the lab to the editing, the subsequent merging of the color graded master, before the film was copied for distribution. This order was broken up by the digital postproduction during the 1990s when the production stages of digital visual effects and animations where spliced in, after editing. However, the workflow was still linear.

In contemporary moving image production the digital material allows for alternatives (Manovich 2001), but at a cost. It is in principal possible to re-process digital images several times in order to make later changes. However, every such change is likely to cause the need for consecutive changes as a ‘domino-effect’, which increases production time, and thus affects the budget (see Paper A).

Since the issues attended to in this thesis spring from the contemporary technological shift in image recording technology, issues concerning sound are mostly disregarded from now on. However, most of the reasoning that regards workflows and agencies is valid for sound design in moving image post-production as well, since sound workflows are affected in similar ways by digital audio file format cruxes.

The new conditions brought by the shift in image recording technology can be summarized as follows: A) the fact that the image material is digital files with
certain codecs from the very start, B) the image file is configured by the camera settings, which needs to be done correctly, and C) the necessity to handle those files in a proper way (Wheeler 2009). Errors in any of the B and C respects are here referred to as ‘cruxes’ and are assumed to affect the workflow, which usually follows an established general order (see Figure 1): Image files are converted to a lower-resolution format that suits editing, images are edited into sequences, color and contrast properties are elaborated, objects are removed from or added to the images, and visual phenomena (such as light or smoke or water) are added. Then graphic titles are added, and a final conform of the image quality is executed. Last, the visual appearance of all the images is adjusted to give the audiovisual object a cohesive look when the master grading is conducted.

What differs between any digital postproduction chain from one with chemical recording is that the recorded file from the camera must be converted in the Pre-post conversion, and given the desired color and contrast qualities digitally, which is what is done chemically when celluloid film is developed in the lab. At that stage there are possibilities to process the image creatively, both the chemically and the digitally recorded images, but in different ways (see Paper B). Editing is similar for digital and chemical recordings, but thereafter the stage of conforming differs, when the images are restored to their maximum quality, since celluloid has a fixed range of color and contrasts depending on the film stock and the exposure chosen at the recordings. The digital conformation still allows for as much creative manipulation as the digital depth permits. Then in the stages of preliminary grading, adding graphic objects, compositing, creating visual effects, and again grading the images for coherent coloring and contrast, there are similar creative
opportunities regardless of recording medium (see Paper B). Successively, graphic titles are added, and again there is an occasion to make a creative impact. Simultaneously, from conforming and on-wards, sound is designed and mixed. This is roughly how creativity is distributed within moving image postproduction. Finally, sounds and images are coupled to a Master, the first completed materialized unit.

The audiovisual design that takes place in Postproduction is separate for audio and visuals, and sound design is carried out in its own process. What specific tweaking of images that occur in postproduction varies from one production to another, but there are usually several processes where image properties are added, removed or changed. Technically, these changes require qualified computer programs and considerably computing power as well as storage capacity (Browne 2007, Case 2001, Clark and Spohr 2002). Designerly, skill-sets and competences that constitute a number of postproduction crafts are needed (cf. Stinchcombe 1990: 33), to process moving images in the desired ways. Design tasks are allocated to each craft according to Moving Image Industry conventions. And for each craft there is a production method (or several) with an assigned tool (or several) that is applied to process image features (see Figure 2). In most cases there are intended

![Figure 2. The Postproduction agent masters a production method.](image)

Usually a production method has an assigned tool that is made for that method, although there is not a complete overlap. The production method often includes things outside of the tool, and the tool often has functions external to the method.

meanings for the audiovisual object, such as stories to comprehend and/or emotions to provoke, that the audiovisual design must contribute to fulfill, along with the aesthetics of the desired production value. It is already thoroughly discussed by e.g. Grodal et al. (2004) that it is a mistake to consider these design efforts as mere executions of intentions from some implicit or explicit ‘author’, such as the director or producer of an audiovisual object. When doing so, one misses the
understanding of the level of detail processing that each designer contributes with, and what importance the conditions for his/her creative work has for the outcome of the final result of the audiovisual objects’ expressions. These aspects are dealt with in this thesis when discussing agents’ creative spaces within a moving image production organization.

The process of adding different properties to (or removing from) each image, are organized into a workflow. These postproduction processes claim aesthetic as well as technical competence from individuals, but also creative capacity and work pace. The organization of moving image production effects how creative contributions are spread out. That is the distribution of creativity. When the technical conditions within production change, it seems fair to wonder what the effects are on organization and design work, since new technology puts new demands on workflows. It is reasonable to think that new technology thus brings new requirements along with new possibilities and space for creativity.

My interest in this situation is founded in my previous engagement in the TV industry as a video editor and a news cameraman. Being a lecturer in Media Production forces me to deal with these issues on a daily basis when addressing students. My take on the above situation, as Innovation and Design research, is from the perspective of considering moving image production as a design process, having my focus on the conditions for the creative work during primarily postproduction. Conceivably, innovations can contribute to improve design processes to become more efficient.

1.3 Problem Statement and Objectives

As in other fields and industries, shifts in technology require adaptation from the people and organizations employing new technology. There is such a shift going on within the Moving Image Industry, from chemical to digital technology (Wheeler, 2009). In related fields, such shifts have proven to cause consequential entanglements, and needs to adapt work approaches and routines to the new situations, (Sverrisson, 2000, Henderson 1999). The competition between manufacturers of moving image technology seems to provoke an ever increasing variety of codecs and file formats for digital recordings that exhibit different qualities. Some have high image resolution, some have great color depth, and some are densely compressed. The challenge for the moving image production professionals is to make the right choices in order to keep as high image quality as possible while maintaining an effective workflow, and cutting costs. The wrong choices may cause cruxes later in the production chain and thus increase costs (see Paper A). Reversing the production workflow might be even more costly (see Paper B). A well functioning production apparatus is crucial to maintain productivity (e.g. Stinchcombe 1990: 96). Furthermore, malfunctioning workflows
are assumed to make impact on creative work at a few or several instances in the production chain. A specific aspect of this situation is that the creative work is distributed, which commonly complicates the consequences further. Thus, new technology with new production methods requires new optimization of workflows in order to achieve the best possible work efficiency and quality of the production outcome. Quality is here understood as both a technical standard and communicative properties. These properties might be expressed as a formulated ‘message’, and/or a ‘story’, and/or certain emotional evocations that the audio and visuals are desired to perform, within a given aesthetic framework that the Moving Image Industry labels ‘Production Value’. The technical standards are defined in terms of image resolution (pixels, vertically and horizontally); dynamic range, which in turn can be divided into color depth (in bits per color channel) and luminance/contrasts\(^2\); and frame rate (including line progression). Efficiency is reached through low time consumption and employment of the most suitable equipment when achieving the sought for quality.

In consequence, the objectives of this thesis concern what kind of implications a shift in moving image recording technology has on creativity in Postproduction workflows, at which instances in the production chain these implications are actualized, and to what effect. Quality and efficiency are considered with reference to ‘production value’. Therefore, a survey of Postproduction organization, after the full production chain has turned digital, is conducted. The first purpose is to explore how a shift in moving image recording technology, from celluloid to digital, affects conditions for efficient audiovisual design work with high quality in Postproduction. The second purpose is to understand the role of crafts as agencies in Postproduction, how audiovisual design creativity is distributed between different crafts in a collaborative production mode, and how individuals can acquire and possess such agency. These objectives are here treated as inter-related, and as having implications on how creative spaces are demarcated and distributed within postproduction, as well as on how creativity is configured around different crafts and on how ‘production value’ is maintained. An explanation is required of how the people involved in these processes understand their respective crafts and functions in the production process, especially since those are currently changing.

1.4 Aims and Research Questions

The aim of this licentiate thesis is to point out optimizing factors for creative spaces in moving image production, according to their general distribution and adaption to new digital material as these depend on workflows. Specifically, the use of checklists for distribution of knowledge within organizations is considered. Another aim is to explain the crafts of production people as agencies in audiovisual

\(^2\) Luminance/contrast is calculated from the color depth, but differently by different manufacturers.
design, as well as to point out crucial material conditions for creativity. Those aims should be regarded as inter-woven, mutually dependent on each other, and as crucial conditions for quality and efficiency in moving image production. Since the aims and objectives are inter-related, subsequently, the research questions also are:

1. Does the shift in recording technology (from celluloid to digital) affect creativity in moving image Postproduction? If so, how?
2. In a complex process, where the design of an audiovisual object (e.g. a film or a TV show) is distributed and divided amongst individuals with different crafts, how does this distribution affect creativity?
3. How can we understand workers in moving image Postproduction as agents in a design process?

Table 1. Objectives related to research questions and papers in the thesis.

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<tr>
<th>Objective</th>
<th>Research Question</th>
<th>Paper</th>
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<tr>
<td>I. To understand and explain whether a shift in moving image recording technology affects creativity in audiovisual design work in Postproduction, and if it does, how.</td>
<td>1. Does the shift in recording technology (from celluloid to digital) affect creativity in moving image Postproduction? If so, how?</td>
<td>Paper A Paper B</td>
</tr>
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<td>II. To understand the role of crafts as agencies in Postproduction, how audiovisual design creativity is distributed between different crafts in a collaborative production mode, and how individuals can acquire and possess such agencies.</td>
<td>2. In a complex process, where the design of an audiovisual object (e.g. a film or a TV show) is distributed and divided amongst individuals with different crafts, how does this distribution affect creativity?</td>
<td>Paper A Paper B Paper C</td>
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<td></td>
<td>3. How can we understand workers in moving image Postproduction as agents in a design process?</td>
<td>Paper C</td>
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1.5 Scope and Delimitations

Moving images are produced and used in various ways and under a variety of conditions in contemporary society. Since my interest in this thesis lies in the conditions for design and production of moving images, I do not consider any strict spectator use of moving images at all. Nor do I take any other than professional design or production of moving images into account. Furthermore, the most sophisticated professional design and production of moving images take place within five sectors: computer games, virtual reality, internet multimedia virals, and the film and TV industries. Since the first three include mediated expressions combined with computer programming, I have for simplicity’s sake chosen to demarcate my studies to the latter two contexts. Therefore the answers to my research questions have their primary validity in the same contexts, but it may be possible to transfer them to other contexts that are restrained by similar conditions.
Moreover, this thesis only considers Postproduction. The stages of postproduction within moving image production are all the processes that sounds and images pass through after they have been recorded or computer generated. The reason for this focus is that those stages concern the design impacts on an already created and mediated material. Much interest and effort have been made in studying creativity in front of, as well as around, the recordings. However, postproduction has, with few exceptions, been either neglected or considered to be a given beforehand: just effectuating orders from producers or directors (cf. Grodal et al. 2004). Since the main issues in this thesis stem from the technological shift in image recording technology, sounds are considered only in parenthesis.

The empirical data is situated in a Swedish context: both companies involved and moving image material derive there-from. This is a matter of convenience. When trying to relate the Swedish Moving Image Industry to its counterparts in other countries, comparable statistics are hard to find, since statistical methods and presentations of data may differ as well as boundaries for categories. The Swedish Film Institute found that 84 of the most relevant feature film production companies turned over SEK 1.66 billion [app. €180 million]$^3$ during 2010 (Fröberg, 2011). Whereas the film and video production sector in Britain turned over £ 4194 millions [app. €4.9 billion]$^3$ in 2010 (UK Film Council, 2011). For the US, only the gross numbers from the film industry are found: $325 billion [app. €240 billion]$^3$ per year for the period 1995-2011 (The Numbers, 2011). Nevertheless, the Swedish moving images are internationally recognized as being produced at a high peaking standard,$^4$ and several companies are present worldwide, some with offices in other countries, including Hollywood, USA$^5$.

1.6 Areas of Relevance and Contribution

The research presented in this thesis primarily concerns the field of Moving Image Production, the field of Innovation and Design, and educations related to those fields. The studies included are part of my PhD studies, which are conducted within Innovation and Design research, in the area of Design and Visualization. There from design perspectives are derived, as well as ideas about innovations as solutions to persistent obstacles.

Within Moving Image Production there are concerns about cruxes, brought by the shift to digital cameras that affect workflows in postproduction and the management of those workflows (Paper A, Paper B, Austerberry 2011, DeGeyter and Overmeire

$^3$ Currency conversions are calculated 23rd November 2011.
$^4$ e.g.: Tomas Alfredson’s Tinker, Taylor, Solider, Spy competed at the Venice Film Festival, September 2011; Alfredson’s Millennium won the ‘Emmy’ at The International Academy of Television and Sciences in New York, November 2011; Agneta Fagerström-Ölsson’s A Knife in My Heart (SVT) won the Prix Italia 2005.
$^5$ e.g.: Stockholm Postproductions, The Chimney Pot, and Fido Film.
This thesis explains the effects of those ‘cruxes’ on design creativity for agents in postproduction, and Paper B suggests a design process improvement to mend the situation by helping management to get quick overviews of possible technical bottle-necks. Moving Image Techniques and Technologies may be described as a subdivision of the Moving Image Production field. This thesis develops the explanations of the relations between postproduction tools and the agents using them. Understanding these matters is critical knowledge for students aiming at a career within moving image production, but also contributes to discuss these crafts as design activities. The design management support tool outlined in Paper B is an innovation for design process support, and therefore it is of relevance to the area of Innovation and Design. It will contribute to the understanding of interactive checklists as means for distribution of knowledge within moving image production organizations, especially temporary ones.

Paper C motivates moving image postproduction as a kind of audiovisual design. Postproduction is the stage of moving image production where sounds and images are processed the most, and therefore it has a great impact on audiovisual communication. What is communicated, both intellectually and emotionally by an audiovisual object, is restricted by what audio and visual attributes suggest together. These communicative expressions are enhanced and developed during postproduction. This is equally important for the Information Design student as for the Moving Image Production student to understand. Additionally, it is relevant for the field of Visual Communication to understand the nature of audiovisual postproduction as a set of design processes.

Further, the thesis also discusses the relation between design processes and the management of workflows in the Moving Image Industry, which has relevance for the fields of Design and Organization respectively, since collaborative design work needs to be managed, and thus organized in a proper way, to be successful. As a support for such management and organization, the use of interactive checklists is again accentuated.

The discussion of ‘creative space’ as a cognitive asset for aesthetic problem solving for postproduction agents should be regarded as a contribution within Production Culture Studies, where the critical intelligence of workers is recognized as an important success factor within this industry. The concept ‘creative space’ should help to develop an understanding of the contributions of individuals in media production.

1.7 Related Research

Research related to this thesis is found in several areas: Since it is written within the Design discourse, there are naturally connections to this field of research.
However, many aspects are directly related to the fact that the subject matter is found within the Moving Image Industry, which is also to be considered as Media Production. Shifts in technology within different media production sectors have been studied by Sociologists, whereas the production technologies themselves and their appliance within the Moving Image Industry have been studied by Film scholars. Crafts, skills, and work routines within this industry have been studied from as different perspectives as Organization Studies, Management Studies, and Production Culture Studies. And within the field of Visual Communication there has been an expressed interest for audiovisual objects’ design and production factors, relating these factors to human cognitive capacities.

Crafts, professions and other social demarcations and relations among working people in the Moving Image Industry are researched within Production Culture Studies. John Thornton Caldwell (2008) has contributed with a thorough sociological study from Hollywood, pointing out hierarchies and professional functioning in a loosely organized and constantly changing industry. A similar study of the conditions in Swedish film industry is going on at University West, conducted by ethnographers Margaretha Herrmann and Carina Kullgren (2009, and Herrman 2011). These studies map the social and cultural landscapes wherein this thesis finds its design research questions.

Some sociologists have studied the impact of new technology within the field of Media Production. New technology pushes the change of structures, organization and economy within the sector of culture production, as Richard Peterson and N. Anand have shown (2004). Árni Sverrisson has explained the effects of the shift to digital technology in the field of Photography in the 1990s (2000). The effects are most evident in the way media artifacts are produced, not in their aesthetics, and the concerns in the field regarded image quality and how to make equipment work well. Kathryn Henderson’s study of the graphic industry shows that the resistance towards new technology within that field springs from staffs’ arduous attempts to understand and cope with the structural changes and new workflows brought about by technological shifts (1999). The Moving Image Industry is likewise both a media production and design industry. Hence, the findings in these studies are of relevance to this thesis. The appended papers make references to some of their results. The technological issues addressed and discussed here, could as well be of interest to those fields.

Tightly related to demarcations of professions and crafts is moving image production techniques and technologies. The impact of the crafts persons involved in production, using such technological tools in their crafts, is studied by only few researchers. Film production theorist Jean Pierre Geuens (2000) research is useful, since he follows the traditional production chain and suggests explanations to the aesthetic efforts of crafts people at different production stages, whereas film scholar Valerie Orpen (2003) shows a more profound understanding of skills and
knowledge in the craft of film editors. These theories relate to the understanding of Postproduction design agents’ actions and their creative spaces, studied in this thesis. However, media management researcher Patrik Wikström (2009) shows that as the traditional entertainment industries merge and overlap, produce and re-produce audiovisual content, the crafts and professions blend as well. Therefore, craft demarcations are to be considered with caution.

Film production researcher Barry Salt (1983) thoroughly relates film style to film technology and film production methods. He shows that aesthetic expressions accomplished by a production team are in several ways dependent on technical aspects of the equipment and the material used. This is confirmed by film scholars David Bordwell, Janet Staiger and Kristin Thompson (1985) when they explain the forces behind the stylistic development of Hollywood films up until 1960. How technology relates to aesthetics is a design matter within moving image production. At the core, it concerns what may or may not be possible to express. Such a technical-aesthetical perspective is employed in this thesis, and the technical and material sides of moving image design are core concerns.

Design researchers James Utterback et al. (2006), sees design both as the material perceivable aspect of something, as well as the process of producing that perception. And furthermore, as a produced perception, the meaning of the design is created by the designer. Collaborative Design research has showed the importance of considering social creation and cultural cognition in order to obtain a holistic understanding of collaborative design processes (Le Dantec 2010). Steven MacGregor (2001) has demonstrated that designers in distributed design processes must synchronize their work more often, which is supported by Francoise Darses (2009) who adds that communication resources are increasingly important. These design research contributions relate to how this thesis understands moving image production as ‘distributed creativity’: it is assumed, that creative contributions are spread out in such organizations, as a collaborative design process, and that the smooth functioning of that process is not to be taken for granted.

Design researcher V. Höltää (2010) suggests that design teams need to consider three factors of quality in their collaboration: teamwork, individual awareness and development, and organizational support. Complex design processes can be controlled with the help of computerized virtual workflows (Zapf et al. 2010) in order to avoid mistakes and ‘unnecessary iterations’. Check-list based models have proven to be an effective method, since they distribute critical knowledge amongst agents. The tool outlined in Paper B builds on the findings of Höltää and Zapf et al.: a web-based check-list developed to support design process management at the overall project level.

Contrary to the design discourse, Todd Chiles et al. (2010) have studied how development of innovations can be supported by dynamic and creative self-
organization from an organization research perspective. This might be closer to the situation for instance within film production, where every film project sets up its own organization, which may be quite distinct from that of other film projects. Management researcher Marja Soila-Wadman defends film as an art form when she questions the notion that successful drama productions must adhere to a highly structured management philosophy (2005). Similarly, Laurent Lapierre claims that artists stand above the management and business aspects of art-making (2001). This thesis must consider these findings when dealing with moving image production as design within a production system.

“It takes a lot of people to make an artwork, not just the one usually credited with the result”, sociologists Howard Becker, Robert Faulkner, and Barbara Kirshenblatt-Gimblett claim (2006) as a basic result from their recent study of several kinds of artwork. Creativity is distributed in collaborative aesthetic work, which means that not only the individuals usually credited with the result of an artwork have contributed to its accomplishment, but several more have been involved. Whether considered art or not, filmmaking is nevertheless aesthetic work in distributed collective, collaborative processes. Within the Film Studies tradition Torben Grodal et al. (2004) have recognized the relevance in considering teams of filmmakers and TV producers (collectively) as the most influential agents in audiovisual communication situations. These results provide basic assumptions for this thesis whilst part of its inquest is to understand agencies in distributed collaborative design in moving image postproduction.

I want to relate the communicative actions taken by postproduction agents, when they contribute to compiling an audiovisual object meant for mass communication, to the field of Visual Communication. A recent manifestation of the importance of that field was the 1st International Visual Methods Conference, 2009. Elena Semino (2010) suggests that an understanding of “unrealistic” conceptual metaphors, made through “blending” of expressions, depends on existing genres. Steve Neale (2000) provides an account of film genres that include industry perspectives which in effect is a usable reference to audiovisual design. These contributions open up a gate that makes it possible to relate specific new audiovisual expressions to the production of genres. Such thinking and activities are dependent on what Ann M. S. Barry (1997) entitles Visual Intelligence. Furthermore, the relation between art, perception and visual thinking, as explained by Rudolph Arnheim (1969), is taken as founding knowledge in this field, and is further developed by Yvonne Eriksson in her recent research (2009). These theories together provide a framework of thinking that the study of design activities in the production of audiovisual communication must be related to.
1.8 Thesis structure

Below follows a short summary of the planned contents of the chapters in the thesis.

*Chapter 1 (Introduction)* includes a brief comment on the current situation in the Moving Image Industry, concluded in a problem statement. The chapter outlines the background and the framing of this research. The objectives and specific aims of the thesis are presented as well as the research questions, and also related research and the areas of relevance and contribution.

*Chapter 2 (Theories)* presents the results of other research used as premises in this thesis, and theories used for the analysis of the results. Their respective relevance is commented.

*Chapter 3 (Research Methods)* describes the methodology used in the research, and the research process is commented on. Methodological reflections can be found in this chapter as well as a presentation of the empirical material.

*Chapter 4 (Empirical Studies)* summarizes the appended papers and refers the results to the research questions.

*Chapter 5 (Conclusive Analysis and Comparison)* discusses the results and contributions from a theoretical perspective as well as their relevance to other areas covered by the thesis.

*Chapter 6 (Conclusions and Continuation)* summarizes the conclusions of the thesis, comments their relevance for the industry as well as for the academy, and gives suggestions for future research.

*Appendix:* The thesis has three appended papers, of which two were produced in collaboration with co-authors. The papers are appended in full, with a summary provided in chapter 4. In the co-authored papers Thorbjörn Swenberg and Per Erik Eriksson share the responsibility for data collection, analysis, and writing.
2 Theories

In order to explain the material conditions for creativity that each audiovisual design agent is subordinate to in a production chain for moving images, I need to connect these conditions and delineate their properties. This I do with the help of theories of creativity and of organizations respectively, and by using the concept of ‘creative spaces’. I also need to state what ‘audio-visual design’ means in this reasoning which I relate to design theory as well as theories of multimodality and audiovisual production respectively. ‘Agency’ is defined with the help of identity theory. In my line of thinking audiovisual design agents exhibit artistic creativity in order to find aesthetic solutions for a desired expression in an audiovisual object, usually in a High End production context at High Production Value standard.

The kind of ‘creativity’ that is prevailing in moving image production, and possibly in any media production, regards the shaping of communicative expressions. This is applied aesthetics, where most tools used are of a certain technical sophistication. Creativity comes into action whence these tools are employed by their users in aesthetic processes that shape material features for communicative purposes. This is most evident in Postproduction, where computer tools are highly sophisticated and complex, and their application demands thorough user skills. Francisco Varela, Evan Thompson and Eleanor Rosch explain context-dependent know-how as the essence of creative cognition (1991:148) and cognition as embodied action (1991:172-173). Ingar Brinck builds on this understanding (1999, 2007) when she applies creativity to aesthetic experience, for instance the ways such experience evolves during artistic creativity. She explains this as a cognitive activity in the immediate context of the artist, and as such, as ways to solve aesthetic problems with undecided ends (1999: 34). Artistic creativity is, in accordance with Varela et al., “an embodied, experience based craftsman-ship” (2007: 422). In her results artistic creativity is characterized as distributed and context dependent (1999: 45). Brinck emphasizes that artistic creativity entails cognitive activities by agents in the world, where the immediate surroundings have a major importance (2007: 409-412). The tools and artifacts constrain the conditions for what space there is for “possible actions for the agent” (2007: 423). In this space the relation between actor and the source of content is functional (1999: 37). In the Postproduction context this means that the agent derives his/her ideas in part from the interaction with the tool and the image material. However, equally important is the agent’s exploitation of the technology in use (Brinck, 2007: 424-425). In the moving image production context, technological tools become extensions of our
bodies which help us to touch the digits in the digital image files, and elaborate them as a material to be processed. Thus, the tools aid cognition in shaping the expression of information (Brinck, 1999: 412), simultaneously as these tools set the conditions for what is possible for the postproduction agent to do, and not do, with the material. I build on the reasoning of Brinck and Varela et al. in considering audiovisual design creativity as the kind of artistic creativity outlined here, using cognitive explanations to aesthetic problem solving.

Artistic creativity and other cognitive activities are addressed by the notion of “critical intelligence” within Production Culture Studies (Caldwell 2008:342). In that field, the term indicates a property that individuals make use of in their daily creative work in order to solve production issues. This notion is sometimes used in this thesis to address an individual’s intellectual undertakings in a wider sense than just specifically creative or design work. Furthermore, the concepts of above-the-line and below-the-line personnel are also applied from Production Culture Studies, the former term appointing people with higher status in the production chain and the later is used for people with lower status (2008: 27).

In this thesis postproduction is discussed at below-the-line level, where individuals within production chains work with daily duties and tasks, and the concept of ‘agent’ is applied to explain the work situation of those individuals. However, I find the academic use of the concept of being an ‘agent’ to be rather widespread, diverse and inconsistent, wherefore I want to stabilize it for this thesis. Margaret Archer, in her identity theory, explains ‘agents’ as a collective that shares the same life conditions (2000: 261). Every craft in postproduction is defined and delimited by the Moving Image Industry. It is also conditioned through its appointed production method to master (see Figure 2), tools to use and workflows to adapt to, and each craftsman within that industry shares these same craft conditions (see e.g. Hines 1999, or Wales 2005). In that respect, they can all be considered agents of their crafts, and it is thus that I define workers within Moving Image Industry crafts as agents.

Each such craft is here presumed to master a production method. Nonetheless, there are many production methods needed to accomplish the full variety of sound and image features in a moving image production. Caldwell states that “…negotiated and collective authorship is an almost unavoidable and determining reality in contemporary film/television“(2008:199). Or as Berys Gaut puts it: “A mainstream film is no more the product of a single individual than is the music of an improvising jazz group” (2010: 132). Thus, design in moving image production is a collective endeavor, and functions through distributed creativity, with many designers in collaboration. The critical intelligence of each individual designer is to understand how to design what and in what way (Eriksson et al. 2010). Most audiovisual productions are supposed to communicate some intellectual or emotional meaning, and the design challenge is how to shape it to fulfill that purpose. In a design process, meaning does not occur randomly, but it is always created (Utterback et al. 2006). Every audiovisual design contribution is about
making sense of sound or image aspects. The completed production, as an ‘audiovisual object’, materializes as the Master. The design process is dependent on an efficient workflow in order to function well. A critical aspect considered in this thesis is technical “bottle-necks” that can constrain the process considerably (Hubka and Eder 2001).

The mutual dependence between moving image technology and its possible aesthetics has persisted through the moving image history (Salt 2009). When technology shifts, the aesthetic tool-sets with their respective expressive capacities shift, therefore design is dependent on production methods and the technological principles they employ. There are many process-events in moving image production and it is pointless to distinguish between ‘design’ and ‘production’ because they are mutually integrated. I use these two concepts accordingly, only that ‘design’ indicates an emphasis on aesthetic problem solving and ‘production’ refers in a more general sense to a situation. The difficulty to draw a line between ‘design’ and ‘production’ in media communication is something that Gunther Kress and Theo van Leeuwen have also argued for convincingly in their multimodal discourse theory of modes and media in contemporary communication (Kress and van Leeuwen 2001, p.7, 68ff). Thus, moving image production seems to comprise a complexity of process-events that consist of design activities.

Complexity is addressed in organization theory, which can provide help in explaining organizational complexity in contemporary audiovisual design in moving image postproduction. Neil Johnson (2007) summarizes the current understanding of complexity theory as the “study of phenomena which emerge from a collection of interacting objects”. This is a useful stance when discussing the interaction in between design agents with their respective creative spaces. Complex systems tend to adapt according to emergent orders, Ralph Stacey argues (1996). Hence, the ‘spontaneous’ changes within the Moving Image Industry, after a shift in technology, are more understandable. Katherine Miller states that organizations must be expected to be as complex as their activities, which include the organization’s communication (2011: 11). To survive in a business, functionality must be developed continually within organizations (2011: 174). In organizations, technology is highly ambiguous, as are its effects (Ciborra 2000: 30). These arguments can explain the need for more complex communication when production gets more complex within the Swedish Moving Image Industry, since it is in the middle of organizational transformations, becoming ever more complex due to the shift in recording technology. Moreover, unplanned events cause critical situations that create uncertainty inside and outside organizations, which have to be dealt with, also from a communicational perspective (Miller 2011: 180). Thus, handling complex and delicate technical parameters stringently is crucial in temporal organizations (Miller 2011: 238-40) such as those in the Moving Image Industry, in order for them to function well and to avoid unplanned events. Methods for handling such parameters can offer a significant short-cut to control in
a chaotic situation (Stacey 1996: 183). Thus, the handling of emerging moving image workflows should be dealt with in regard to these aspects: expecting complexity in activities as well as in organization and communication, regarding their temporal character, recognizing complex technological parameters and foreseeing unexpected constraints.

To merely handle the organization of new workflows as entities is not enough, though, since we also must understand the activities that take place within the workflow. Arthur Stinchcombe provides a useful explanation of the professional skills: to master a set of work routines and principles for decision-making, as knowing when to apply what routine (1990: 33). He also makes an important point of noting that there are individuals in organizations who are better than others at keeping track of crucial information and knowing how to use it (1990:1-17), and other professionals who only work with limited tasks according to very specific instructions (1990: 40). Productivity, in turn, depends on all machines to be working, since this is crucial in order to keep the budget (1990: 96). If there are problems, information about the complications is critical for decision-making (1990: 110). These conditions have significant influence in moving image production, when discussing planning and workflows.
3 Research Methods

This thesis strives to understand phenomena in a professional context, particularly material factors constraining the creativity of agents in design processes within moving image postproduction. Therefore, critical realism influences the approach since material resources are core aspects of what is studied here (Deacon et al. 2007:10). Ethnographically influenced interviews with company representatives who overview design processes are used in order to map the current situation, as well as to reach the conceptualizations of the people involved (Aspers 2007). Written material originating from the industry is used in order to grasp the demarcation of different production methods and crafts, as well as the expectations on duties and competences associated with each craft. A production analysis is applied on a complex audiovisual object in order to explain the principal interrelations of crafts, their respective creative spaces and design efforts.

Scientific research methods must be designed to suite the issues that are identified as the object for the research. The objectives of the study should inform the choice of method (Creswell 2007). Studying real-world phenomena that includes real people in real situations and what has meaning to them, makes qualitative methods appropriate (Yin 2011). Further, critical realism claims that meaning occur in relation to the setting where ‘life’ takes place (Deacon et al. 2007).

3.1 Research Design

The initial parts of design research methodology (Blessing and Chakrabarti: 2009) is applied as an overall design strategy for the research within this Licentiate thesis. The research is designed to first get an overview of the field of study, Postproduction, as it is currently developing, in a Research Clarification. Consecutively, it is designed to find possible constraints for creative work that can be derived from the current development, in two Descriptive Studies.

Research Clarification is mostly carried out with the help of literature, and in one case complemented with brief interviews with company executives, where notes are taken.

Descriptive studies are then carried out: in one project as a production analysis of the TV show Värsta Språket (Paper C), and in the other project, New Design
Processes in the Audiovisual Industry, by interviews with moving image production personnel (Paper A, Paper B). Previous insights on the Moving Image Industry in Sweden indicated that there were on-going changes regarding production technologies within this industry. The researchers in this project, with their moving image production and teaching background, were also acquainted with people at some of the companies involved, and could easily get access to and talk on equal terms with informants about these changes. This research project was designed to render some kind of design process improvement.

The prescriptive study used to assess the implementation of that design process improvement support goes beyond the scope of this thesis.

3.2 Methods for Collecting Data

In the Research Project New Design Processes in the Audiovisual Industry (Paper A, Paper B) data is collected in two phases:

First, we conducted literature studies regarding distributed design processes (Utterback et al. 2006, Ware 2008), moving image production conditions (Boorstin 1995, Barclay 2000, Salt 2009, Wheeler 2009, Wales 2010) and moving image production cultures (Caldwell 2008) as well as moving image materiality (Flusser 1983, Manovich 2001, Kress and van Leeuwen 2001) and their perception and cognition (Grodal 1997, Bordwell 2005). This literature represents relevant perspectives that we anticipated to render explanatory power in regard to the issues we were confronting in this project. We used a design research take on the issues, and we needed a broadened description of the activities in the field, as well as an understanding of how it may be explained to work as a production culture. We also wanted to regard the understanding of the new digital materiality, as well as perceptual and cognition aspects of moving image production as conditions for audiovisual design.

Two brief non-structured interviews were also conducted with managers of two postproduction companies, one mid-sized firm in Stockholm and one small firm in rural Mid-Sweden. These interviews were transcribed, and rendered a general comprehension of the situation, possible to turn into more distinct interview questions to be used in the next phase of interviews:

1. What are the consequences of the celluloid-digital technological shift in the production of films, commercials, information films and TV-shows?
2. If there are any problems related to this technological shift, could you please define them?
3. If these problems may be defined, what are the solutions to these problems?
In the second data collection phase seven additional companies were addressed. Since qualitative research depends on acquiring adequate and appropriate data that is rich enough (Fossey et al. 2002: 726), it was critical to reach persons with thorough knowledge about the production workflow alternatives within each company. However, they also had to be well aware of the configurations of production chains and processes within the Moving Image Industry in a broad sense. Thus, mostly personnel at the managerial level of the hands-on production people were interviewed. In order to get an as wide overview as possible of the current situation in the Swedish moving image production industry, a variety of companies was included: small and mid-sized companies, very specialized firms, as well as production houses handling the full production chain (3 firms with 2-6 employees, 3 with 15-20 employees and 1 company with approximately 50 employees). This way technical supply, recording, editing, postproduction areas, and technical distribution were covered, including approximately a third of the national High End segment of the Moving Image Industry\(^6\). This segment was expected to be first to experience the impact of changes in production technology, and possibly the heaviest impacts as well. The complete list of companies and interviewees is presented in Paper B. Competition is not considered to have had a major impact on the data since none of the interviewees knew that any of the other companies participated in this research project. These interviews were semi-structured, and all were videotaped, completely transcribed and coded according to ethnographic research practice (Aspers 2007, see details in the chapter *Methods for Analyzing Data*).

The other study, a production analysis, was a close reading of the TV series *Värsta Språket* [Talkin’ da’ talk] (Swedish television 2002-2003) where sounds and moving images and their composition were deconstructed for attaining what production methods had been used when compiling them. Here too, a literature study was included, which focused on postproduction methods and crafts, their respective demarcation as well as on what competences and tasks that are assigned to each craft, design expectations included (Hines 1999, Fairservice 2001, Case 2001, Mitchell 2004, Browne 2007, Salt 2009, Wheeler 2009). This was complemented with more recent Moving Image Industry job descriptions from the internet (imdb.com, media-match.com, skillset.org, wikipedia.org). I combined those data with my own previous experience from the moving image production industry. However, demarcations of production methods and crafts are recognized to be ever more ‘floating’ when entertainment industries and their channels of distribution merge (e.g. Wikström 2009). The production challenge of making TV shows both unpredictable and understandable is also taken into account (Williams 1974, Bordieu 1996).

\(^6\) One-man-firms are excluded.
3.2.1 The Audiovisual Material

The audiovisual material used in this study was desired to fulfill three criteria: It must originate from the same production chain (i.e. the same production), in order to be able to reveal actual workflows. It should include as many production methods as possible, in order to provoke an exhaustive analysis. It should be as novel as possible in its kind, and at the same time successful, in order to present an information design challenge that was contrived.

Therefore, the audiovisual material used in this study was selected from one season of the same TV Show, *Värsta Språket* that employed a variety of production methods which were among the most sophisticated by the time the show was produced. The specific mix in the use of colors, graphics, visual effects and sounds was rare, if not all new, in fact driven TV shows in Sweden at the time. Therefore the production team could not have relied on any given success formula for the design of the show, by the time it was produced. Obviously, it was a successful: it was awarded, praised by critics and kept a large audience (Arvidsson, 2006; Frigyes, 2003; Media Measurements in Scandinavia). For the analysis the official DVD edition of the TV show was used.

3.3 Methods for Analyzing Data

Continuing the ethnographic approach towards interviews, a systematic analysis was arranged:

Categorization of statements by coding schematically, uniquely and non-contradictorily, was followed by structuring a code hierarchy (Aspers 2007) in order to ease cross-readings and to find relational patterns between codes. The subject matter codes are presented in Paper B, Table 1. The coded statements were analyzed for over-lapping codes which indicate needs for closer examination (Aspers 2007:194). This was particularly the case with statements coded as workflow, file format, or production method, which were frequently overlapping, and therefore scrutinized in the analysis. Coherence of meaning between similarly coded statements from different informants was compared. The coding was assessed at this stage, and some statements where re-coded (see paper B). A broad comparancy of the relation of the statements with the most frequently occurring codes was made (Aspers 207:192). Concepts that emerged from this analysis are induced into the theories presented. The anticipated outcome of this analysis was a descriptive overview of the current production situation within the Swedish Moving Image Industry (see Paper B).

A production analysis of an audiovisual object is a deconstruction of its composition. The purpose is to point out the production methods that have been applied during its production. Each method employs a certain technology that leaves certain imprints (Salt 1983, Kress and van Leeuwen 2001), and often the methods used are audio-
visually apparent to those acquainted with them. The analysis is made in two steps for each shot: First, sound and image attributes are identified. Second, the production method used is determined.

This production analysis was performed at a desktop computer, playing the TV Show on VLC Media Player 1.1.5. The need to frame-step sequences and to magnify images was met with the use of the moving image editing software Adobe Premiere Pro 7.0. The sound was listened to in ordinary office computer stereo headphones, which is sufficient to distinguish what sounds are used in a composition, but not to detect the design of parameters (Ternhag 2009).

Sequences and shots were extracted to cover as many production methods as possible and to attain the more complex ones, where several methods are used in combination.

### 3.4 Method Relations to Research Questions

#### Table 2. Methods related to Research Questions

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Methods</th>
<th>Profits (Pro) and Contra (Con)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Does the shift in recording technology (from celluloid to digital) affect creativity in moving image Postproduction? If so, how?</td>
<td>Interviews</td>
<td>Pro: Informants expression of experience from processes. Informants offered to express situations. Con: Informant reluctant to admit mistakes. Possibly sensitive to stakeholders. Generates lots of data, tricky to analyze.</td>
</tr>
<tr>
<td><strong>2.</strong> In a complex process, where the design of an audiovisual object (e.g. a film or a TV show) is distributed and divided amongst individuals with different crafts, how does this distribution affect creativity?</td>
<td>Interviews</td>
<td>Pro: See RQ 1. Con: Possibly sensitive to stakeholders. Generates lots of data, tricky to analyze.</td>
</tr>
<tr>
<td></td>
<td>Production analysis</td>
<td>Pro: Immediate and thorough access to the final result as an overview of production complexity. Con: No access to actual negotiations and rejections.</td>
</tr>
<tr>
<td><strong>3.</strong> How can we understand workers in moving image Postproduction as agents in a design process?</td>
<td>Interviews</td>
<td>Pro: see RQ 1. Con: see RQ 1.</td>
</tr>
<tr>
<td></td>
<td>Production analysis</td>
<td>Pro: see RQ 2. Con: see RQ 2.</td>
</tr>
</tbody>
</table>

7 Additional details in Paper C.
3.5 The Research Process

My own pre-conception of what audiovisual communication is about derives from my career within TV production. This makes me reluctant to accept ideas in the ‘auteur’ tradition which states a single mind behind the design of moving image productions. It neither matches my personal experience, nor does it correspond with other experiences from the field (Boorstin 1995; Clark and Spohr 2002), or with later research (Gaut 2010, Caldwell 2008, Becker et al: 2006; Grodal et al: 2004). Rather, the design and production going on is collaborative. Therefore, I want to explain the situation of the individual as an active agent participating in this collaboration.

The individual’s situation has several aspects that need attention. As a researcher I need to explain the situation: a production process that includes creativity and design practice, but also a situation of audiovisual communication where an idea is processed to reach an audience.

The current professional moving image production processes can be observed at a general level by collecting data from people with the most insight into those processes and design creativity matters: mostly people just above ‘the floor’ level of image processing. These managers often have a background within the crafts concerned.

My research approach, to congregate a multitude of qualitative aspects of current production processes, and recent or current changes in those processes, was to gather data from a variety of Swedish companies that are involved in moving image production in different ways. Interviewing has the advantage to admit follow-up questions, and long reasoning to clarify matters, if necessary. It is also a method that allow for more diverse expressions of experience. The disadvantages of the method are that in a face-to-face situation informants might be reluctant to admit mistakes or shortcomings. Their statements are also possibly loaded with personal investment, prestige and sensitivity to stakeholders. Therefore, interviews generate complex data that is challenging to analyze. Especially the coding was demanding, since codes interrelate and some statements involve several codes.

The communicational aspect has already been studied from the perspectives of design and sociology, so by using those outcomes in addition to my own understanding of the production situation I can draw conclusions from examples of completed productions deconstructed by production analysis. The advantage of this method is to be able to spend as much time as necessary with the completed audiovisual object, even analyzing it frame-by-frame if required. The draw-back of the method is that rejected parts that were tried out during the production process, but were left out of the final result, were no longer available to me. To get to those parts one has to observe the production process and take part of the design negotiations and decisions.
The situation of the individual also includes aspects that are closely related to his/her craft. These aspects are studied in part with the help of literature from the field, in part with the results from other research, but they also have to be covered by the interviews to get new data on recent changes that affect the demarcations of, and expectations on those crafts. The production analysis also contributes to the explanation of the individual’s situation through revealing the complexity of a production and its compilation.

3.6 Methodological Reflections

3.6.1 Ethnographic Interviews with Postproduction Personnel

In the project New Design Processes in the Audiovisual Industry we interviewed mostly managers in a variety of moving image production companies in Sweden. Yet, it is the below-the-line workers (Caldwell, 2008: 27) that experience the actual impact of the technological shift in their every day work and thus can tell about their respective concrete examples. The risk is that the perspectives that are already studied by previous research or and the managers themselves is emphasized, instead of being broadened. Nevertheless, we estimated that managers of the hands-on-producing personnel have a better overview of both the totality of design work within the specific firms addressed, as well as production processes in the industry at large. A critical moment when using interviews is the coding, which requires thorough transparency for its possible examination. Vague data has been compared to previous scientific research.

Additionally, this research project is limited to Sweden, so the results must be assessed as such. If similar conditions exist elsewhere, a careful transfer of conclusions might be valid. However, the change pace is rather quick within the Moving Image Industry, so further changes as well as solutions to cruxes have occurred since the collection of data. Nevertheless, the principal results and conclusions are still valid. The issue of file format and codec cruxes apply to all of the industry, whereas the issue of crafts applies only to those companies that employ specialized crafts.

3.6.2 Production Analysis of Postproduction in a TV Show

To trace the audiovisual design activities in a moving image production is the key point in doing this kind of production analysis. In this case only postproduction is of interest. The impact a production method has on design activities, through the constraining of an agent’s creative space is estimated to be significant. It is

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8 Habitually, within the Swedish Moving Image Industry, firms with approximately fewer than five employees are forced to let individuals work within more than one craft, whereas companies with approximately more than ten employees use one individual per craft. This is my ad hoc estimation after the data collection made in the study of New Design Processes in the Audiovisual Industry.
appropriate, though, to recognize that for each production method there are alternative tools. However, most of the tools within a production method use similar technical principles. Therefore, the tools are here considered to have less impact on the agent’s creative space than production methods have.

The core principles of how audio and visuals have been processed designerly is often possible to state for someone who is acquainted with professional moving image production processes and is experienced in using these tools and methods. Since the creative employment of production methods is at heart of this study, finding these core principles of sound and image processing is what is important. However, singular adjustments of parameters, or the specific tool used, are not possible to detect.

The shortcoming of production analysis as a scientific research method is that it is hard to be explicit about actual manifestations of specific design activities in a specific moving image production, only from deconstructing the production chain. The actual design actions are better studied by observation, at the production site. This would reveal the actual distribution of creativity, and actual negotiations of creative space between agents, and is suggested for further research.
4 Empirical Studies

This thesis originates from two empirical studies that were conducted as parts of my PhD studies. The research project *New Design Processes in the Audiovisual Industry* is the framework for two of the included papers. The first paper is a research clarification that motivates the use of Design Research Methodology in the study of the field of moving image production. The second paper presents the descriptive study made in that field, with the objective to suggest design management improvements.

The third paper presents a second study. This is a production analysis of the TV show *Värsta språket* [Talkin’ da talk], in order to reach an understanding of the current creative situation for information design agents in the professional moving image postproduction, when they compile audiovisual objects for mass communication.

4.1 Paper A – Research Clarification

In *New Design Processes in Moving Image Production: A Design Science Approach* we scan the field of film production, to see whether the shift in recording technology, from chemical to digital, might affect the industry. That change might seem convenient, however a multitude of ways to do things emerge, and is exploited, wherefore workflow cruxes occur within organizations with distributed creativity. In that respect the paper represents a State-of-the-Art and forms a theoretical base for continuous research on the field.

We propose using Design Research Methodology for executing that research. The relevance of such an approach, we explain to be found in the ever more industrial circumstances within film production, as well as in recognizing the creative activities taking place there as design activities, collaborative, but organized in a distributed fashion. Television production is also included in this reasoning, since it employs the same production methods when producing at High Production Value.

Our suggestion is to develop a distributed creativity workflow model for the Moving Image Industry. It is proposed to facilitate the design process and make the successful execution of contemporary digital film- and TV-productions possible to a greater extent, by the means of avoiding technical bottle-necks and thus reaching smooth workflows. The outcomes of the use of such a model are suggested to be less time waste and more time to spend on creativity within the process.
4.2 Paper B – Descriptive Study

The journal paper *Creative Spaces in Contemporary Swedish Moving Image Production* also investigates how the distribution of creativity has changed since recordings turned digital, specifically within film production, in Sweden. It is a descriptive study, focusing the material conditions for creative work, with the purpose to reveal how the shift to digital recordings has affected design processes. Mostly managers at High End production companies are interviewed. Nevertheless, these firms are of different kinds, covering all production related parts, from equipment rentals to technical distribution. Smaller as well as mid-sized companies are addressed. That way most aspects of the consequences of the technological shift are expected to have been gathered in our data, and thus they contribute to our understanding. Data is coded and analyzed according to ethnographic standards where re-occurring and overlapping phenomena are sought for.

We see that there is a chain of related phenomena at play when recordings turn digital. Economy impels choice of recording technology and specific equipment. Equipment, in turn, constrains production methods by deciding digital codes, which in turn is decisive for the rest of the workflow. The right digital code is critical for tools to function well, but also in order to allow for adequate design processing of sounds and images. Thus, digital code affects what options there are for aesthetic processing, and is a decisive factor for the ‘creative space’ of each audiovisual designer.

It seems a better way, if workflows are decided upon first and recording equipment chosen accordingly, depending on what measures are planned for at the postproduction phase. Altering the workflow later, if the wrong choices are made, increases work-loads at several other instances, later in the production. Quoting one Producer: “If there is a small movement at the axis end of a window wiper, it causes a much larger movement effect at the other end”. He transferred this allegory to film production processes, where a small change in the early phases of a production has large effect on the later phases.

The outcome of this part of the study is an outline of a comprehensive web-based check-list towards which any production could be checked, to avoid later lock-ups and reversals of the production process. Thus, production managers may save time and money, and spend it on creative contributions instead of digital problem solving.

4.3 Paper C – Production Analysis

The third paper is also a journal paper: *Agents, Design and Creativity in Moving Image Postproduction. A Production Analysis.* It concerns another study than the other two, and conducts a production analysis of the TV show *Värsta språket*
[Talkin‘ da talk]. This is a deconstruction of the sound and image features that the production is compiled from, in order to reveal the complexity of the composition of the show. The purpose is to reach the applied production methods and to explain what ‘creative spaces’ there are for moving image production people as design agents in processes of audiovisual communication. This includes explaining how creative spaces affect each other in postproduction.

The official DVD version of the show is analyzed on a desktop computer using VLC Media Player and Adobe Premiere Pro. The sound and image material was searched for the more complex compilations, which were then in turn studied more closely. Sometimes frame-stepping was needed, as well as enlargement. Computer head-phones were used for detecting sounds. Music was categorized with the help of a fellow doctoral student, Sören Johansson, researching young musicians’ constructions of careers.

The production analysis takes into account that the shift in technology (see Paper A and Paper B) constrains design creativity within moving image postproduction in new ways, since the type of digital image material in use (e.g. file formats and codecs) is decisive for what is possible to perform within each design process. Each production method has a preferred file format and codec, and thus affects the creative space for the craft person performing design with that method. However, if the preferred digital material is of a different kind than what is preferred in the previous or next step in the production chain, production methods used consecutively affect the creative spaces of the design agents lined up after each other. This happens either through time waste, when file conversions are needed, or through limiting the amount of digital matter available for processing.

Each craft is specialized on one production method according to industry requirement, and thus inhabit the accompanying creative space. These requirements can be spelled out as expectations on design tasks as well as knowledge of production procedures. The design efforts of several designers in an organization with distributed creativity must be coordinated among these designers, since the overall aim is to achieve an audiovisual object meant to communicate certain meaning. The designer must understand the contribution of his/her design to this overall meaning, and in doing so, as well as in fulfilling design expectations, s/he becomes a design agent.

4.4 Results

The results from the empirical studies, in accordance with their respective research questions, may be summarized thus:

Paper A: The State-of-the-Art in contemporary moving image production industry shows that there are constraints in productions due to a diversity of file formats and
codecs for digital video, beyond the scope of most professionals to overview. This leads to ‘cruxes’ in production processes. A workflow model for the Moving Image Industry, based on the concept of distributed creativity, is suggested for development. This could be achieved successfully through the use of Design Research Methodology. The anticipated outcome of the use of such a model will be less time waste and more time for creativity.

Paper B: Efficiency, smoothness, and a fast pace are wanted from moving image production processes. It is critical to attain those properties as part of the technical capacity of a production’s organization, including knowledge about technical parameters. The competition amongst moving image equipment manufacturers seems to provoke a market full of alternative codecs and file formats for digital video. This diversity accumulates to a problem since it is hard to overview and to navigate for people, who are not primarily digital technicians. Furthermore, file format and codec have to be controlled from the start of recordings in order to attain the desired image quality as well as its flow-ability through the production chain. In postproduction the issue re-occurs as the digital files have to contain enough information to enable processing in the desired ways so that the ‘production value’ sought for can be achieved. On the other hand the amount of data must be manageable. Therefore, a proper postproduction workflow is critical: how file formats flow, or do not flow, through technical production systems is the key. If there is one single desired file format and codec for all postproduction which can be used already in recordings, it would be optimal for attaining smoothness. If not, production companies are forced to use expensive equipment and skilled staff, consuming time to convert image material to the proper, processable format, which must be considered a faulty use of technology, as well as a misuse of creative individuals.

The responses to this situation from Swedish Moving Image Industry are several: 1) to consult workflow experts, 2) to spend planning time on scheduling workflows, 3) to minimize the number of equipment brands employed, 4) to decide image processing before workflow, 5) to invest in workflow-, media- and project-control-systems, 6) to use check-lists, 7) to keep the option of multiple parallel workflows open, 8) to let distribution quality decide production quality, 9) to only use non-compressed media, or 10) to adhere to standard procedures.

The need for new knowledge and new competences within this industry is another issue raised by our informants. This has led to new emerging crafts: The DIT (Digital Image Technician), a support function to digital cameras, who is responsible for camera settings, nurses the image files after recordings, backs up the material, and distributes the files. In the Swedish context some big-budget High End productions have a Postproduction Producer with the assignment to manage the digital issues in the complete production chain. In the US, Digital Management Technician (DMT) is the title for this craft. Postproduction Manager (PPM) is yet
another craft, suggested by one informant. The PPM is responsible for the digital material once it is recorded, and for organizing the postproduction.

Obviously, it is the digital workflow management that is the key issue in organizing moving image production. This requires certain knowledge, of which it is currently a shortage among people who manage moving image production projects. The consequences of the digital cruxes, caused by this lack of knowledge, can be observed in less time spent on creative design activities – that is a decreased creative space for the design agents, as well as much time instead spent on technical problem solving. This means less efficiency, quality at risk, and possible failures to achieve the desired ‘production value’.

Paper C: Creative Spaces affect each other in relation to the complexity of image processing. The more processes employed, the more comprehensive is the mutual impact of creative space on each other. From this perspective, the achievement of the meaning sought for in an audiovisual object becomes a delicate matter. Accordingly, analyzing the most complex shot found in the TV show Värsta Språket, concerning production methods used (see Figure 3), reveals such impacts. The image seems to originate as either a still image or a frame from HD video. The image has been graded: colors are notably tuned, and the lighting within the shot has been attuned to create the impression of coming from a lamp and then contrasts have been smoothened. Animated 3D graphics are composited onto the image, where after a flickering bluish light is added across the scene (indicating a TV screen), as a visual effects. Sounds are vignette music mixed with a ‘TV noise’. The last visual processing, as for all shots, is the final grading of the complete show, to adjust colors and contrast into a coherent ‘look’, as well as to maximize image quality.

This is as complex as this production gets, regarding applied production methods, and designerly impact: The grading achieves a warmer color scale, as well as it makes lights and contrasts appear natural within the image’s world. The animated 3D graphic letters are moving as if they constitute a body, breathing with huge
breaths. In this example, the large creative spaces of both Animator and Colorist are mutually dependent, and probably there is collaboration during the design work. The blue-ish flickering light is added, spreading all over the scene, requiring a notable creative space for the Visual Effects Artist as well. Furthermore, this is part of the vignette where the Editor uses a large creative space, and it is vital that sounds are designed with caution there. The creative spaces of the Compositor and the On-line Operator are perhaps smaller in this example, in comparison.

In the case of a fact driven TV show that needs to keep its credibility, a delicate design matter is how not to over-do things. If the ‘play’ with features is exploited too much, there is a risk that the over-all impression is ‘silliness’. Thus, the facts and theories presented in the show might be disputed, which would then be a design failure. Instead, all the sound and image features successfully add layers of meaning over the original manuscript. These are the design contributions of several design agents. Agents that need to exploit their respective creative spaces in order to effectuate their design tasks at the appropriate quality, and that need to collaborate in order to optimize their creative spaces and thus maintain production efficiency, while they together achieve the communicational balance between convention and challenging novelty.
5 Analysis, Comparison and Discussion

Although this thesis is built on two rather different studies, its focus is creativity in moving image postproduction, and what happens with such creativity in digital production chains, which must fulfill a certain ‘production value’. The core aspect that runs through the two studies is that the management of time spent on design within the Swedish Moving Image Industry is a significant success factor in order to keep such ‘production value’ (Paper A, Paper B, Paper C). This is shown through the development of the concept ‘creative space’, which combines time spent on design with the quality of a digital image material as well as both human and technical capacities to process the material, and thus combines quality in a production with production efficiency.

Building on Brinck, who relies on Varela et al., artistic creativity is considered to be a cognitive activity: aesthetic problem solving with an undecided end (Brinck 1999, 2007). In the moving image production context, that means that there is only a shared mental sketch of what the outcome is going to be like, beforehand, amongst the production people involved. It is through the vast extent of design during the production of an audiovisual object that the final result is achieved.

The space metaphor (cf. Lakoff and Johnson 2003) is linked to creativity already by Stacey (1996:186), though from psychological aspects, whereas “the space for possible actions for the agent” is mentioned by Brinck (2007:423). The point of mapping creative cognition with the help of the space metaphor is that different dimensions can be described as coupled, yet independent of each other from a causal perspective. Creativity can thus be described as a cognitive action that takes place in some sort of cognitive space, with the dynamics of its constraining factors maintained. Nevertheless, it is limited to the reach of space’s dimensions. When we can spell out the dimensions and how far they stretch out, we can describe the ‘creative space’. In moving image postproduction these dimensions can be understood as time for creative activity, the digital material’s capacity to be processed, and the expressive potential of the agent using his/her tool (see Figure 4).
The user, which is the craftsperson who makes design contributions, uses creativity as a cognitive activity in aesthetic problem solving (Brinck 1999, 2007). The ‘creative space’ is his/her immediate surrounding cognitive context. There are three dimensions in this model: The tools can be more or less sophisticated, regarding its functions as different ways to process the material, with a greater or lesser capacity to accomplish such processing. This capacity regards the amount of data as well as the processing speed. The user’s skill concerns the capacity to handle the tool, which is a software (cf. Manovich 2012), as well as to apply the processing and work routines (cf. Stinchcombe 1990; see also Figure 2). Processes and routines vary with the material in use. The capacity of the tool and the user’s skill taken together constitute the expressive potential of the creative space, and represents the maximum amount of possible processing that could be achieved with a certain tool by its user.

The critical property of the image material is how much digital information it contains that is available for processing. The kind of digital file and the codec that has compressed the information decide this availability. These properties differ. A generous codec allows for much processing whereas a hard compressing codec

**Figure 4. Dimensions of a designer's Creative Space in moving image production.**

**Figure 2. (See page 15.)**
leaves very little information to be processed, or requires lots of time to do it. Time is a limited resource in all kinds of production, here as well. And it is desirable that most of the time is spent on creative work, rather than on computing.

These factors are comparable between productions, production methods, tools and file formats respectively, as long as the other factors are kept constant. The creative space is what each agent needs to maintain the desired aesthetic quality, or ‘production value’. A decreased creative space indicates either less quality, less efficiency, or both. Efficiency taken as a minimum of time spent on other things than creative work, to achieve the wanted quality, using the optimal tools for that work. Thus, we can use creative space as a theoretical tool to explain the results of the studies, in accordance with the research questions raised in this thesis:

1. The way in which the shift in recording technology within moving image production has affected creativity in moving image Postproduction is negative: Creative Spaces have shrunk.
2. The way in which distribution of creativity affects creativity within complex processes as the design of audiovisual objects is double-edged: Creative Spaces affect each other, most often in a negative way, but sometimes the opposite.
3. We should understand postproduction professionals as design agents since they make design decisions based on external expectations on their design efforts, combined with an individual understanding of their respective design task and the supposed outcome. It is as design agents they inhabit their respective Creative Space.

I will now discuss the three answers more thoroughly, relating the research questions to the studies and comparing the results.

5.1 Shrinking Creative Spaces

The first research question of this thesis asks: "Does the shift in recording technology (from celluloid to digital) affect creativity in moving image Postproduction? If so, how?" From Paper A we see that the shift in technology has rendered an ever increasing number of digital image file formats and codecs, as the outputs from digital cameras. This has in a first stage caused confusion over what file formats and codecs to use. In a second stage it has rendered problems to set up workflows that work fluidly throughout a production chain. There is no given workflow to assume from the start. In order to cure this situation a workflow model is suggested, as a design process support that warns for ‘process break-downs’. These break-downs are identified as production downtime due to file format and codec errors. The files do not function in the production system and need to be converted, which affects efficiency. As the study develops, Paper B unveils that the
most production cruxes, due to file formats and codecs, occur in postproduction. Thus, since the capacity of a user to master his/her tool is practically taken for granted in industrial production of moving images, the material qualities of the digital moving images (cf. Manovich 2001) are of greater importance that those of what software is used (cf. Manovich 2012).

The consequence of the conversions needed is that production time is lost. This time is supposed to be used for creative work in designing image features. Instead, a minimum of time is available for design. Furthermore, the amount of digital information within an image file is decisive for its capacity to be processed. When an image is recorded with a traditional film camera using celluloid, the limit for how much image information there is left for postproduction is set by the digital conversion apparatus, which can keep more than 4K (4000 pixels horizontally). This is more than what is needed for cinema projection. The conversion is made by the postproduction people in accordance with what quality and standard they need. Thus there are no extra, unwanted conversions that waste time when celluloid is used, and image quality is good. When a digital camera is used and an image file is recorded, the standard of that file is set in the camera before shooting. Therefore it is critical that it is set correctly to contain enough information, and that the information is configured properly so that it is readable for the tools that come further down the workflow. This is where the errors usually occur. Cinematographers are not digital technicians, and the available options in the camera settings can be counted by the hundreds, so the opportunities for mistakes are enormous, and unfortunately frequently realized. Often enough the image files do not contain the amount of color and contrast data needed for the postproduction design processes to achieve the desired production value. Accordingly, both the material dimension as well as the time dimension of creative space is affected negatively by the shift in recording technology, from celluloid to digital: both quality and efficiency is reduced.

5.2 Creative Spaces Affect One Another

The second research question of this thesis is formulated: “In a complex process, where the design of an audiovisual object (e.g. a film or a TV show) is distributed and divided amongst individuals with different crafts, how does this distribution affect creativity?” This kind of distributed creativity is explained in Paper A as design processes, from the perspective that design involves producing perceptions (Utterback et al. 2006) and the process is spread out over many crafts that make design impact on an audiovisual object. Such processes may have technical ‘bottle necks’ that constrain them (Hubka and Eder 2001). This seemed to be the case within film and TV production, which is confirmed as the study develops. Furthermore, the principal interchangeability of digital files is also sketched,
explaining how they may flow between the different production stages usually employed in High End productions, and their respective methods. The technical aspect of distributed creativity, as dependent on a fluid workflow with the right file formats and codecs, is explained in Paper B. This is also where the model of a creative space is first introduced, which explains the relation between creativity and the tools in use and the material worked on. And, as explained above, faulty file formats and codecs need to be converted to proper ones, which takes time and occupy production equipment as well as work-time for designers, implicating both efficiency and quality aspects.

In Paper C we identify the complexity of postproduction workflows and how creative spaces, affected by the digital material, also affect each other. Naturally, the time dimension is the same throughout a production: the production as a whole has a deadline, and therefore every part of the production has its respective subordinated deadline. The final deadline usually stands, so if some craftsperson cannot meet the set deadline, the next craftsperson might be forced to shrink his/her time usage.

**Figure 5. At each step in Moving Image Postproduction workflow images are processed by an agent that masters a specific production method. The Creative Spaces of the agents may constrain one another.**

The material dimension might be an issue of conflict since different production methods need different amounts of data for their respective processes. If a
compromise between such needs is attained, this may well include that the material standard agreed upon is less than what is required for a certain production method, which affects the production value, however, it may still be more than needed for another production method. Thus, an increased creative space for a craftsperson employing one production method (and tool) may well have a decreasing affect on another’s creative space, and vice versa (see Figure 5). However, both quality and efficiency aspects are concerned.

5.3 Design Agents Inhabit Creative Spaces

The third research question of this thesis is posed: "How can we understand workers in moving image Postproduction as agents in a design process?" A main point in Paper C is that an individual craftsperson in moving image postproduction is assigned certain design tasks according to what is expected by the Moving Image Industry from that craft. In a specific production there is a sketched idea of how the completed audiovisual object is supposed to be, what it is supposed to communicate, and with what production values. The individual must interpret each task in accordance with the communicative purpose granted the object, and therefrom take design action. This means creatively processing a set of image features so that they contribute to the overall communication aim of the audiovisual object. These design actions take place within the realm of the production method that the craftsperson masters through certain skills. The craftsperson is a design agent through the exercise of mastery over that realm (cf. Archer 2000). Each craftsperson is a design agent in relation to the production method s/he is currently engaged in.

The space for possible design actions within that realm is limited though. Given the task, and given that each individual works in a social setting of colleagues, managers and clients, that space is what is described above as the ‘creative space’. Thus, in the very design work, a postproduction design agent inhabits a creative space that is limited by time, materials and tools (since the skill of the agent is what it is). In a production chain each design agent inhabits a creative space of his/her own. These creative spaces can be compared to each other, and thus, the skills of different agents are factors to be compared as well. Anyhow, as shown, these spaces affect each other at times, which may then have effects on quality as well as production efficiency.
6 Conclusions and Continuation

6.1 Conclusions
The shift in recording technology, from chemical to digital, within the Swedish Moving Image Industry has brought new workflows and new constraints to production, especially to postproduction.

Digital image files of faulty formats or with improper codecs constrain creativity in two ways: either the files do not work at all in the production system and thus need to be converted, which hostages valuable time and occupy expensive production equipment. Or they contain less information than needed for the design processing. Workflows are no longer to be taken for granted, but need to be optimized for each production project in order for a production chain to function well. The overall affect on creativity is negative: Creative Spaces have decreased, which causes inefficiency in workflows, and which is likely to affect the quality of moving image production outcomes, either as decreased production value or at a higher cost to maintain the desired production value.

The effect of distribution on creativity differs. As long as file formats and codecs are kept the same, and optimized to the workflow of different production methods and tools, there is no negative impact on creativity. However, if the file format and codec chosen is a compromise between what is preferred by different production methods (i.e. tools), the material quality is likely to be higher than needed for some designers, whereas it will be lower than needed for others, thus affecting the production value negatively. The time dimension is also mutually dependent between designers employing different production methods. If deadlines are not kept, the creative spaces of the designers downstream the workflow will shrink, since the overall deadline for a production usually stands. Thus, Creative Spaces affect each other when creativity is distributed. Accordingly, this can either improve or decrease both efficiency and quality in moving image production outcomes.

The individual craftsperson in moving image postproduction must be considered a design agent, since there is a set of expectancies from the Moving Image Industry on each craft, as an agency, that the craftsperson must subordinate to: This includes skills that incorporate knowledge about the tools in use, processes to apply and work routines. The individual also needs to know how and when to apply those
processes and routines properly. Furthermore, s/he needs to understand what the overall communicational aim is for the audiovisual object as a whole, including its desired production value, and what his/her design contribution thus must be, as well as how to achieve them. This is design thinking and design actions that is subordinate to the individual’s judgment and fulfillment.

6.2 Academic and Industrial Benefits

The academic achievements of this project are four-fold: First, the understanding of Postproduction crafts people as ‘design agents’, rather than executers of pre-imposed creative ideas from an ‘auteur’, is a specific academic stance taken. This is a prospective view of media production as collaborative design of audio and visuals in aesthetic problem solving with undecided ends. Prospective, since audiovisual design is considered here to try to create novel meaning. Collaborative, since many design agents are included and cooperate in the process of designing and producing the audiovisual object. It is also an aesthetic problem solving, since the purpose with the communication of such an object usually is sketched rather roughly compared with the level of detailed design that the finished audiovisual object contains, and the way to reach there is a seeking design process where the end is open until a suggestion is agreed upon. Second, the creativity of the design agents is explained as taking place in ‘creative spaces’ inhabited by these agents. This relates the agents’ cognition to tools, digital material and time to spend on creative work. Third, the impacts of a shift in recording technology within the Moving Image Industry are revealed. The consequent changes are explained, showing that digital does not mean convenient, but rather brings new and more complex requirements to audiovisual design processes. Fourth, the need for innovation to help moving image production managers manage design processes and workflows is demonstrated.

These achievements, on one hand, specifically add to the understanding of Production Cultures and Moving Image Production. They also contribute with some additions from an audiovisual perspective to the fields of Design Processes, Collaborative Design and Visual Communication respectively. Furthermore, they combine Innovation and Design in suggesting an innovation for improved design processes through improved workflows. The importance of smooth workflows is also relevant for organization research.

The industrial result is a strategic benefit that could be made by improving the definition of workflows in moving image production. A digital workflow check-list is suggested that will warn for lock-ups due to choices of file formats and codecs, and thus keep production efficiency and production value high. This tool should be appreciated among those High End moving image production companies that have struggled with the recent and contemporary shifts of production technology and
subsequent remodeling of workflows. This result is even of great value to Middle Range and Low End production companies within the Moving Image Industry, since their restraints have been even harder.

Since it is shown how the distribution of creative spaces within contemporary moving image production interrelate, one can also understand what benefits there are in considering moving image production people as agents in an audiovisual communication process. To students in this field this knowledge is urgent: to be able to get reasonable understanding of the field of practice where they anticipate their future careers to develop.

6.3 Future Work

The continuation of this research will focus on how postproduction professionals achieve their creative decisions on how to process image features. What are their bases for the creative decisions that they make? In this study, which is already started, I gather data through interviews with directors, producers, cinematographers, and film editors. I will also investigate whether their specific decisions are effective, considering how viewers respond perceptually to image properties concerned. Will viewers look at the moving images as the production people intended? This will be a study where at least two methods must be combined: observations with recordings at production sites, and eye tracking of viewers.

To reach a thorough understanding from the design-production perspective, of how actual distribution of creativity and negotiations of creative space between agents take place, we need empirical studies at production sites. This has only been implied in principal through the analysis of Värsta Språket. Such a study is already planned, following the production of a feature film from start to finish.
References


**Internet References**


Audiovisual Reference


Other Reference

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Appendix I

Paper Abstracts and My Contributions

**Paper A**

**New Design Processes in Moving Image Production. A Design Science Approach.**
Industrial design processes have several common denominators regardless of the actual design. This is to say that the production of moving images is a kind of design process. Even though every single film- or TV-production is unique, the production processes as such are often similar. Therefore we suggest that a Distributed Creativity Workflow Model will be useful in film- and TV-production. This model will facilitate the design process and make the production of contemporary audio-visual material more cost effective. Hopefully more time can be spent on creativity within the process.

**Keywords:** distributed creativity, design models, audio-visual design, and film/TV-production.

**Contribution:** My contribution is data collection, analysis and re-writing.

**Paper B**

**Creative Spaces in Contemporary Swedish Moving Image Production.**
Production of moving images is turning completely digital. This leads to new possibilities and new constraints for creativity within film and TV production chains.
This paper describes professionals’ current comprehension of the consequences of the shift from celluloid to digital technologies, within the Swedish Moving Image Industry. New technologies bring new workflows, new design processes and new constraints.
We aim to illuminate factors that affect design creativity in digital moving image production, by addressing questions about production related responses to the digital turn as well as the affects of such responses on creativity.
Inspired by Ingar Brinck’s creativity theories (1999, 2007) we view aesthetic problem solving as a cognitive process and suggest creative spaces to be the critical phenomenon to manage. We also use organization theories, particularly the
work of Katherine Miller (2011) to explain why creativity ought to be a primary management concern.

The empirical material used is semi-structured interviews with management personnel in Swedish moving image production companies. Outcomes include that the variety of digital formats available today is hard for crafts people to overview. This has brought costly workflow constraints that largely limit creativity. We suggest a pre-production file format check-list as a tool to support design management.

**Keywords:** technological shift, file formats, workflow, creativity, design management.

**Contribution:** My contribution is data collection, analysis, theoretical work and writing, equally shared with co-author Per Erik Eriksson.

**Paper C**

**Agents, Design and Creativity in Moving Image Postproduction. A Production Analysis.**

Postproduction makes great impact on audiovisual expressions and their communicative qualities. However, design creativity of postproduction professionals is constrained by a shift in production technology, where the complete moving image production chains are turning digital (Swenberg and Eriksson 2012).

This paper addresses how the individual craftsperson, as a postproduction agent, has to deal with this new situation, its expectations and constraints, in designing audiovisual information.

The aim is to inter-relate material constraints for creativity the way they affect people of different postproduction crafts.

The paper builds on theories presented by Ingar Brinck (1999, 2007) where artistic creativity is explained as aesthetic problem solving. Design as meaning-making is also used as an important theoretical stance (Utterback et al. 2006, Kress and van Leeuwen 2001).

The empirical material used is a Swedish TV show from 2002-2003, *Värsta Språket*. It is complemented with Moving Image Industry related writings on crafts and production methods.

**Keywords:** moving image production, audiovisual design, crafts, creative spaces, agents.

**Contribution:** The whole article is my singular work.