INTERNATIONAL DESIGN CONFERENCE - DESIGN 2010
Dubrovnik - Croatia, May 17 - 20, 2010.

DESIGN 2010

NEW DESIGN PROCESS MODELS FOR THE AUDIO VISUAL INDUSTRY: A DESIGN SCIENCE APPROACH

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

1. Introduction

This paper describes a project that aims to come up with suggestions for guidelines and new workflow models concerning the distribution of creative decisions within contemporary production organizations in the audio-visual industry. In this context we define creativity as the social and psychological process that enable people to generate new ideas and concepts or to come up with new associations between existing ideas and concepts.

From a theoretical perspective, the purpose of this paper is to discuss new design processes and workflows in the production of moving images in order to establish a general comprehension describing contemporary digital production chains for moving images. In order to be able to formulate guidelines and workflow models, the researchers tied to this project are to find and analyze the weak and problematic links of the production chain. Thus, the main contribution of this project is a flexible workflow model for the production of moving images. By *flexibility* we mean the ability to adapt to new challenges and changes, both external and internal.

We have recently initiated this unique collaborative research project that focuses on how small audiovisual production enterprises in Sweden have developed and are developing new design processes due to a number of recent socio-economic and technological challenges. For the first time a number of the front-line production companies in Sweden participate in a scientific research project on common issues.

Research questions to be addressed:

- Has digital technology in film/TV production increased the flexibility and responsiveness of the production system?
- Does this lead to more diffuse or better-defined work-roles among individual film/TV-workers?
- Do new workflows and the distribution of creativity lead to an actual decentralization of creative decisions and responsibility in the design process of moving images?

2. State of the Art

Audio-visual production plays an increasingly important role in the Swedish economy. The audio-visual media sector is part of the creative industries, and the creative industries' share of the Swedish GDP in 2002 was 5%. Surprisingly this industry has attracted comparatively little research in Sweden. This might seem peculiar since the TV-shows, fiction films, documentaries, commercials, "infomercials", Internet virals and other visual content that these enterprises produce, are seen and heard by hundreds of thousands of people, around the world, on a daily basis. In part, this lack of

research interest can be explained by the fact that although audio-visual productions clearly are visible and audible, the industry as such is not. Only 1% of media enterprises in Sweden have more than 150 employees. These big companies in Sweden, such as Bonnier (i.e. TV4), which in essence is a distributer of media content, are part of the Swedish media discourse. The companies that produce the actual media content are not. Perhaps this is not surprising since big companies such as Bonnier generate about half of this sector's monetary value. However, to a large degree, these flagship companies owe their existence to the output generated from smaller audio-visual production companies.

Another reason why the changing landscape of audio-visual production has generated little research in Sweden may be due to the fact that the analytical toolbox offered by universities researching image production so far has not been adequate. It has either been focused on ownership, ideology and power or on traditional production roles. As a consequence most film/TV-textbooks treat production output separate from production, and treats image crafts in isolation, disengaged from production chains.

Since the early 20th century production chains and crafts have been organized in the same way globally [Salt 1992]. Scholars have up until now studied the different steps in the production chain separately. However, contemporary research on film and TV production requires addressing the changing conditions that digital workflows have brought to the business due to the conversion of recording modes from analogue to digital. Therefore, in order to understand how moving images really are crafted in contemporary non-linear production chains/networks, one must take into account the ways in which traditional work-flows are breaking-up and the confusion surrounding technical formats and conversions of data files within the production chain. Let us define the key differences between the traditional production chain, and the contemporary one. The traditional production chain adhered to a strict chronological and linear order: The film or TV idea turned into a script, then it was pre-produced, rehearsed, lit and designed, recorded, partly developed ("rushes"), pre-screened, re-recorded, developed (work print), cut, test screened, re cut, mixed, chemically altered (superimpositions for instance), graded, assembled out of original film rolls, printed, and, finally, distributed. In comparison, newer types of production chains are non-linear and less dependent on chronology. There are other design related differences worth of shedding light on as well. Within the traditional production chain, the production tasks, or "links", were seldom outsourced to specialists and a single, large, company that was located at a media production cluster usually controlled the complete production. This is not necessarily the case nowadays. Therefore, it is clear that contemporary production chains require researchers not to be neglectful of the ways in which distributed decision-making affect the final outcome of film- and TV-production and how this situation calls for new professional roles and crafts. According to J.T. Caldwell [Caldwell 2008], negotiated and collective authorships are nearly inevitable in the making of contemporary film and television.

This relates to recent design research that has found that the success of the design industry in Lombardy, Italy, depends on its ability to build and maintain clusters/networks within the sector, embracing enterprises of many kinds, from small innovation firms, design consultants, to large media and fashion companies. What is essential, here, is the inclusion of different processes where knowledge and creativity are distributed. [Utterback et al. 2006] This shapes a discourse of its own, but this is in close relation to discourses in education and the media production industry. The quality of the interaction and cooperation between the participants are understood to be the key issues. Also, similar to what is happening in the audio-visual industry now, technologies and expressions are re-negotiated and "brooked" to transfer the sector into the digital age. One example of this is the cooperation – or lack of cooperation – between cinematographers and special effects specialists. This cooperation is decisive in terms of whether highly "posted" (altered in post-production) moving image sequences that originate from a cinematographer's recording, will appeal to an audience or not. Perhaps the solution to this, primarily an authorship dilemma, is the implementation of a "production design" approach?

Digital media makes for a "messy" analysis because in digital networks all media belongs to multiple non-linear production chains where the media may be manipulated at almost any given point [Manovich 2001]. This means any film/TV professional belonging to a production chain may at any

point change the technical parameters of the digital media such as color, light, rhythm, pitch and more; hence contribute to the look of the final production. Because of this, the old concepts around which traditional film studies were organized are no longer adequate, but they are still entrenched in academia. Our aim is to renew this discourse through explaining how the new kind of constantly re-negotiable design in contemporary film- and TV-production functions and how this affects the final output products, as well as how the increased complexity of the production process bring new costs – costs that might be avoided.

As philosopher Vilém Flusser reminds us of, there can be no critical reflection over images without getting into the guts of the machines that create them [Flusser 1983]. Like Flusser, our preoccupation is with the production apparatus. We are concerned with how meaning is constructed in the production of moving images. This means we are interested in the range of skills that articulate design, this articulation we refer to as production. Thus, design and production – mode and medium - are hard to separate [Kress and Van Leeuwen 2001]. This articulation occur all along as a project is being carried out, and, as "digital" is "non-linear", design details can be re-negotiated at any given point until someone decides that a production is complete and the moving images are ready to be distributed. Looking into the heart of this matter, we must recognize that digitally recorded images may be distributed through a wide range of technical formats of different constitutions, through different audio and video codex. The range of technical formats and codex is too great and changes too fast for even the most skilled design professionals to be able to grasp. When an image is to be processed at different stages such as grading, compositing and special effects (see figure 1.), any change of format might have to include a transfer from one codec to another, which immediately decreases the technical quality and technical parameters of the image.

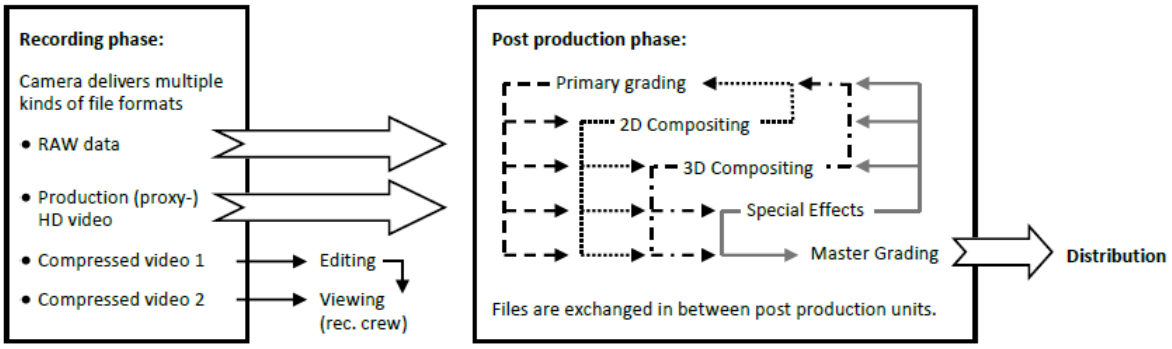

Figure 1. A flow-chart showing how several file formats must be produced in the recording phase, and that the HD video, as well as new proxy files created from the RAW data files, are converted and merged several times as files wander through the post production phase. The 3-D compositing and 2-D compositing may also be defined as separate, simultaneous and parallel, flow-charts

In the TV and film sector some mistakes spring from the idea that digital media is ultra convenient and therefore, somehow, will figure out "by itself" its right form and place in technical systems. Unfortunately, as many production teams lately have realized, nothing could be further from the truth.

A skilled design professional should rather be spending time and energy on design matters than on technicalities. It is how a designer materializes a design that matters [Kress and van Leeuwen 2001]. To many film theorists this is an issue of minute importance. However, cutting edge research on the mechanics of visual cognition shows us that because design can be considered to be an extension of the viewer's brain – a tool for cognition – viewers might misinterpret a design if the design elements do not support the design's visual query [Ware 2008]. Hence, to an audience, for instance, a "pixely", or "rough" video look might be considered to be a design element. This design element is frequently used in professional productions to infer – more or less convincing - that the recording is documentary in nature. The horror, sci-fi, fiction film *Clover Field* exhibits this particular design element, as the TV-series *24*.

3. The distribution of creativity as a design process

What, then, is the key analytical tool for describing the distribution of creativity in the production of moving images? In many ways the audio-visual industry is comparable to other design industries. Many of the recent technologically and economically driven changes in the audio-visual industry have already taken place in similar forms in the "conventional" design industry. Indeed, the audio-visual industry seems to lag behind other industries in terms of how it has adapted to new business realities. For instance, concepts and terms such as "out-sourcing", "lean-production", "market diversification" have not until very recently become part of how the audio-visual industry conducts business. Hence, the changing ways of producing "stuff" in the conventional design industry have already resulted in a canon of design research. Leading design researchers define "design": "as a noun, design is what the user perceives; as a verb it is the process by which the designer produces that perception" [Utterback et al. 2006] and we only need to exchange "designer" for "film editor" and the conditions are the same for how the actual editing of a film is decisive for the viewers' perception of it. The outcome of any audiovisual production can be evaluated in terms of the "production value" of the audience's experiences, which in turn are key criteria for design according to Utterback et al. This shows how the integration between design and production works in the audio-visual industry through a number of crafts that each one has its own design impact on the end product, distributed creativity, and how it relates to design science. One example of this is the discrepancy between recorded images, and these images processed in postproduction. It is commonplace that the desired high production value look (e.g. the aesthetics of high production value) of a high-resolution image sequence cannot be correctly evaluated in the stage of recording. If a director, for instance, does not understand this discrepancy in the field (or studio), perhaps this will result in a frenzy to add contrast by the means of lighting on the set, thereby decreasing the possibilities of using the ultimate tonal range in the postproduction phase. In other words, the technical parameters, as well as artistic intentions, will further or obstruct the distribution of creativity within a production chain.

Obviously there are dissimilarities between the audio-visual industry and the conventional design industry. The main difference is that the audio-visual industry produces stuff that is not – directly at least – tactile. For instance, the issue of safety is usually a critical concern in the conventional design industry. People are likely to die if an airplane malfunctions. An audience will live through the annoying experience of having to listen to crappy audio. Another striking difference that becomes apparent when reading descriptions of non audio-visual design processes is that the conventional design industry's terminology is not easily translated into an image/audio production context. For instance, in the conventional design industry the terms "creative" and "creativity" implies "problem solving". While the terms creative and creativity in a film or art context refers to artistic capacity or characteristics. This is one of many examples that illustrate the potential problems of adaption. However, we believe that there are a lot more advantages than disadvantages in using the design theories and models generated by more than half a century of research on the conventional design industry in order to formulate the analytical tools to illuminate the systematic, iterative, collective, processes by which designs such as "moving image designs" materialize.

This is to say that the production of moving images is a kind of design process. Industrial design processes have several common denominators regardless of what is the actual design. There are many examples: if the sales department or/and a customer cannot express what they want, the product will end up inferior. If the design process is not adapted to deal with issues related to technological "bottle necks" the design process will end up extremely cumbersome [Hubka and Eder 2001]. If a customer is given too much freedom in choosing the design, the budget will bloat. If a factor in the design process is considered to be fixed, but in reality it is not, the product may not be delivered on time. If the designer cannot communicate the design to the manufacturing department, again, perhaps the deadline is missed. The issue of deadline is critical for all design enterprises. The late delivery is the single largest contributor to loss in company profits. When the British Department of Trade and Industry looked at a cross section of UK industry in the early 1990's it estimated that on average, if a project is shipped 6 months late, the percentage loss in after tax profits will be over 30% of that expected with delivery on time. However, if a project manages to finish on time, but overruns its development costs

by 50% (!), it is predicted to incur a loss of less than 5%. The message is clear: do whatever it takes to meet the deadline. These aspects are all to be recognized in the audio-visual industry as well.
Any chain is only as strong as its weakest link. This is certainly true of TV/film-production chains as well. One reoccurring problem in many productions has to do with how work is organized. We may call this the "workflow-link". For instance, it is not uncommon in digital production chains that craft workers spend days generating graphics only to later find out that the image that is supposed to provide the backdrop for the graphics is incompatible. Another problematic "link" is the notoriously shaky collaboration between the "audio department" and the "image department". In the field this conflict might translate into an argument between the camera crew and the sound crew over who has the right of way. Because movie making by many is considered to primarily be about images, the image department usually wins this argument. As a consequence, the audio recording might end up inferior. This is serious since audiences are more sensitive to bad audio than bad images (human beings cannot effectively turn off their ears). As a result, in Hollywood alternative audio recording strategies have emerged in which audio is recorded and fit to the images in the stage of post-production. However, this solution is not ideal. Despite advanced audio software, and skillful actors, this method is expensive and complicated and perhaps – as the French filmmaking community seems to believe – severing film's historical link to live acting at the expense of artistry.
These production breakdowns are examples of kinds of socio-technological interactions. Thus, it would not be useful in this project to try to separate sociology from technology. The impetuous for this research is the fact that rapid technological change within the audio-visual industry has destabilized the traditional ways that tasks are distributed during a production [Caldwell 2008]. However, this does not mean humans are slaves to technology. Within the field of culture production, as technology changes, opportunities emerge [Peterson and Anand 2004]. As this project will prove, it is within this dynamic dichotomy of technological forces and human agency that the semiotic potential of images and sound is to be illuminated. There is no "meaning" hanging around all by itself somewhere, it is always created. Which goes for any kind of design [Utterback 2006].

4. A conceptual model of film and TV production

In one sense each production including moving pictures is unique. Every picture is somewhat different from all other pictures, even though many things are shared. For example, a picture of a boy in front of a tree is not unique as such, but this one boy in this very outfit in front of this very tree in this specific weather and light conditions framed in one certain way from a chosen angel, most likely makes it impossible to find another picture looking the exact same way. The same goes for the sound, the story, the set, the location, the production team etc. This uniqueness of any film or TV production is perhaps overemphasized by people in the industry because this aspect always needs to be met with openness (even sometimes seeking) for organic changes within a production phase in order to find new ways to deal with up-coming production dilemmas. Thus, this kind of uniqueness of the specific production becomes a motive not to generalize productions into schemes or models.
Contrary to this we want to recognize re-occurring aspects and phenomena that can be identified within most productions. We find it even likely that common patterns might be read when studying several cases. The changes now occurring within this industry are driven by the change in technology from chemical to digital (electronic) media and the problems that emerge are a consequence of production teams dealing with new "digital issues" as unique aspects of single situations in their specific projects. Individuals having some ad hoc knowledge of parts of this new technology, but not having an overarching technical perspective on the complete new production chain, often deal with these issues. Hence, many "digital issues" are solved in an unplanned fashion. And when a production team solves problems the organic way (unprepared), phase by phase, separately throughout the production, and handling their production chain as a traditional one, built on the chemical/analogue paradigm, severe faults are committed that cause even more and larger problems in later production phases. In its totality this cost frustration, lots of time and therefore money. Resources would be better spent on artistic creativity and increased quality in the production.
This is the urgent cause behind searching for control over these new production constraints. Production processes within the film and TV industry must be put on a trail leading to more

standardized workflows and production processes. The benefit from our research would be a step-by-step model where phases in production are relatively fixed, whereas each phase must be allowed some organic dynamics for unique issues (*flexibility*), still dealing with the delicate issues of technical formats and how to control their flow, minimize the number of conversions between those formats, and find ways to fixate the technical specifications for delivery of data files between production units and production phases.
Within industrial design a wide range of conceptual project and production models exist. The overall target of this project is building a conceptual model of the film/TV production process that focuses production issues rather than interpretation and reception, which will, however, be retained as important feed-back mechanisms in the model. Specifically, this conceptual model will illuminate the common and persistent breakdown points in various kinds of digital production chains so that production enterprises will be able to work around these problem areas.
In order to build a conceptual model we will study if and how digitalization of film/TV production increases the flexibility and responsiveness of the production system. Further we ask if this does lead to more diffuse or better-defined work-roles among individual film/TV-workers, and whether old work-roles have to make room for new ones. Perhaps new crafts are emerging and how, then, do these relate to old and new work-roles? And finally we investigate if the new workflows and the distribution of creativity lead to an actual decentralization of creative decisions and responsibility in the design process of moving pictures. In addition, informed by Information Design, we study the internal communication and creativity flow in the production chain. It is not obvious how the distribution of creativity can work in the actual case as to make the end product, a film or TV-show, have a coherent and unifying design where the over-all message is tightly interwoven with all the aspects of sounds and images and their qualities respectively. Having a broad perspective on this industry, as we have already indicated, perhaps calls for new ways to organize film- and TV-production considering those new socio-technical constraints.
In consequence, the project will deliver concepts and analytical approaches that can be used by industry actors – workers, management and distributors – to navigate the complex change now taking place in Sweden, globally, and design their productions accordingly. The relevance of the work is ensured through close cooperation with major companies, managers, subcontractors and personnel as well as a selection of smaller companies that nonetheless have a key role in the change taking place.

5. Methods

We will use Design Research Methodology (DRM) [Blessing, Chakrabarti, 2009] to realize the objective for this collaborative research, namely to create comprehensive design process models. Our target is that the design process model will be of use for both academia and the audio-visual production industry. In addition we strive for forging closer relationships between the audio-visual production industry and the media research community. The results will consist of design process models and production theories. We will also simulate different kinds of production scenarios. For instance, we will simulate a production chain including cameras that record in so called "RAW-format". These types of cameras are extremely light sensitive and support multiple formats and have the ability to record in several different kinds of digital formats simultaneously. Several universities in Sweden (e.g. Dalarna University) have a tradition of media production education and staff together with the collaborative partners of this project provide the technology employed in these simulations. The results of these simulations will be distributed (as QuickTime movies on the Internet as well as on DVD's).
It is necessary to use methods that are consistent and transparent; otherwise there will be a risk that the research project itself will develop in a more or less organic (uncontrolled) way. DRM offers a methodology for design and problematizes the fact that a methodology requires several methods. The methods that will be used are participant observations and semi-structured interviews. Every step of the research process is illustrated in Fig. 2.

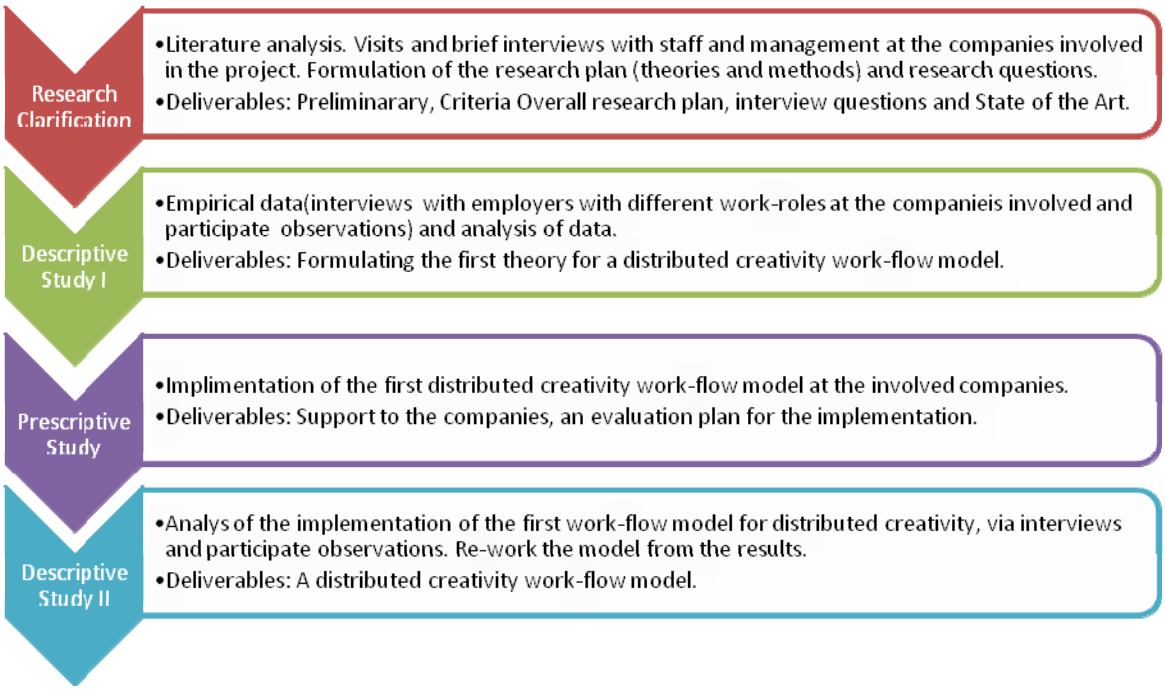

Figure 2. A schematic graph of the design research methodology used in the project, inspired by Blessing and Chakrabarti

Research Clarification: To find out the current state of affairs, the research activities start out with visits at the six enterprises involved, a scan for new image production activities and first brief interviews with staff and management on their most urgent hassles. These enterprises are post production firms, film studios as well as video recording and production technology consultants. The smallest company employs two to three people and the largest about 40, which is reflective of the audiovisual sector in Scandinavia. A brief outline of the over-all situation is the expected outcome. From that we will formulate the interview questions and what aspects we will observe during the participant observations. While formulating the state of the art we will consider earlier theories concerning film and TV-productions. A historical review of production chains will be made, professional roles and workflows within the industry, to be compared with our new findings. This is a literature study.

Descriptive Study I: In the descriptive study phase, a mapping exercise is carried out by conducting interviews and observations including various craft persons of different work roles. We will interview producing staff and directing staff at each project member company, conduct interviews with three to six chosen employees (per company) whose work is highly affected by new workflows. Not least important is to include persons from enough many work-roles and crafts to be able to briefly trace new patterns of distribution of creativity. These interviews are analyzed according to a theoretical method where terms and concepts, used in the industry, will be generalized into first order constructions, whereas the second order constructions, reached by the research team, will be the academic concepts forming the full theory, for explaining new models of producing moving pictures and, briefly, the distribution of creativity. In addition, the internal information within the production chain is analyzed.

In addition we will make interviews with a selection of other actors such as software developers, technical consultants and buyers of media content in and surrounding the industry that support this kind of work; this time the interview will take place in a group of two to three role-holders with different roles in the market. The reason for this focus group method is that they will probably position themselves against each other more clearly in such a situation, compared to a face-to-face interview with researchers. These “contextual” interviews are essential for rounding off the analysis of data gained in the first round of interviews. An analysis of the total amount of data gathered by now will provide a new understanding of all related problems of new production processes and workflows.

The next step within the descriptive study will include observations of actual work processes. The kinds of work processes that are of special interest to us are new types of work activities that interact and go in and out of parallel design processes and production chains. Examples of this are the work activities of art directors, technical supervisors and production designers. These roles are sometimes not explicit ones, but rather hidden and temporary. Nevertheless these roles are important, because these roles have developed in response to various production constraints. Due to Eriksson and Swenberg's TV production background (as videographer and editor respectively) we believe that this project's members are particularly well suited to observe these "hidden" roles. Visual materials, examples and photographs of work situations will be gathered simultaneously and generally used either as straightforward documentation or as examples of the manifestations of particular discursive constructions in actual film productions. Swenberg and Eriksson also teach image production (moving images) at Dalarna University, Falun. This, in combination with their industry past, make them understand how the production processes evolve and can therefore conduct research without unnecessary interruption of the person's work during the time of observation. An elicitation will be carried out "after work" with the individuals studied each day, if necessary, to provide explanation of possible hassles. The aim of these intensive studies will be, partly, to identify key innovations, partly, to describe the discourse within which they are defined and diffused, and mostly, to identify how distributed creativity actually works within contemporary production networks. At this stage a thorough analysis of production processes in relation to distributed creativity will be undertaken, with the purpose to identify possible solutions in terms of communication and some kind of "standard workflow". That is a first theory and a first model of the distributed creativity workflow model.
Prescriptive Study: This stage is an in-field try-out of the suggested "standard workflow", carried out in different production chains (at different companies). We will implement the first model and support will be given to the companies in how to organize their work with help from the model. And, finally, the analysis of this try-out will provide the last answers to the projects' set questions. Our main objective is to implement a workflow model that will make the complete production process transparent to all its participants, and by doing so, make the production process structurally sound, support the distribution of creativity, reduce time waste and avoid inferior image quality due to file conversion related issues.
Descriptive Study II: The implementation of the suggested model will be evaluated from interviews and participate observations. Finally a distributed creativity workflow model will be presented.

6. Concluding remarks

Our suggestion in this theoretical paper is that a distributed creativity workflow model within film- and TV-production will be useful. The aim of our recently started research project is to achieve such a model in order to meet the needs of the audiovisual sector. It will facilitate the design process and make the successful execution of contemporary digital film- and TV-production possible to a greater extent. The result will be a reduced waste of time and more time for creativity within the process.
In Sweden there are at least six universities that offer courses on TV and film production. None of these have the sufficient analytical tools to describe and explain current TV and film production processes. This is reflective of the situation in other European countries as well. There are no models that point out the potential design process breakdowns in modern production chains. This is unfortunate because students are forced to a large extent figure out for themselves how to circumvent the pitfalls of contemporary production chains. Likewise, the film and TV production companies have been forced to figure out the production kinks as they go along. For the industry this has resulted in a frustrating situation in which earnings are suffering – because deadlines are missed - and working conditions have proven not to be optimal. For "below-the-line" laborers it is not uncommon with a 70-hour workweek. The term "digital sweatshop" is not unfounded. We aim to remedy this, or at least to be a part of the solution. By providing theories and design process models that in many regards function as a "design-process-breakdown-early-warning-system", in combination with the forging of closer ties between the media research community and the audio visual industry, it is our hope that in the future this sector will be able to realize its full potential and become more efficient and, hence, even more competitive in the global media production market.

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