Media Technologies in the Making
user-driven software and infrastructures
for computer graphics production

Julia Velkova
Abstract
Over the past few decades there have emerged greater possibilities for users and consumers of media to create or engage in the creation of digital media technologies. This PhD dissertation explores the ways in which the broadening of possibilities for making technologies, specifically software, has been taken advantage of by new producers of digital culture – freelancers, aspiring digital media creators and small studios – in the production of digital visual media. It is based on two empirical case studies that concern the making of free software for computer graphics animation production in two contexts: by a loose collective of anime fans in Siberia, Russia, and by a small animation studio in Amsterdam, Netherlands. The case studies are presented and analysed in the scope of four journal articles and one book chapter which form the core of the dissertation.

The dissertation draws on a media practice perspective and an understanding of software as an artefact that concentrates and mediates specific infrastructural arrangements that entangle politics of technological production, economic interests and practice-related concerns. The analytical focus of the research problematises in particular practices of software decommodification and its further repair and development by non-programmers; the anchoring of software development and repair in actual production practices of computer graphics animations; and a commitment to sharing software, animations and other artefacts online as commons. The thesis combines several concepts from anthropology and science and technology studies to theorise these practices: – politics and regimes of value (Appadurai, 1986); repair and artful integrations (Jackson, 2014; Suchman, 2000); gifting (Baudrillard, 1981; Mauss, 1925/2002) and autonomy (cf Bourdieu, 1993). Bringing together these concepts, the dissertation regards them as constitutive and indicative of what I refer to as ‘media-related infrastructuring practices’, or practices in which non-programmers generate infrastructures through creating and mediating arrangements around technical artefacts like software.

The results of the dissertation indicate how making free software for computer graphics media is entangled in diverse conditions of technological unevenness that may enable, but also limit, the possibilities of aspiring media creators to improve their status or work positions in the broader field of digital media production. By attending to these conditions and to practices that attempt to alter them, we can better understand the spectrum of problems and politics related to contemporary software that underpins
much of digital visual media today, and the formation of new user-driven infrastructures for media production that try to resolve them.

**Keywords:** Blender, commons, computer animation, computer graphics, Cosmos Laundromat, decommodification, gifting, infrastructuring, media practice, Morevna project, repair, Synfig, user-driven software.
Acknowledgments

...we are never through,
but occasionally we stop
to tell our colleagues what we have learnt.

(Howard Becker, 1982/2008: xxi)

In 2006, I embarked on a short but major personal challenge. It was about walking 600 km on the ridge of the Balkan mountains in 20 days, crossing Bulgaria, the country where I grew up. The hike, which was an exercise in both mental and physical endurance, was led by two experienced guides, who kept the group motivated during the ups and downs that accompanied each of the 8–12-hour-long hiking days. The successful end of this hike taught me that the borders of one’s endurance can always stretch a little bit more with the help of others, that persistence and small but frequent breaks are needed to cover a long distance and that comfort can be sacrificed in the name of other rewarding experiences that open up other horizons.

The journey through the five years of this PhD work has been a greater challenge but also shared some similarities with that hike. The horizons that this PhD explored would have remained hidden for me without the exciting and ambitious projects of the Blender community, the Blender Institute and the anime animation community in Gorno-Altaysk. I am particularly grateful to Ton Roosendaal, Konstantin Dmitriev, the Blender artist and developer community and the Cosmos Laundromat team, the Morevna project participants and Synfig artists, Boud Rempt from Krita, David Revoy, the Libre Graphics community, Jason van Gumster from OpenSource.com and Sybren Stüvel for sharing their worlds and passions for computer graphics with me, for supporting and critici
ing my research, as well as for their hospitality.

I am immensely grateful to Patrik Åker, my primary supervisor, for continuous guidance, patience, endless conversations, constant encouragement and interest in this project and in my capacity to complete it even at times when I had lost faith in it. I am particularly thankful for his insistence on
the value and importance of striving to have a historical perspective (something that I am still working my way through), for keeping me on track and for always being there when needed.

I am also deeply grateful to Göran Bolin, my second supervisor, for always making any difficult task feel easy and exciting. His deeply engaged and optimistic attitude to academic work, teaching and research have been, and remain, truly inspirational. Further, I am thankful to Kjetil Sandvik and Bo Reimer, who were opponents and commented upon my work during the mid-term and final seminars, respectively. Their questions and engaged reading further shaped this dissertation and were especially important for the final shape and form it took. All mistakes, omissions and decisions to not engage with some of the comments that I received remain, of course, my sole responsibility.

I feel very fortunate to have been able to work on this dissertation at the Department of Media and Communication Studies at Södertörn University. The friendly and encouraging atmosphere there, together with the richness of perspectives, breadth of competence and willingness of many colleagues to comment on my work in progress have been stimulating and provided me with an example of how a supportive research environment should look. Stina Bengtsson and Sofia Johansson have been particularly helpful with sharing knowledge and experience on how to reconcile the two equally demanding worlds of doing a PhD and being a committed parent. Ewa Rogström has always taken excellent care of all administrative paperwork, in addition to being a friendly and attentive colleague.

This work would have not been possible without the generous financial support provided by the Foundation for Baltic and East European Studies, which funded my PhD education. In addition, the Swedish Institute provided me with funding to complete my fieldwork in Gorno-Altaysk, Russia. The Institution for Culture and Education and the Media and Communication Studies Department at Södertörn University provided me with additional financial support to attend conferences, workshops and summer schools where I presented drafts of the papers that make up part of this dissertation and where I was able to connect to a broader academic community engaged in media and communications research. The publication committee at Södertörn University has been helpful with funding the proofreading of some of the articles.

Much of the theoretical discussion that penetrates the articles emerged at various encounters with passionate and deeply engaged researchers at venues beyond Södertörn University. Some of these venues included the
AOIR conferences in Daegu, Phoenix and Berlin; the Hackademia event in Lüneburg in 2016; the Dubrovnik research school on Digital Work in 2016; the ECREA Doctoral Summer School 2015; the Communication and Democracy ECREA section conference in Copenhagen in 2015 and the Brestolon research network. I cannot thank Kylie Jarrett enough for her deep engagement, support and promotion of my work at unexpected venues and moments since we met in 2014, for long formal and informal conversations and for making me believe in the value of standing for a different perspective. Paško Bilić and Brian Beaton further opened up a breadth of perspectives in front of me, and I have enjoyed immensely our short, but intellectually rewarding exchanges. With Sebastian Kubitschko, Dina Vozab and Stefan Baack, common research interests and friendship got blurred, leaving many memorable moments from Zagreb, Bremen, Prague, Berlin and Stockholm.

In my closer proximity, Peter Jakobsson, the co-author of one of the articles that is part of this dissertation has, on many occasions, provided me with stimulating criticism that has nurtured many hours of reflection and theoretical thinking. Linus Andersson has generously shared a lot of knowledge on alternative media and on teaching it to students, and Carina Guyard has been supportive in my first steps in teaching. Anne Kaun has been one of the most inspiring scholars close to me who has cared to engage me in a range of exciting smaller and larger projects and provided me with continuous support and sharp advice on my writings as they have progressed.

Through my affiliation with the Baltic and East European Graduate School and the research area of Critical Cultural Theory at Södertörn University, I met a lot of wonderful people who made the lonely process of working on a PhD feel less lonely. Thank you, Adriá Alcoverro, David Birksjö, Erik Bryngelson, Maria Lönn, Iwo Nord, Emilia Pawlusz, Olena Podolyan, Patrick Seniuk, Gabriel Itkes Sznap, Rebecka Thor, Kim West and Natalya Yakusheva for lunches, sporadic inspiring conversations and occasional drinks together.

I have also had many pleasurable moments with my fellow PhD colleagues at the Department of Media and Communication Studies, Ingrid Forsler, Alberto Frigo, Roman Horbyk, Signe Oerpermann, Liisa Sömersalu, and Matilda Tudor, some of whom have already graduated. I want to specially thank my office roommate for several years, Matilda Tudor, for being an involuntary witness and attentive listener to many of the personal experiences, emotional anxieties and self-doubt that accompany the
research education process. Special thanks also to Ingrid Forsler for engaging in stimulating hours-long conversations and for making a draft translation of a summary of the thesis in Swedish. I am further thankful to Curtis Budden, who proofread parts of the dissertation, Jonathan Robson who did the typesetting, and Nikolai Mamashev, who designed the cover.

This dissertation would have not been the same without the distractions, timely support, ideas, occasional close readings and much inspiration from some of my closest friends. Thank you, Raul Ferrer Conill, Florencia Enghel, Ekaterina Kalinina, Paola Sartoretto, Irina Seits, Ekaterina Tarasova and Liudmila Voronova for conversations, walks, dinners, coffees and beers. Some of our meetings have shaped my life and my views on academic work in more profound ways than I could have imagined.

In Bulgaria, my old friend, Albena Lozanova, has been an important mentor on several occasions in between our long conversations about parenting.

I am deeply thankful to my parents, Svetlana and Valentin, for opening up the world of technology for me, for always pushing me towards greater pursuit of knowledge and education and for never questioning my decisions even when they did not understand them. Together with my sister, Ekaterina, they have been an important source of support and stability.

I cannot overstate my gratitude to my Swedish family. I am deeply indebted to my mother-in-law, Ing-Marie Jonsson, who despite being one of the most active and busiest people I have ever known, has always found time and enthusiasm to help in solving the complex logistics of parenting and work even at the cost of complicating her tough schedule even more. Otto Tuxen-Meyer, Ann-Britt Jonsson and Classe Karlsson have been helpful with endless furniture transport between Jämtland and Stockholm and with emphasising the importance of finding time for good food and big family dinners.

This dissertation is dedicated to Jonas, Adrian and Vera, who keep brightening up my life in the most wonderful ways. Jonas’s immense patience and encouragement during these five years of research education have been most important of all. His life passion for free software, DIY projects, technology and education are a constant source of inspiration.
Contents

List of papers ................................................................................................................................ 15

PART 1 .......................................................................................................................................... 17

CHAPTER 1
Introduction ................................................................................................................................. 19

Aims and research questions ................................................................................................. 23
Why computer graphics and why free software? .............................................................. 25
  Computer graphics media ............................................................................................... 25
  Free software for the creation of computer graphics media ....................................... 28
Positioning in the field and contribution ........................................................................... 34
  Production studies of media............................................................................................ 36
  Online and open media, and technological production .............................................. 38
  Infrastructure studies, software studies ......................................................................... 40
Contribution ...................................................................................................................... 42
  The form and structure of the dissertation ....................................................................... 42

CHAPTER 2
Research strategy, methods and material ................................................................................ 45

A case study approach ........................................................................................................... 47
  Reflection on the choice of cases ..................................................................................... 50
Empirical material .................................................................................................................. 52
  Two open film projects ..................................................................................................... 52
  The people ......................................................................................................................... 54
Data collection and analysis .................................................................................................. 57
  Ethnography ...................................................................................................................... 57
  Participant observation in Amsterdam ............................................................................ 58
  Shadowing in Gorno-Altaysk, Siberia ............................................................................ 61
  Qualitative interviews ....................................................................................................... 63
  Reciprocal communication .............................................................................................. 66
Ethical considerations .......................................................................................................... 67

CHAPTER 3
Context: the role of software in media production ................................................................. 69

Media authoring software and industrial media production .............................................. 70
Media authoring software and individual creative practice ............................................... 72
Method and material ..............................................................................................................................139
The Blender and Synfig software projects: from commodities to commons and beyond..................140
Shifting values in the open-source production of animated films ..................................................143
The movement of people between different regimes of value: from fanboy to a freelance professional..........................................................147
Conclusion ........................................................................................................................................150

Paper 2
Open Cultural Production and the Online Gift Economy:
The Case of Blender ..................................................................................................................................153
Introduction ........................................................................................................................................155
The Blender Institute: Who they are and what do they do? .................................................................157
Gifts of value ........................................................................................................................................161
Software: A useful gift ........................................................................................................................164
Culture: A gift for consumption and status .........................................................................................166
Public labor: The disciplining gift ......................................................................................................168
Secrets of the open gift economy .......................................................................................................172
Conclusion ........................................................................................................................................175

Paper 3
Repairing and Developing Software Infrastructures:
The Case of Morevna Project in Russia .............................................................................................177
Introduction ........................................................................................................................................179
Infrastructures of breakdown ............................................................................................................180
Infrastructuring through repair .........................................................................................................182
Methods .............................................................................................................................................185
Identifying the need for repair ............................................................................................................187
Repairing software through fitting together local structures with online actors...............................190
Speeding up development through integrating local with online financial resources .....................192
Conclusions: Situating software infrastructures ...............................................................................194

Paper 4
Negotiating Creative Autonomy:
Experiences of Technology in Computer-Based Visual Media Production.....................................197
Introduction ........................................................................................................................................199
Creative autonomy and the media industries ..................................................................................200
The politics of technology in digital media production ......................................................................201
Early-career negotiations ....................................................................................................................202
Negotiations in later stages of a career ..............................................................................................204
Conclusion ........................................................................................................................................207
Paper 5
Free Software Beyond Radical Politics:
Negotiations of Creative and Craft Autonomy in Digital Visual Media Production .... 209

Introduction ......................................................................................................................... 211
Media Production and Free Software in the New Spirit of Capitalism ....................... 213
Materials for Media Production ........................................................................................ 216
Crafting Technical Autonomy: The Blender and Synfig Free Software Projects ...... 217
Sensibilities of Craft............................................................................................................. 221
Tools Development as a Source of Precarity ................................................................. 224
  Hiring a Developer ......................................................................................................... 224
  Becoming a Financial Patron of a Project ................................................................. 225
  Motivating Developers................................................................................................. 226
Conclusions .......................................................................................................................... 227

Bibliography ............................................................................................................................... 229
Sammanfattning (Summary in Swedish) .............................................................................. 251
Södertörn Doctoral Dissertations...................................................................................... 255
List of papers

This dissertation is based on the following papers. Each paper forms a chapter in Part 2 and is referred to in the text by reference to the respective paper number.


Reprints are made with the permission of the respective publishers.
PART 1
CHAPTER 1
Introduction

In 2010, a small animation studio in Amsterdam called the Blender Institute released an open-source film called *Sintel*, a 3D animated short that was largely circulated on YouTube (Figure 1.1). The film was presented in the following way:

‘Sintel’ is an independently produced short film, initiated by the Blender Foundation as a means to further improve and validate the free/open source 3D creation suite Blender. With initial funding provided by 1000s of donations via the internet community, it has again proven to be a viable development model for both open 3D technology as for independent animation film (Blender Institute, 2010).

This statement was intriguing, as it suggested that a film was being made not just for audiences to enjoy but also to develop open technology that, in turn, could be employed more broadly in the computer graphics projects of other media creators. The ways this could be done were, as the quote hints, anchored in economic models facilitated by the Internet and technological approaches inspired by hacking – particularly free and open-source software development – that were applied to the production of computer-generated 3D film media.

At a time when scholarly debates in media research were focused on the rise of participatory cultures and online creativity, this statement prompted questions about the relationship between digital creativity and the digital technologies for media production that underpin it, particularly software. It also suggested the presence of an underlying dynamic involving the creation of free software for digital media production in the field of computer graphics driven by actors – such as small animation studios – rather than companies and corporations from the software industries.
Figure 1.1: Sintel, by the Blender Institute, 2010. © copyright Blender Foundation | durian.blender.org
This PhD dissertation analyses the nature of this dynamic by studying the practices and politics through which creators of digital media who work with, or aspire to work with, computer graphics animation attempt to create user-driven media authoring software,¹ the contexts and reasons for doing so and the ways in which they relate these practices to existing economic and digital media production structures (and infrastructures). By user-driven, I mean software whose development is initiated and guided primarily by those who use it for creating symbolic expressions of digital culture – digital artists and hobbyist and professional creators of computer-generated visual media – rather than industrial manufacturers that have traditionally provided the tools and infrastructure for digital media production.

Over the past few decades, processes of digitisation and the spread of communication technologies have fundamentally transformed the conditions for media production. Professionals, hobbyists and self-taught creators can make and circulate online digital media content of various degrees of complexity and genres, ranging from text to music, images, computer games, animations and films. Made individually and collaboratively, in art spaces, makerspaces or at home, the creative expressions of these new producers have enriched digital culture and saturated the Internet with media expressions created by non-industry actors who try to claim their relevance and agency in media production.

At the same time, there has been a broadening of possibilities for users and consumers of media to create or engage in the creation of digital media technologies (Coleman, 2013; Kubitschko, 2017; Löwgren and Reimer, 2013; Ratto, 2011). In their study of ‘collaborative media’, Löwgren and Reimer (2013) argue that the development of complex technologies, which had, for a long time, been possible only by minor groups and subcultures of engineers, artists and hackers, is now increasingly becoming part of the cultural mainstream. Academics, hackers, artists, media practitioners and

¹ By media authoring software, I mean, following Manovich (2013), programs for recording and editing music; software for making computer graphics animations, for designing 3D objects and digital simulations; or, more broadly, programs through which many of the contemporary expressions of digital culture are produced. The term comes from the software industry and has been contested for the discourse related to authorship of programs that are made by design cultures that have a very different understanding of authorship than the intended users of the software (Gillespie, 2003). Manovich also ultimately abandons the term and uses ‘cultural software’ (Manovich, 2013) instead as a broad umbrella term that includes any software through which culture is produced. While I acknowledge the problematics of the authorship discourse that Gillespie points to, I do not engage in this discussion and find instead ‘media authoring software’ to be a convenient term to delineate the type of programs that I focus on.
common citizens have, in different parts of the world far from Silicon Valley, been hacking, repairing and repurposing existing digital media technologies or creating new technologies with new social arrangements around them. These practices have gained tremendous variation, breadth and aims.

For example, technological enthusiasts have been developing open-source 3D printers (Söderberg, 2014) in hopes of realising broader utopian dreams of wealth creation through automatism. Design students have been putting their works online and developing together new digital tools for design (Manovich, 2008). Fablabs, hackerspaces and hackerlabs have been experimental grounds for technologists and consumers of media technologies in different places around the world to exchange knowledge and experiment with making and repairing diverse kinds of hardware and software (Kannengießer, 2016; Maxigas, 2014; Toombs et al., 2014). Academics have come to engage citizens and artists in projects of ‘critical making’ (Ratto, 2011; Ratto and Boler, 2014) or ‘collaborative media’ (Löwgren and Reimer, 2013) in which the making of software and hardware is used as a critical tool for conceptual reflection and a different way to create knowledge, as well as criticise society.

In many cases, these practices have been enabled by ideas and artefacts developed initially by the free-software movement or its further ‘modulations’ (Kelty, 2008: 242ff) in other domains, including open hardware and open culture. The free-software movement has helped to reconfigure ‘the material politics of cultural action’ (Coleman, 2013: 185) by inventing new legal and organisational forms that have made complex software development broadly available to individuals as much as industries (Coleman, 2013, 2016). Leading to a broader reorientation of knowledge and power, ideas from the free-software and open-culture movements have been used and interpreted across diverse practices and domains of cultural production ranging from activism to corporate practices of technological co-creation.

The circulation of code online and the sharing of programs for creating digital media as free software have further been recognised as an important means of opening up materials for artists engaged in software art and new-media art (Cramer, 2002; Goriunova, 2012). The breadth of experimentation on the part of artists with free software has ranged from graphic design, music and web art through university teams coding new digital instruments for musicians such as Björk and Madonna (Mansoux and de Valk, 2008). In such cases, it has been pointed out that the use of free software has enriched the possibilities for individual creative expression by
allowing creators of digital symbolic products to achieve a degree of ‘virtuosity in using it as an instrument’ (de Valk, 2009: 91). As de Valk (2009: 91) writes, ‘there is a need for tools that match an artist’s needs, instead of tools that match what an industry determines an artist needs’.

Taken in their diversity, such practices have been destabilising general ideas of the digital media user as merely the producer of online content and bringing attention to the myriad of ways in which creators of digital media can also engage and become engaged in making digital media technologies, including media authoring software, across a wide range of practices and locations around the world. As Löwgren and Reimer (2013) observe:

Not only can people produce media texts, they also can take part in the design of the infrastructure – the programs, software components, and web services that can be used for media production. People working within the media industries (broadly defined) as well as interested citizens can now participate in creating the tools that enable different kinds of media productions (Löwgren and Reimer, 2013: 18).

Of course, the intensity and scale of these practices is not a phenomenon that is equally present across all areas of media production. They also do not exist in a vacuum but are intertwined in different ways and to different degrees with the specificity of local and geographical contexts, and with existing structures such as the capitalist market, as well as with the dynamics of the production of symbols within specific media industries.

Aims and research questions

The aim of this dissertation is to analyse how the broadening of possibilities for making technologies, specifically software, has been taken advantage of by new producers of digital culture – freelancers, aspiring digital media creators and small studios – in the production of digital visual media.

Through such a study, I want to deepen the understanding of media and communication studies about the significance of the possibilities of, or hindrances to, creating, changing and affecting media technologies at the infrastructural, algorithmic level as related to the technocultural politics of the distribution of power in the contemporary media landscape (Bucher, 2012b; Couldry and Hepp, 2017; Kubitschko, 2017; Langlois, 2012). As Langlois (2012: 96) astutely notes, if the critical question of the mass media era has been about the possibilities that media users have to speak, the critical questions today revolve around the apparatus through which we express
ourselves. With this remark, she calls for a greater understanding of the ways in which ‘the field of cultural expression [is] managed by technocultural power formations’ (ibid).

Software has arguably come to play a significant role in these formations. Software and the materiality of media are at the centre of lasting politics of power that shape every aspect of interaction with digital media. The extent to which software has become an omnipresent, and at the same time, mediating element in the production of culture and society today has been reflected through a new vocabulary of media. It includes characterisations of society as ‘softwarised’ (Berry, 2014) and denotes profound transformations of culture into what Manovich calls ‘software culture’, because ‘today software plays a central role in shaping both the material elements and many of the immaterial structures that together make up “culture”’ (Manovich, 2013: 33). Similarly, Striphas (2015) and Galloway (2006a) refer to the rise of ‘algorithmic culture’.

These new concepts have led to a redefinition of media as software (Manovich, 2012) and have acknowledged that software itself has become, as Mackenzie (2006: 21) writes ‘a force and sometimes a tool’ through which to revisit traditional questions of social theory concerning agency, materiality and sociality.

The exploration of such questions has rightfully found a particularly strong resonance in the context of digital communication environments such as platforms and network communication due to the scale of their use and penetration in everyday life (e.g. Bucher, 2012b; Gillespie, 2014). They have, however, eclipsed the ways in which the dynamics of power, as shaped through the frameworks of development and circulation of software, unfolds and is contested in other, equally important fields of media practice, such as the production of digital visual media, particularly computer graphics.

With this dissertation, I aim to understand the cultural, technological and economic practices through which freelancers, aspiring digital media creators and small media production studios form alternatives to popular commercial software for the production of computer graphics media; the politics of such practices and the ways in which they matter for the field of digital media production.

The dissertation is based on two empirical case studies that concern the making of free software for computer graphics animation production in two contexts: by a loose collective of anime fans in Siberia, Russia, and by a small animation studio in Amsterdam, Netherlands. The case studies are
presented and analysed in the scope of four journal articles and one book chapter. The papers are introduced and discussed more extensively in Chapter 5.

Using as a specific empirical object of study the creation of *free software* for computer animation, I pose the following two more-specific research questions:

- How do creators of computer graphics media develop, shape or guide free software alternatives to industrial media authoring software for 2D and 3D animation production?

  Subquestions here include: What cultural values and ideas about the relationship between their practice and the role of technology therein do they embed in such software? What are their politics, and how do they relate to existing structures, such as the capitalist market, the media and the software industries?

Second,

- What meaning do such alternatives to industrial media production software for computer animation gain in the practices of creators of computer graphics media who use them?

**Why computer graphics and why free software?**

**Computer graphics media**

My interest in the making of technologies for the production of computer graphics media stems from the fact that they have been largely ignored in media and communication studies despite the ubiquity of computer graphics in society and everyday life.

Computer graphics media – such as computer games, computer animations, virtual reality simulations and interfaces – are among the most ubiquitous and most important forms of media today. Irrespective of whether we turn on an electronic device such as a computer, a mobile telephone, a GPS navigator, a game or a television, every time we see an advertisement or browse a magazine featuring interior design or fashion, we are consuming computer graphics. The multiple forms of computer graphics media – computer games, visual effects, user interfaces, digital comics, computer animations and simulations – have also yielded some of the symbolic goods
of major financial and aesthetic value produced by the media industries and computer cultures in the past two decades, ranging from Hollywood films and computer-generated advertisements, through computer games, to user-produced animations in game communities like Machinima.

Importantly, technologies for making computer graphics have been pivotal in redefining the cultural meaning of computers from number-crunching machines to devices that generate images, process photos and produce animation and special effects for film and television (Bolter and Grusin, 1999/2003: 23). They have enabled the computer to become part of everyday media, and alongside computer code, they have reconfigured media materiality, expanding it into information spaces that have led to an opening up of cultural techniques, conventions, forms and concepts (Manovich, 2001: 324–333). With these changes, it is now nearly impossible to make digital media without using software for the production of computer graphics.

The possibilities for creativity and new forms of cultural expression that have emerged in recent decades have therefore been facilitated (and constrained) as much by the Internet and new communication technologies as by the development of new software for creating graphical user interfaces, for visual image manipulation, film editing, animation, music and game engines. While new communication technologies have received enormous scholarly attention, the frameworks for the production of software for making digital media, particularly computer graphics media, have been of more marginal interest, remaining mostly a rather narrow object of interest of software studies and, to a limited degree, to some of the materialist strands of film studies.

One reason for the relative lack of attention paid to media authoring software for the production of computer graphics is its relative novelty. The current ubiquity of computer-generated imagery obscures the fact that the first computer-generated feature film, Pixar’s Toy Story, was made only about 20 years ago and remained, for a long time, a technological possibility for only a handful of big Hollywood animation studios. It is only since the end of the 1990s, after the mass digitisation of the media industries (see, for example, Sito, 2013), that software for computer graphics emerged as a product that is available to the average consumer, leading to a boom in animation and digital imagery in the early days of the web, while new media creators started exploring digital visual aesthetics (see Chapter 3 for a more detailed contextualisation).
Within film studies, recent scholarly explorations of computer graphics feature the monumental work by Sean Cubitt (2014), who traced the genealogy of changing material practices related to the manipulation of light, from paper to digital pixel. With this work, he established some of the foundations for understanding the materiality of computer graphics and digital visual media today, of which software is just one part. A similar, genealogical project, although with its focus on the ways in which the emergence of the digital has transformed art aesthetics, was carried out by Hoy (2010), who argued that there was a need to reconceptualise digital practices in larger contexts of art and visual culture in an attempt to bridge disciplinary boundaries between art, media and film studies.

The role of software in practices of digital media production has been celebrated for the ways in which it enhances one’s creative potential and provides a rich toolset that makes it possible to create new media such as digital animation today (Gehman and Reinke, 2005; Manovich, 2013; Wells and Hardstaff, 2008; Wood, 2015). But, more interestingly, some of these studies have hinted, although only superficially, at the emergence of tensions in negotiating the interests of the producers of media authoring software and user practice, as well as the creative ambitions that emerge in encounters with such software. For example, Wood (2015: 54) notes how, in Maya, the popular commercial software for 3D animation, user-friendly interfaces and scripting possibilities offer users a great degree of freedom in customising the toolset to fit their needs. When moving beyond certain movement conventions, however, software presents ‘boundaries founded on a relatively inflexible set of parameters. When confronted with the limits of those parameters, the seamlessness of working with software becomes forced and the confines of a software’s influence more marked’ (Wood, 2015: 56).

While such limitations can be productive and can generate new genres or forms of media creation, they can also be constraining for media creators, setting limits on what is possible and leading to a degree of standardisation of particular aesthetics and forms of knowledge (cf. Becker, 1982/2008). Craft theorist Peter Dormer comments on the latter in the style of Frankfurt school authors Adorno and Horkheimer’s (1944/1993) concern with sameness. He notes how everything begins to look the same. If all over the country the same building technology or computer or graphics software is applied to the variety of architectural, graphic or industrial design commissions, then each of these individual jobs and commissions receives the same underlying thought.
Consistency and predictability of outcome are almost guaranteed, but the price is uniformity (Dormer, 1997a: 142).

Part of the reason for this sameness, according to Dormer (1997a: 141), is the desire of technological manufacturers to produce what he refers to as a 'workmanship of certainty', one in which all risks related to human error and unpredictability of practice are removed. To this can be added the historical tendency of media production tools, like cameras and recorders for producing visual media, to favour certain uses and aesthetic visions over others (Caldwell, 2008: 151; Ihde, 1995).

The new software for making computer graphics media that has entered the field of media production since digitisation represents, therefore, not just an instrument for work, but also material embodiments of ideological visions, norms and ways of seeing in a world that constrain as much as enable creators of digital media.²

Free software for the creation of computer graphics media

In parallel to industrially developed software for computer graphics media, there have emerged since the early 2000s diverse non-industrially driven projects dedicated to developing free software³ for the production of computer graphics. These developments have taken diverse forms and direc-

² For a discussion of the ideological function of apparatuses and technology in film studies, see Baudry and Williams (1974/1975) and Comolli (1980); in communication technology, see Marvin (1988); in science and technology studies, see Cartwright (2012), Clarke and Fujimura (1992/2014) and Downey (1998).

³ From here on in this dissertation, and in all papers except one, I use the term free software to refer to a specific kind of software as defined by the GNU Operating System project and the free-software movement. According to this definition, free software 'means that the users have the freedom to run, copy, distribute, study, change and improve the software. Thus, 'free software' is a matter of liberty, not price. ... With these freedoms, the users (both individually and collectively) control the program and what it does for them. When users don’t control the program, we call it a ‘nonfree’ or ‘proprietary’ program. The nonfree program controls the users, and the developer controls the program; this makes the program an instrument of unjust power’ (GNUProject, n.d.). This definition is different from other common scholarly abbreviations that are used concurrently, such as FOSS, F/OSS, FLOSS or OSS, in which the OS in the initialism stands for open-source. I use the term ‘free software’ because it more precisely reflects the ideological outlook of the programs that I chose to study in this dissertation. This outlook is aligned with that of the free-software movement and engrained in its distribution licence, GNU-GPL. Nevertheless, the informants in this study, as it will become evident in the papers included in this dissertation, use a mix of terms such as ‘free software’, ‘open-source’, ‘free and open-source’ and have a more open attitude to the ideological distinctions between ‘free’ and ‘open-source’.
tions. If we look at them through the lens of their different goals and participants, such projects can conditionally be divided into three clusters.

The first cluster consists of software projects led predominantly by hackers and software engineers, who can be broadly seen to represent an ideological spin-off of the free-software movement. Examples of projects developed include free graphical user interfaces such as GNOME and KDE, as well as programs for painting and digital image manipulation such as GIMP, Inkscape, MyPaint or Pencil. They are oriented mostly towards creating free graphics technical infrastructures that are aimed at integrating with existing Linux-based operating systems, thus extending the free-software movement to create software that is free to use, share and modify in the field of computer graphics media. Some of these projects, like GIMP, Inkscape and MyPaint, are further aimed at acting as socially and politically better alternatives to corporate software for the production of computer graphics.

Another cluster of non-industrially driven projects in the sphere of computer graphics software was formed predominantly by conceptual artists, visual artists, demoscene participants and individuals who prefer to code graphics rather than to use interfaces and programs for this purpose. Some of them work both to erase traces of mediation when making computer graphics (cf. Bolter and Grusin, 1999/2003) and to erase the many layers of interface that stand between them and the computer as a machine. Others try to develop an artistic critique of the contemporary technological condition. For this purpose, they engage in developing software prototypes or in modifying existing free software in order to offer critical visions of society and digital labour and to explore relations with machines.

Among the many examples of such practices are the works of the Argentinian duo Widú, who made an animated series called *The Amorzorzores* (Figure 1.2) entirely through programming; the artistic curatorial projects of the Elli Kuruş collective, which questions the erasure of

---

4 Following Coleman (2016), I understand here hackers to be skilled technologists in whose practices craft and craftiness converge, and who often have a liberalist political outlook. I do not engage here with debates on the broad spectrum of application of the term, which Coleman extensively presents in a range of works (Coleman, 2013, 2014, 2016). For my purposes, I only want to accentuate the engagement with technologies for the creation of computer graphics on the part of technically savvy individuals and programmers.

5 As there are already a plethora of detailed histories and descriptions of this movement, I have chosen not to repeat them here. For reference, see Söderberg (2012), Coleman (2013: 61-89), Kelty (2008: 97-117) and Kelty (2010).
labour and humans from algorithmic work, as well as humanity’s striving to create perfect, platonic forms (Figure 1.3); or artistic techno-academic projects such as *The Screenless Office* (Figure 1.4) by Brendan Howell, who created

an artistic operating system for working with media, that eschews the use of a raster-based display. The goal of the project is not to produce techniques that can be justified in terms of speed and efficiency. Instead, the office seeks to describe an alternative phenomenology of everyday human interaction with media. The system is constructed using free/libre/open hard- and software components, especially for print, databases, web-scraping and tangible interaction (Howell, 2014).

The free software that gets developed or modified in such ways is often demonstrated at conferences such as the Libre Graphics Meeting⁶ or new media art conferences, and in most cases, remains at the level of an unfinished prototype and part of a specific artistic project that rarely gets to be circulated or integrated in the practices of other media artists or practitioners.

---

⁶ The conference has been held yearly since 2006 with the aim of attracting developers, artists and professionals who use and improve free and open-source software graphics applications. The conference is described as having a ‘strong artistic focus, with designers and artists showcasing their work alongside the work of software developers’ (Libre Graphics Meeting, n.d.).
Figure 1.2: Amorzorzes by Widú, http://amorzorzes.com/, CC-BY 4.0

Figure 1.3: Image from Platonic Solids project. 3D scans of plasticine sculptures, by Elli Kuruş, http://www.ellikurush.com/?page_id=361 (used with permission)
A third cluster of free software for computer graphics is developed in a non-profit-oriented collaboration between digital media practitioners such as CG animators, storyboarders, game designers, digital painters – mostly individuals whose work is oriented towards producing computer graphics content for the media entertainment industries – and industrial designers and computer engineers. Some of the more notable examples of such software projects include Blender for 3D animation, Krita for digital painting and Synfig for 2D vector animation. The purpose of these software projects and collaborations is often communicated as an attempt to give powerful, free media authoring software to individual creators and small computer graphics studios. For example, under the slogan of ‘Open Source 3D creation. Free to use for any purpose, forever’, Blender (Figure 1.5) is presented as follows:

Blender is a public project, made by hundreds of people from around the world; by studios and individual artists, professionals and hobbyists, scientists, students, VFX experts, animators, game artists, modders, and the list goes on. Blender is [a] free and open source 3D creation suite. It supports the entirety of the 3D pipeline—modelling, rigging, animation,
simulation, rendering, compositing and motion tracking, even video editing and game creation (Blender, 2017).

Figure 1.5: Blender software website, http://blender.org (accessed 8 September 2017)

Similarly, the non-profit Krita foundation behind the digital painting software of the same name reveals its inclination to subject software development to the creative needs of a broad range of digital media creators:

Krita is a professional FREE and open source painting program. It is made by artists that want to see affordable art tools for everyone (Krita, 2017).

Each of these three clusters has been developing with a varied intensity over the past 10 to 15 years. To my knowledge, none of these clusters or the practices and technologies that get produced by them have been addressed in media and communication studies generally or specifically in relation to the new possibilities that have emerged for creators of digital media to engage in the development of technologies and infrastructures for media production. Some of them have been mentioned between the lines as a phenomenon and practice that exists but have not been studied in depth (see Cubitt, 2014; Manovich, 2005, 2013).

I have decided to take as an empirical object of study the practices of the last cluster of free software projects for computer graphics. There are several reasons for this choice (a more extensive explanation of my choices can be found in Chapter 2).

The practices of this cluster seem to be explicitly oriented towards creating technology that is supposed to be valuable for a broad range of contexts and media production practices, ranging from individuals and hobbyists to smaller animation studios. Their explicit focus on collabora-
tive, media practitioner-led technological development invites a discussion about the role of software users as creative agents of technological change. It is also relevant for extending existing discussions about the nature of practices, politics and economies of user-driven media technological development that emerge in this context.

At the same time, two of the major software projects in this cluster – Blender and Synfig – which also form the empirical core of this dissertation, represent software that is primarily oriented towards the production of computer animation, which has generally received very little attention in media and communications research (it has mostly been studied in the area of film studies, especially in the tradition and texts of literary criticism), following the general marginalisation of animation as a cultural form from its birth (Wells, 1998). There has been more attention, however, in the context of discussions of new media (Manovich, 2001), the dissolution of film unions in the United States with the entrance of computer graphics media in Hollywood production studios (Sito, 2013), the relationship between materialities of bodies and those of technology (Cartwright, 2012) and the industrial development of simulation algorithms (Peddie, 2013). Most of this literature has, however, come from scholars outside of the field of media and communication studies.

By taking the practices of making free, user-driven software for computer graphics animation as empirical objects of study, I therefore wish to make an additional contribution by elevating the significance of a rather marginalised empirical object of study in discussions of media, the production of computer animation, whose marginalisation in media research is hard to justify given the ubiquity of computer graphics and animation in the contemporary media landscape, ranging from flight security videos through food and hair cosmetics advertisements to films. That said, this research is not about film production; rather, its focus is on the development of software for enabling computer animation. Nevertheless, the insights gained from the research could be relevant to other domains of computer graphics and media production, such as digital games or computer-generated music, for example.

Positioning in the field and contribution

The study of the practices involved in technological production within media and communication studies represents a relatively new direction of
research if seen in the light of the longer development of the discipline. For decades, media and communication studies have been oriented towards mass-communication research, organised broadly around the studies of media ‘texts’ and focusing on the production, reception and representations of these texts. Within production studies of media specifically, the main objects of interest have been either the people producing such texts or the larger economic and organisational structures that govern their production.

This interest has been sustained even though cultural theorists, such as Stuart Hall (1973/1980), were arguing already in the 1970s that media production in this division is much more than the production of texts and messages. He observed that it included the material instruments and technical infrastructure, which come with their own set of social, production-oriented relations that are organised and combined through practices in relation to and through media apparatuses. For a long time, however, the making of the technical infrastructure and the social, production-oriented relations surrounding it have generally been neglected within media and communication studies.

In recent years, however, there has been a more sustained effort by different strands of media research to include the materialities of media, as well as the practices of technological development in research on the production of media and digital culture. In particular, there has been a general reorientation and broadening of the understanding of what objects, actors and processes media production entails. This reorientation can be summarised as moving away from studies of the production of media content to studies of the production of media technologies and infrastructures, and from the production practices of the technological and media industries to those of a broader variety of actors.

Some notable contributions in this direction in the context of digital media have been made by research on the cultures and politics of hacking (Coleman, 2016; Dunbar-Hester, 2009; Himanen, 2001; Jordan, 2017; Kelty, 2008; Kubitschko, 2015; Lievrouw, 2011; Maxigas, 2014). They have brought to the forefront the cultural significance and politics of actors dedicated to actively reconfiguring the legal and organisational aspects that have surrounded the production of the software and hardware underpinning digital media and digital communications. In parallel, we could see the emergence of subfields of media research such as software studies (Chun, 2013; Frabetti, 2015; Fuller, 2003; Galloway, 2006b; Manovich, 2001). This

---

7 One notable early exception is represented by the work of Carolyn Marvin (1988).
body of research has focused on questions of ontology, governmentality and the societal effects of media software. Scholars of media have addressed writing machines (Gitelman, 1999), performativity and inscription of cultural values in software (Chun, 2013; Frabetti, 2015) and media infrastructures (Hogan, 2015; Parks, 2005; Parks and Starosielski, 2015; Starosielski, 2015b). Anthologies that discuss the materialities of media technologies (e.g. Gillespie et al., 2014) have further extended the engagement of media research with the cultural politics of the production of digital media technologies.

Whereas these strands of media and communications research have adopted different perspectives and objects of analysis, they are symptomatic of the broadening of the borders of the field of media and communication studies to encompass questions and practices that surround the production of media technologies, and moving further away from studies of media texts.

This dissertation expands on this general reorientation of media research towards the production of digital media technologies by adding a discussion of the practices and politics of technological development – particularly free software for computer graphics animation – in the field of digital media production. More precisely, it expands on research into open cultural and technological production and participatory cultures, production studies of media and infrastructure studies.

Below, I briefly review some major themes that have been explored in these subfields. As I argue, even though there have been a vast range of production studies of media, from how public service is organised through how culture is produced in industrial media settings to how media workers create their professional identities, few have studied the making of the technologies that underpin these productions. In particular, only marginal interest has been paid within media and communication studies to the intangible technologies of digital media production, i.e. software, which has penetrated and arguably transformed the nature of media work and digital culture.

Production studies of media

The strand of media research that is commonly referred to as production studies of media is generally concerned with studies of the media and cultural industries, as well as the industrial production of the symbols that these industries produce and circulate in global media markets.
For a long time, the major themes within this body of research have been the economies and organisation of creative labour within large media industries such as broadcast media, Hollywood film production, music and publishing. Predominant have been organisational ethnographies of the work and cultures of producing media texts within these industries or political-economy accounts of the broader structural and economic logics that govern these productions (Bolin and Forsman, 2002; Born, 2005; Caldwell, 2008; Fast, 2012; Gitlin, 2000; Hesmondhalgh and Baker, 2010; Mayer et al., 2009; Stahl, 2010; Stiernstedt, 2013; Szczepanik and Vonderau, 2013). Within the field of media industry production studies, the main topics of enquiry have been the tensions emerging in the relationship between art and commerce, storytelling and production, as well as between discourse and economy (Freeman, 2016: 12).

In his volume titled *The Cultural Industries*, David Hesmondhalgh (2013) provides a systematic and nuanced analysis of some differences in the focus and approaches that such studies have taken.

For most of these studies, Hesmondhalgh notes, media production has been translated into the industrial production of culture and has had an impact on the ways in which culture also produces industries, the ways in which media workers establish their identities and self-representations, as well as policy-oriented analyses of the media and cultural industries. A further major theme of such studies has been the autonomy of creative labour in the media production industries and the tensions that emerge for media practitioners from trying to reconcile cultural production with commodity production in industrial contexts.

Within this trajectory of studies of media production, even though digital technologies such as software and communication infrastructure like the Internet have been recognised as important, the processes that underlie their production in relation to media production practice have generally not been a specific object of interest.

Their absence becomes evident if we take the long list of research questions that McDonald (2013: 149) poses and Freeman (2016) later extends as an agenda for research in terms of industrial media production. These are still broadly along the frameworks of macro-organisational accounts, forms of the organisation of labour and management of change, construction of consumers and producers and the systems of belief and value that are produced among practitioners. Infrastructure, software and the technologies that broadly make digital media industrial production function are not part of the object of study.
The major issues in relation to technological change in the media industries have been discussed primarily in terms of the ways in which they have restructured the organisation of labour, putting media workers in greater precarity, while finding new ways to extract value from them and from new audiences (e.g. Deuze, 2007; Fast, 2012; Hesmondhalgh and Baker, 2010).

However, the increased possibilities for media practitioners to take part in the production of symbols by engaging in technological, and not only content, production have only been marginally addressed, mostly within the subfield of studies dedicated to game cultures and platform research (Arvidsson and Sandvik, 2007; Dovey and Kennedy, 2006; Montfort and Bogost, 2009). Some important insights that these studies have generated concern the ways in which the game industries have been trying to enhance experiences of game play and the strengthening of game brands by providing gamers and game fans with software for game design.

Unintentionally or deliberately, a lack of theoretical interest in research that addresses the engagement of media industries with the production of digital technologies for creating digital visual media has resulted in an instrumentalist view of technological change, a problem that has been prevalent across media studies generally, that, as Gillespie et al. (2014) note, reproduces a deterministic understanding of technology according to which it is assumed to represent

- the intervening variable that explains a measurable change,
- the historical catalyst that explains a social shift, or
- the tool with which passive audiences can finally succumb to or resist the tyranny of mass culture (Gillespie et al., 2014: 3).

Yet, the extent to which technologies, particularly software, have entered media practice means that it is no longer possible to detach studies of media production from questions of software production.

Whereas production studies of media industries have left this topic aside, there have been some developments in other subfields of media production research.

Online and open media, and technological production

Another large cluster of studies of media production has focused on user creativity and content production online. Many theorists initially saw in the Internet a new form of ‘alternative media’, an arena for the democratisation of media production in the sense that it offered a new platform for creating
and circulating content in supposedly more horizontal ways than before, through networks, peer production and new models of self-communication (Atton, 2002, 2007; Bailey et al., 2008; Benkler, 2006; Bruns, 2008; Castells, 2009; Jenkins, 2006; Lessig, 2001).

The proliferation of free and open-source software and free culture online at the end of the 1990s led to an intense polarisation of views on how to understand the reshaping of culture, knowledge and capitalist modes of production and labour associated with them. These views were split between seeing such practices either as expressions of a liberalist critique of capitalism or as new forms of capitalist production based on free labour and on new forms of online creativity through sharing. A notable strand of this research has departed in its discussions from the enabling role that the free-software and free-culture movements, and hackers in particular, have played in reorienting culture, knowledge and power (Kelty, 2008: 2), which has allowed new actors to become participants in the field of online cultural and technological production. Focusing usually on a narrow set of empirical examples – the Linux operating system and the creation of Wikipedia – this strand of research has focused on outlining ideological distinctions of property rights over code, and making questions of copyright central to this discussion (Benkler, 2006; Berry, 2008; Berry and Moss, 2006; Cohen, 2006; Dulong de Rosnay and De Martin, 2012; Fuster Morell, 2010; Lessig, 2004; Stallman, 2002). Genealogical and anthropological research on the cultures of hacking has provided more perspectives on how liberalist values and politics have been expressed through practices of free software coding and hacking and thereby inscribed in software, hardware and institutional arrangements (Alberts and Oldenziel, 2014; Coleman, 2013, 2016; Jordan, 2017; Kelty, 2008; Kubitschko, 2015; Maxigas, 2014). The narrow focus on programmers or highly technically savvy communities has defined them in many cases as new digital elites whose politics can be complex and controversial but generally revolve around reconfiguring and contesting power through technologies.

On the other hand, Marxist discussions of digital labour, rooted in the autonomist tradition, have focused on the relationship between the development of free software and the capitalist organisation of labour. This approach has accentuated the political potential for disrupting established forms of the division of labour by controlling technology (e.g. Hardt and Negri, 2009; Lund, 2015; Söderberg, 2012). This approach has, however, been refuted by subsequent debates on digital labour in which the participatory activities of online media users, hackers, free-software program-
mers and open-culture proponents alike could be successfully monetised and added to renewed labour models of established and emerging media industries (Arvidsson and Sandvik, 2007; Fisher and Fuchs, 2015; Terranova, 2000, 2004; van Dijck, 2009).

These debates have been met with strong criticism by media theorists who use feminist- or cultural-studies approaches, suggesting that user cultures and the meaning-making practices of media users and producers need to be considered in relation to the creation of economic value by the media industries ([Bolin, 2011; Hesmondhalgh, 2013; Jarrett, 2016]. They have also underlined the need to create more complex and nuanced models of technological change that avoid reductionism and discourses of rupture, emphasising instead the historical continuity of how social and economic structures operate.

Infrastructure studies, software studies

Finally, as noted earlier, a more recent strand of studies of media production has been more radically reorienting digital media research to deal with questions of production of media infrastructures (Parks and Starosielski, 2015) and media materialities (Gillespie et al., 2014). They have been moving away from the mass communication model of studying media texts in their production, reception and distribution, instead calling for an understanding of how media content gets shaped, imagined and organised by our current media infrastructures and the people who make them (Starosielski and Parks, 2015: 2). Such infrastructures are understood as ‘material forms as well as discursive constructions’ that make it possible to ‘understand the materialities of things, people, and processes that locate media distribution within systems of power’ (Starosielski and Parks, 2015: 5). Related to this change, media scholars have expressed concern about how the possibilities to create, change and affect media technologies, or hindrances thereto, at the infrastructural, algorithmic level have become an increasing matter of the politics of the distribution of power and the preservation of democratic values in the contemporary mediascape (Couldry and Hepp, 2017; Kubitschko, 2017).

Some of the objects of study in this subfield have been satellites (Parks, 2005; Parks and Schwoch, 2012), Internet cables (Starosielski, 2015b), data centres (Hogan, 2015; Holt and Vonderau, 2015; Hu, 2015; Velkova, 2016a), pirate infrastructures for media distribution (Larkin, 2008), Internet platforms (Plantin et al., 2016) and ERP software (Rossiter, 2016). Within this dynamic subfield, new conceptual frameworks have been developing
for theorising about media and media production with a focus on the interplay between the symbolic production and consumption of media and its material grounding in physical infrastructures for the distribution of power. To a great extent, the object of enquiry within this subfield has been the industrially owned and developed large-scale media infrastructures that underpin contemporary digital communication networks. Relatively little attention has been paid to the making of digital artefacts and infrastructures for creating media that are not industrially made, but that the production of audiovisual content today depends on.

The broader interest of media scholarship in digital infrastructures provoked Durham Peters (2015: 30–33) to talk of a turn of media studies to ‘infrastructuralism’ oriented towards the study of infrastructural media, or as he calls it, ‘media that stand under’ – behind the scenes, under our digital worlds. One form of infrastructural media is software. Software and algorithms have been predominantly addressed within subfields such as platform studies and software studies, which have engaged in questions of software ontology, interfaces and the ways in which they transform culture and thereby media themselves. Starting with the foundational work of Manovich (2001), which can be seen as an extension of the Toronto media school tradition that engaged in questions of the medium and its influence over society, other authors have explored the ontology of software code (Chun, 2013; Frabetti, 2015; Fuller, 2003; Mackenzie, 2006) as language, signs and algorithms, and how they are shaped by and in turn shape culture. Questions of governmentality and the structuring effects of software, and particularly algorithms, on online sociality, agency and materiality have been other important topics of enquiry (e.g. Bucher, 2012a; Galloway, 2006a, 2006b; Gillespie, 2014; Pasquale, 2015; Strivhas, 2015). In addition, earlier anthropological research on software developed an understanding of the cultural histories of diverse categories of software (Campbell-Kelly, 2003; Ceruzzi, 2003). These histories tend to end generally in the late 1990s and early 2000s with the dotcom crash and the emergence of free software (network software and operating systems), which is where the debates that I outlined in the previous section start. A decade later, Manovich (2013) resumed the efforts to create histories of software with a focus on some of the industrial contexts and practices that gave birth to software for the production of computer graphics media. Yet, as indicated earlier, non-industrially developed software for computer graphics has also started to proliferate, and its histories and the practices through which it is developed remain largely undertheorised. Therefore, beyond addressing questions of
the medium and its effects on society, it is also important to continue deepening our understanding of the practices and actions of people who engage in making software and the digital media production infrastructures organised around it.

**Contribution**

This dissertation deals with this turn on the part of media and communication studies to infrastructuralism and has a general interest in the production of the intangible technologies that underpin media, such as software. It contributes to the expansion of production studies of media in several ways.

First, it contributes to the first body of production studies focused on media industries by shifting the empirical focus away from the organisational ethnographies of large actors in media industries to the practices of the technological development of media creators who work or aspire to engage in the field of the production of computer graphics media.

Second, it theorises the technologies and practices that media creators of computer graphics media develop as emerging infrastructures of significance for different forms of digital media production, also becoming relevant for media work and media industries. It thereby prompts production studies focused on audiovisual media industries to consider user-driven software development as an important object in discussions of media work.

Third, it adds one more technological object of study – user-driven software for the creation of computer graphics, specifically animation – to the emerging field of infrastructure studies. I understand such software to form a crucial part of the infrastructures for digital media production, at the same time that it is also an interface for other infrastructures that imagine its functionality and create and support its proper functioning.

Altogether, these contributions deepen the theoretical understanding of media and communication studies about the practices of producing technologies for digital media creation and thereby the entanglement between the construction of the technical and that of the symbolic as expressed in contemporary practices of media production.

**The form and structure of the dissertation**

This dissertation is organised as a compilation. It consists of four articles and one book chapter, referred to as ‘papers’, all of which were published between 2015 and 2017. These publications contain the empirical analysis
of the dissertation. They are united through a contextualising part (Part 1 in this dissertation) that presents the broader aims, methods, conceptual framework and the contribution of the dissertation. All papers have been peer-reviewed, which could be interpreted as a sign of a degree of quality. One of them was written with a co-author\(^8\). One of the advantages of this form of work compared to a monograph is the possibility to obtain multiple reviews of written texts in progress from an engaged and rigorously critical academic community. This process has enriched my knowledge of media and communications far beyond the subject of my dissertation.

There are, however, two major disadvantages to this approach. One of them is that, once written, the articles cannot be changed, making their integration into a coherent argument challenging as the research progressed. This integration could have been accomplished in part by including portions of empirical material not found in the papers in the contextualising part of the dissertation, but I have avoided doing this, as it would have required further analysis within the contextualising chapter. For these reasons, the argument of this dissertation is less coherent than it would have been had it been presented in a monograph.

The second disadvantage is the potential difference in the degree of quality of the articles, a natural result of the learning curve that happens in doctoral training. I have tried to minimise this risk by aiming to write and publish the articles not too far apart in time, but still, some unevenness in the tone and depth of analysis is inevitable in the papers.

The dissertation is organised in two parts. Part 1 consists of six chapters. The first chapter is this introduction, in which I outline the aims, object of study and the positioning of the dissertation at the crossroads of several subfields of media and communication studies related to the production of digital media.

Chapter 2 presents and discusses my methodological and empirical choices based on a grounded approach and ethnographic, qualitative enquiry. In this chapter, I also present in greater detail the two main case studies through which I have addressed the research aims and questions.

---

\(^8\) As a first author of this article I was responsible for the collection and analysis of the empirical material, methodological approach and the main idea. The theoretical argument has been developed jointly by me and Jakobsson and we have jointly written up the final draft of the article. Even though I have generally had a leading role in the work on the article, after a certain moment in time our ideas and contributions converged in the final versions of the text.
Chapter 3 provides context and discusses the role of software in media production. It draws on previous research from software studies, science and technology studies and media industries production studies. This chapter also indicates the primary ways in which I approach software: as a cultural technology, a production tool and an interface for infrastructures rather than as code, which is otherwise more common within software studies and in research on digital media production.

Chapter 4 presents the theoretical perspective that is derived from recent developments of practice theory and the ‘media practice’ perspective (Couldry, 2012; Postill, 2010). I further present the conceptual framework and theories used in each of the papers, after which I unite them by drawing on theories of infrastructures and the concept of ‘infrastructuring’, which I borrow from science and technology studies (Karasti and Syrjänen, 2004). Through this concept, I extend the media practice perspective into media-related infrastructuring practices.

Chapter 5 presents the results of the research. It starts with a presentation of the empirical results in relation to the research questions, also connecting the articles and papers to a more coherent narrative. This presentation summarises the key points of the articles and their main findings, while integrating them with one another and with the case studies. The second part of this chapter presents a more theoretically anchored discussion of the results.

Chapter 6 concludes the dissertation with a summary of the main contributions to media and communication studies and proposals for future research.

Part 2 of the dissertation contains the papers. The first three papers address the first research question and narrowly focus on the two case studies that are the empirical objects of the research, the histories, practices and politics of creating two programs for computer graphics animation by two different actors: an animation studio called the Blender Institute in Amsterdam, Netherlands, and an informal collective called the Morevna project in Siberia, Russia. The last two papers respond to the second research question.
CHAPTER 2
Research strategy, methods and material

To repeat, the aim of this dissertation is to analyse how the broadening of possibilities for making technologies, specifically software, has been taken advantage of by new producers of digital culture – freelancers, aspiring digital media creators and small studios – in the production of digital visual media, such as computer graphics animation. The study of the practices and politics of emerging alternatives to industrially driven media production software initially presented several methodological challenges.

First of all, such practices were relatively new and in development around the start of my research. Industrially produced software for computer graphics by companies such as Adobe and Autodesk had only started to proliferate more broadly in the first half of the 2000s. Therefore, any projects aimed at creating alternatives to such software were even newer and largely in formation. Engaging with phenomena or practices that are still in formation represents a clear challenge to research.

I adopted a grounded-theory approach and ethnography-inspired qualitative methods. Grounded theory, as developed by Glaser and Strauss (1967/2009), implies that the researcher does not have a theory in advance to verify, but that the theory develops in the process of the research. The main principle of grounded theory is that it is the data that generates the theory and that the analysis of data elicits the concepts used by the researcher (Charmaz, 2006: 3). This, however, does not imply that doing fieldwork and researching social action means exploring it as a ‘tabula rasa, waiting for things to emerge’ (Becker 1982/2008: xi). Instead, as Becker astutely observes, ‘[t]opics and problems do not “emerge” […] – we “emerge them”, invent them as a result of what we learn once we begin our work’ (Becker 1982/2008: xi). This implies a movement in and out of a research environment, of collecting data and attempting to theorise it, going back to the field again, returning, theorising. Charmaz (2006: 3) describes the process in the following way: ‘We raise questions that emanate from thinking about our collected data and shape those data we wish to obtain’. A later development of the grounded-theory approach sought to further
append the recognition of partial knowledge, multiple perspectives, uncertainties and variation in the empirical experience and the resulting theories (Bryant and Charmaz, 2011).

My choice to adopt such an approach situates my research in the social constructivist tradition. My fieldwork observations, data and analysis are a product of my own constructed efforts and interpretations of a social reality. They have been affected by my own initial assumptions about these practices, for which I account further down, and which evolved as my knowledge and postgraduate education progressed.

My initial research strategy was to map different free software projects for the production of computer graphics and the collectives behind them. As a result of this initial mapping, I was able to establish a preliminary, conditional differentiation of distinct clusters of such projects, with seemingly different approaches and goals for their stages of development. From there, I noticed that some of them were explicitly aimed at making free software for industrial computer graphics production to be used by others, while other projects had more artistic, exploratory goals. The results of this mapping underpin the distinction between the different clusters of free software projects for computer graphics development that I make in the Introduction. This preliminary mapping was helpful in narrowing down the scope of data, and it led me to new questions.

If I had taken a specific software project as my point of entry for further data collection, I would have had to account for the fact that the work of creating complex software that makes it possible to create computer graphics media cannot be done by one person or solely in one location. Therefore, I was unsure how I could empirically study any software program while it was being developed. Would I need to focus on practices of code writing, and if so, how?

Second, creators of computer graphics media today are generally dispersed around the world. They create media either alone, in small collectives or in specialised studios in different locations around the globe. Even if I could identify active users and developers of the narrow set of software projects that I discovered, it was less obvious how to deal with the geographical distribution of media creators and the temporal aspect of technological development, i.e. any technology takes time to develop despite discourses of rapid change.
A case study approach

In order to tackle these challenges, I chose a case study approach in order to have an in-depth focus rather than a broad one. My choice of case studies was partially influenced by earlier encounters with specific free software in development, and it shaped some initial assumptions and expectations towards my data. I will briefly account for them as I present the cases.

Around 2007, there emerged an increasing number of studies and greater enthusiasm about practices of free software development as a form of activism and supposedly as a means of disrupting capitalist modes of production, which resulted in some of the key writings on hacker practices of technological development and free software (Benkler, 2006; Coleman, 2013; Ghosh, 2005; Himanen, 2001; Kelty, 2008; Söderberg, 2012; Weber, 2004).

I was intrigued by this enthusiasm in part due to the scholarly writings on the topic and because, since 2000, I had been closely involved in several projects being carried out by a free-software community of hackers in South-eastern Europe.

As part of my involvement in such projects, I had stumbled upon a number of enthusiastic digital artists in Bulgaria who started studying and using one – new at the time – free software program for 3D computer graphics and animation called Blender. Their interest in the program was provoked by the online release of the ‘first open movie’ in 2007, a 3D animated short called Elephant’s Dream that was developed with this program by a Dutch animation studio called the Blender Institute. With high production values for its time, the film served as a demo of what the software could do. The film was also ‘open’ in the sense that its creators shared the software, graphic assets and documentation about the film online, as well as the software under an open licence. According to the Blender Institute, its goal in making this film was not so much to encourage participatory culture but to stimulate the development of the free Blender software for 3D animation.

The enthusiasm of the computer graphics artists around me at that time stemmed from the potential they saw in the software. It came at no cost and offered the promise of providing high production values and a great degree of control over the computer animation production process. There was also scepticism, however. At that time, there were no other free-software projects for computer graphics animation, and nobody knew whether this one would survive. Five years later, however, I stumbled upon Big Buck
Bunny (Figure 2.1), Sintel and Tears of Steel (Figure 2.2), the second, third and fourth open movies developed by the Blender Institute.

They still had technology production as their main focus, as evident from the following excerpt from the website for the film Big Buck Bunny:

Figure 2.1: Big Buck Bunny by the Blender Institute (2008), (c) copyright 2008, Blender Foundation | www.bigbuckbunny.org

Figure 2.2: Tears of Steel by the Blender Institute (2012); (CC) Blender Foundation | mango.blender.org

This Open movie project had as [its] main targets:

- Developing tools in Blender for editing and rendering hair, fur or grass,
- [Improving] character animation tools for cartoonish motion and deformation,
- [Testing] Blender with giant outdoor environments, with large grassy fields and many trees with leaves,
- Further [validating] Blender as a professional animation creation suite.
I found the entanglement of open cultural production – of making open films – with the development of the free Blender software particularly intriguing. They hinted that two different phenomena – ideas about open software production from the free-software movement and ideas about free culture developed by the modulation of the free-software movement, ‘free culture’ – were converging in these practices. They simultaneously provided a suitable case through which I could address my aims.

In effect, I became interested in learning about the ways in which this entanglement of two different streams of ideas from ‘openness’ movements were helpful for developing software for the production of computer graphics. How was it realised in practice, and how did the media practitioners involved in it make sense of it? How could one make or improve software by making open films? The production of open movies by the Blender Institute and through them the production of software therefore became one of my case studies.

As a second case study, I chose the work of a collective of anime fans in the city of Gorno-Altaysk in southern Siberia, Russia. This collective was trying to develop a software called Synfig, for 2D animation. Using the name Morevna project, it presented itself online as:

an independent initiative aimed at testing and improving open-source tools by adopting them in real animation production. As part of [these] activities we [are] documenting the developed workflows and approaches to help others learn from our practices and publishing [the] results of production as free content. (Morevna project, 2016)

My goal in choosing this second case was to provide a base of comparison in terms of differences in practices involved in the production of free software for computer graphics media in different local contexts. With one case from Russia and one from the Netherlands, I could have a broader, non-US-centred and partially non-Western-centric discussion of digital media production and account for some of the different conditions and contexts surrounding the creation of digital media that contemporary media creators face. In production contexts like Russia, for example, there is generally a high degree of software piracy that conditions the workings of creators of digital media in specific ways. They also represent a different, political, economic and cultural context, and not least, a different infrastructural context in terms of availability and speed of Internet, as well as
access to specific hardware and software. My choice of a Russian-based case prompted further questions, such as what meaning free software for media production can gain when developed and used in a culture of piracy.

Reflection on the choice of cases

I could, of course, have chosen other cases. Besides my previous knowledge about the existence of one of them – the work of the Blender Institute and the Blender software – one specific reason to focus on these two were their longevity.

At the beginning of my research in 2012, making open movies in order to develop alternatives to industrially developed software for computer graphics animation appeared to be gaining in popularity. I found a vast array of projects online for open movies that presented themselves in similar ways. There were several in Finland, for example, that were developing free rendering engines for computer animation. Others, like the US-based Tube project, were aimed at developing free software tools for distributed production of complex animated films through attempting to make one such, Wires for Empathy (Figure 2.3).

Figure 2.3: Wires for Empathy by Urchn Studio, part of Tube project (in production since 2013). CC-BY-SA.

A third kind worked to create open movies in order to extend the Blender software, as in the case of the Russian-based collective from Perm, Lampibata. A variety of other projects could be found in France, India, Iran and Russia, among other places. Judging by their online presentations, they seemed to share a spirit of participatory culture, while being profoundly concerned with engaging in making, learning or testing software for the production of computer graphics animation.
Initially, I considered adding more such cases. I tried with some, but it proved difficult to get in touch with the producers of Tube; I learned too late about the production of Lampibata; and while I was considering the feasibility of taking an Iranian case, the project was suspended and its website taken down. Therefore, the two cases that I outlined remained my central focus. Even though this may have been limiting, they involved practices that had existed long enough as to provide some rich material. They had also managed over a decade to establish some communities of practice (Lave and Wenger, 1991) around the software that they had been developing.

Blender, and to a more limited degree Synfig, had managed to actually penetrate the practices of a broader range of users, ranging from professionals to beginner computer graphics animation artists. Even though hard to measure in numbers, Blender has to date the largest user community and most mature software in the category of non-proprietary software for making professional computer graphics and animation. Oriented towards individual 3D graphics creators and small studios, it is easy to find online hundreds of examples of commercial and free culture animation projects, interior design and computer game resources created with it.¹

Not least, Blender is explicitly presented as a project developed through the contributions of many kinds of media practitioners:

Blender is being made by hundreds of contributors from around the world; by studios and individual artists, professionals and hobbyists, scientists and students, VFX experts and animators, and so on. All of them are united by the desire to have access to a fully free/open source 3D creation pipeline. (Blender, 2017)

With a much smaller user base, Synfig has also been gaining in popularity among freelance creators of 2D animation. More important in my considerations of this, however, were the practices of the Russian collective behind it, which provided possibilities for discussing the technological practices of media creators in non-Western contexts.

¹ For examples of some of these projects, see Blender Conference (2016).
Empirical material

Two open film projects

My choice of the two cases further directed my analysis of the entanglement of open film and cultural production with open technology production. Using the practices of making open-source animated films became a central focal point to see how making such films was entangled with the development of software.

Two such films became the focal point of my research. The first was a 3D animated short called *Cosmos Laundromat* (Figure 2.4), produced in 2014–2015 as part of a project called Gooseberry by the Dutch animation studio the Blender Institute. The second was a 2D animated short called *The Beautiful Queen Marya Morevna* (Figure 2.5), which was part of the Morevna project in Siberia, Russia. Production of the latter film began in 2007, and I engaged with it on several occasions between 2012 and 2016.

Both film projects had the initial ambition of being feature-length productions; neither succeeded in achieving this, and both ended up being animated shorts with a runtime of around 12–16 minutes. They both succeeded, however, in making substantial software improvements to Blender and Synfig.

The two cases differed significantly from one another, even though they appeared similar on the surface. The Blender Institute was a formal organisation and a small animation studio registered since 2007 in Amsterdam. For its open-movie projects, it employed professionals who had worked on large productions in global media industries, including the US Pixar, the Finnish Rovio (the company producing Angry Birds) and the Australian LEGO movie productions.
Figure 2.4: *Cosmos Laundromat* by the Blender Institute (2015). (CC) Blender Foundation | gooseberry.blender.org
The Morevna project, which has also existed since 2007, was instead a loosely organised collective led by one self-taught animator in the city of Gorno-Altaysk in southern Siberia, Russia. The project consisted of volunteers and local self-taught artists who would show up for some time and then drop out of the project.

The different degrees of professionalisation of these cases, their different geographical anchoring and, at the same time, their apparent similarity in terms of their goals, concerns and approaches to free software development provided fruitful ground to get an in-depth understanding of the mechanisms through which free software for computer graphics animation was being developed and how it was reconciling or creating tensions among different interests, practices and production needs.

These film projects narrowed down my research context by limiting my exploration of these issues to practices of the production of actual media content rather than through programming and studying programmers. That said, my focus was not on film production as such, but on the ways in which their production gets entangled with the making of software for computer graphics animation.

The people

Having narrowed down my material to the work of the Blender Institute and the Morevna project involved in two instances of free software for the
production of computer graphics animation – Blender and Synfig – and related practices of open film production, this led to my encounter with different media practitioners who were involved in various ways in these productions.

The participants in the film productions were mostly white, male and represented what could be termed, following Banks (2010b), the ‘artistic labour’ part of media production. In short, these are the individuals who, in industrial contexts, would be responsible, in different roles, for realising the aesthetic vision of a media product. I met with and interviewed, to a more limited extent, the craft labour, or programmers, involved in both productions, as well as key software developers in the Blender and Synfig software projects.

Part of the reason was that there were far more of the former than the latter in the case studies that I had chosen. For example, the Cosmos Laundromat core production team consisted of 25 individuals, including eight programmers. Only three of the latter were involved in the film production project on a more or less regular basis, while the rest worked on improving general features in Blender such as stereoscopic animation support and the organisation of production pipelines. Notably, most of the developers were former artists who had requalified as programmers. Most of the participants in Cosmos Laundromat were freelancers who otherwise worked on the creation of computer graphics models, animations and advertisements in different parts of the digital visual media industries in Europe, the United States and Australia.

The Morevna project had, at the time of my research, six more-permanent participants, while others joined and left the production at various times. The more-permanent members included one Synfig programmer, one project leader, and five Synfig users, of which one animator, one digital painter and three students of animation. Most of them were locals, but participants from other countries occasionally joined online for short-term tasks. The Morevna project was also integrated in the activities of a local folk arts and crafts school for extracurricular education. The main local participants involved in the project came from this school.

In general, the participants in both case studies were young or middle-aged and male (although in the Morevna project the artists were mostly female). The gender dimension also deserves some attention.

Generally, computer graphics media production is dominated by relatively young, white men. This male domination has been noted in writings that concern work in the media industries generally (e.g. Deuze et al., 2007;
Dovey and Kennedy, 2006; Gill, 2013; Kennedy, 2012), but also through controversies such as Gamergate that have led to academic discussions about masculine ‘toxic technocultures’ (Massanari, 2017).

Similarly, the use and development of free software for computer graphics are highly masculine environments. This means that my research took place in a highly gendered context. While I did not experience any ‘toxic’ behaviour directed towards me, occasional sexist jokes or opinions about the professional roles that were ‘most appropriate’ for women in producing computer graphics within a project were also made by male project participants who otherwise openly admitted that they wanted more women to be part of their community. As one of the few women and rare researchers in this context, my presence often provoked curiosity and scepticism among them, and kept a certain degree of distance between us. To be a researcher in such a specialised domain was even more challenging because of the high degree of technicity of this domain of practice. The production of software for computer animation and films with it is a highly technical specialty, with terminology often adapted to that of the software that the practitioners use. This implied that I had to learn, at least to a limited degree, the terminology used in this field of technocultural practice, similar to how ethnographers are usually expected to learn a new language as part of their research.

These experiences shaped the knowledge generated by this research. From an epistemological point of view, no knowledge is neutral – it is always situated and embodied (Haraway, 1988). Even though I aimed to develop more general conclusions, my account is shaped by my gendered experience and suffers from the degree of distance that remained between me and my informants. It also reproduces to some extent the views and practices of a masculine culture that stems from the structural dominance of men in the practices that I examined.

Even though I interviewed formally or informally all female and some transgender users of Blender and Synfig whom I met in the course of this research, making sure that their voices and experiences are also present in the empirical analysis in this dissertation, most of the material reflects white, masculine perspectives on free software for computer graphics. It makes this research part of the broader process of the reproduction of knowledge generated by white, male cultures and is a shortcoming that should have been addressed by, for example, adding a greater gender emphasis in the papers and analysis in this dissertation. Regrettably, I have only scratched the surface of this topic in Paper 3 in a rather limited way.
The gender dimension of the entire field of the production of computer graphics therefore remains an area that needs as much attention in research into digital media production and participatory cultures as in more conventional production studies of media.

Data collection and analysis

Ethnography

After choosing my cases, my aim was to see films and software in the making. I wanted to capture negotiations, decisions and choices being made in relation to actual production practices, as well as the reasoning and experiences of the participants. Therefore, I chose ethnography as a primary method that included participant observation, shadowing, qualitative interviews and the collection of various documents, notes and other material.

Ethnography is about the study of people’s actions and accounts in everyday contexts (Hammersley and Atkinson, 2007). Its aim is to create a ‘thick description’ (Geertz, 1973) of people’s actions as they acquire meaning in situated contexts. As the production of open films appeared to be central to the making of Blender and Synfig, I found it important to get closer to the production contexts in which these films were made. The Blender Institute, as a more formal organisation and animation studio, had a clear start and end to its film projects, which had the goal of introducing major improvements in the Blender software. The Morevna project was much more loosely structured and mundane, and in it, film and technology production had become part of the everyday. This posed challenges to an ethnographic approach, which I account for below.

My ethnographic approach is closer to what some media researchers have termed media ethnography or media anthropology (Bolin, 1998; Drotner, 1994; Rothenbuhler and Coman, 2005). This means that the fieldwork and ethnographic enquiry are more narrowly focused on the media-related practices and experiences of people rather than their lifeworlds. Unlike many media researchers who have turned to different versions of online, virtual ethnography or netnography (Bengtsson, 2014; Hine, 2011; Markham, 2013; Markham and Baym, 2009), I aimed to find actual, physical sites in which I could do fieldwork. The reason was my belief in the value of a physical presence for understanding digital media production in its local contexts, of which the online is one part only.
Participant observation in Amsterdam

One important part of my fieldwork included participant observation in Amsterdam at the Blender Institute studio. The production of the film *Cosmos Laundromat* took place in Amsterdam from August 2014 to September 2015. The film’s producer, Ton Roosendaal, had gathered there a team of ‘the best artists from all over the world with the best developers from the open source community’[^2], all of whom were Blender users.

Gaining access can be a difficult and time-consuming process. It took me five months to be granted permission to be a participant observer during the production of *Cosmos Laundromat*, which was surprising in light of the openness articulated online by the Blender Institute. As Hammersley and Atkinson (2007: 41) note, however,

> the discovery of obstacles to access, and perhaps of effective means of overcoming them, itself provides insights into the social organization of the setting or the orientations of the people being researched.

[^2]: The quote is a citation from an advertising teaser that preceded the making of *Cosmos Laundromat* and was aimed at raising funds for the film’s production. Available on the Blender Institute’s official YouTube channel at [https://www.youtube.com/watch?v=XfezG5M2ICg](https://www.youtube.com/watch?v=XfezG5M2ICg), accessed 25 April 2017.

It gave me an insight into my own position as an outsider in this production context and into the implicit scepticism towards researchers in this field. Nevertheless, I was granted access on condition of reciprocity, which I explain in a dedicated section below.

I conducted participant observation in Amsterdam on four occasions, which represented four stages of the production of Cosmos Laundromat: in August and December 2014, and again in February and May 2015. The duration of each field visit lasted between four and ten days. It could be argued that such a short amount of time is insufficient to gain in-depth knowledge of a production practice, and it is true that if this were the only data I had gathered, it would have been insufficient. My participant observation was important, however, to gain knowledge and material about three aspects: to get a sense of the ways in which software production was integrated into the development of the film; to get examples of how the shaping of free software happens in practice; and to get access to individuals it would be valuable to talk to in the broader Blender community of users.

This fieldwork brought to my attention the ways in which crashes in the Blender software during the everyday production of *Cosmos Laundromat*
could be fixed quickly by several programmers on-site; the ways in which artists were encouraged to complain about missing functionality in the Blender software and work with software developers to add it; and how the script for the film purposefully incorporated technical challenges that pushed the need for the development of complex functionality. For example, since the initial aim of *Cosmos Laundromat* was to improve the system for hair simulation in Blender, the film script was developed to include scenes that unfolded in an environment full of moving grass, and the main protagonist became a sheep that was part of a flock, all of which were very woolly. Then, the task of the developers at the Blender Institute was to develop and integrate new algorithms in the software that would make it technically possible to achieve these specific artistic requirements.

Whereas these examples are not a prominent part of the papers in this dissertation, they shaped my thinking and knowledge about the relationship between media producers, software and software developers as a central problem of the politics of digital media production software today. My observations revealed the power of the user of technology in shaping it to their own needs, as a tool of practice in which problems emerge and are solved in a craft-like rhythm (see Chapters 3 and 4 for a longer discussion of this aspect).

Being a participant observer physically present in an open office landscape in Amsterdam also revealed some of the challenges in the ethnography of contemporary digital work and creative practices. In his book *The Soul at Work*, the Italian autonomist Francesco ‘Bifo’ Berardi (2009: 74) sums up the physical manifestation of contemporary work in the following way:

> Today, what does it mean to work? As a general tendency, work is performed according to the same physical patterns: we all sit in front of a screen and move our fingers across a keyboard. We type.

Rather than typing, what I most often saw at the Blender Institute were people frenetically clicking and moving objects between two or three screens. Usually, this work was done in silence, the result of everybody using headphones, and was interrupted only for lunch or for a meeting.

The question of what exactly I was observing troubled me until I was introduced to the ‘secret channel of the production’, as one of my informants called it. This was an IRC channel in which all team members held an ongoing discussion regardless of whether they were sitting in the room next to one another or not. This preference for mediated, rather than
direct, communication offered an excellent complement to my participant observation that added substance to it and extended it spatially and temporally beyond my immediate presence in Amsterdam. It was like turning on the sound of a movie and becoming part of it.

If I was in the Amsterdam office, I could pose questions to team members both on IRC and face to face in order to clarify situations that I was overhearing but could not fully understand or just to observe discussions of problems as they arose. For example, I once overheard a conversation between a developer and an artist who was working on virtual lighting. They were orally discussing a problem with Blender that concerned the ‘colouring [of] nodes’ and that a new feature in Blender was needed. After that, I could ask for an extended explanation of the process that I had just observed and how it was to be organised, as in the example below, an excerpt from an IRC chat:

<julia> hey, where would you request this feature that you just spoke about to campbell? do you do it here in irc? or is there a website or something?

<artist> hey! there are a few places where this happens. Usually the discussion would start on IRC as an idea or in the forums (blenderartists.org). If it gets enough attention then they make a ‘design task’ on our developers’ platform, developer.blender.org, where the real discussion happens between developers and artists. For this feature in particular, this is the thread: https://developer.blender.org/D458

(fieldwork notes, 2014)

These kinds of clarifications were helpful in uncovering the links between the multiple online contexts and websites surrounding the broader, geographically dispersed Blender user community, and the actual film and technology production practice taking place at the Blender Institute. They also highlighted tensions and modes of the development of the software in relation to envisioning missing technical features in the film projects:

<artist> Developers are artists too, they get excited about new stuff, they get bored too. Their time is so valuable that whatever is going to be coded, it should have been thought through and designed properly. It needs to fit in the rest of Blender, otherwise it will just end up as a half-finished feature that maybe doesn’t even make it to the final Blender. Since we use our own version of Blender, the ‘danger’ of too experimental features not making it to a future Blender release is bigger than usual.
Ah, right, have not thought about that. Hm. So, who is the final judge for what makes it to the final version? Campbell and Sergey?

Mainly module owners. Blender is split in modules. Animation module, render module, interface module, game module, and so on. Each module has owners, people that really know the area and can take decisions. On top of that is Ton, who has the big picture and the vision [of] how and in which direction Blender should go.

Right!

Here’s a (bit outdated) module owners list http://wiki.blender.org/index.php/Dev:Doc/Process/Module_Owners/List

Oh, thanks!! Most people have been at the Institute, familiar names. Cool!

yep! We’re all a big family :)

My participant observation therefore stretched across multiple online and offline contexts, some of which were more private, out of sight and inaccessible than others, and that continued online even when I was not present in Amsterdam. It was ‘multi-sited’ (Marcus, 1995) and included a process of ‘tracing the changing nature, and use of things in different contexts’ (Marcus, 1995: 105–108), which allowed me to make interpretative links between the practices of Blender development across temporal and spatial contexts. This involved tracing documents and relevant data in both online and offline settings, performing face-to-face and Internet-mediated qualitative interviews and conducting participant observation in online settings and in situ.

Shadowing in Gorno-Altaysk, Siberia

This fieldwork site was very different from the one in Amsterdam. My participant observation in Gorno-Altaysk, where the Morevna project was located, was more limited but still crucial for developing an understanding of the local context, efforts and modes in which free, user-driven software and infrastructures for computer graphics animation emerge.

My fieldwork in Gorno-Altaysk lasted two weeks in November 2014 and was based on ‘shadowing’ (Czarniawska, 2007; McDonald, 2005; Vásquez et
al., 2012) one person, the Morevna project leader. I had established access to this site through intense Skype communication with the project leader.

Shadowing is a technique in which the researcher closely follows a member of an organisation over an extended period of time. In organisational contexts, this could mean selecting a key individual and following them in meetings, at lunches and during work activities, being present at all times from the start of the working day until the moment they leave for home (McDonald, 2005).

As McDonald (2005: 456) writes:

> Shadowing can include hours of stationary observation while the person being shadowed writes at his or her desk, running between buildings for a series of meetings or attending dinners held for clients. Shadowing activity will be as various and complex as the job of the individual the shadower is investigating.

The value of shadowing is primarily in the level of detail and richness of data that can be obtained through this process. The approach relies not only on the individuals' accounts of their role and actions in an organisation, but these can be viewed directly, giving the researcher access to that which is both trivial and more difficult to articulate (McDonald, 2005). Shadowing also makes it possible to examine individuals and their role in creating an organisation in a holistic way that solicits not just their opinions or behaviour but both concurrently (ibid).

The Morevna project had a rather unstructured organisation and no office. I shadowed its leader from the time of my arrival in Novosibirsk, where I was met by him and accompanied to Gorno-Altaysk where he lived and worked, to the moment of my departure from there. During this period, I spent many hours in stationary observation, observing him working with Synfig, Blender, Krita and Ardour, sometimes for a private client, sometimes for Morevna, at his home and at a folk school for extracurricular education for schoolchildren in Gorno-Altaysk.

This form of participant observation was crucial for my understanding of Morevna as a project for infrastructural repair (which I discuss in Paper 3). It provided me with an important hidden context and encounters with individuals who would have been difficult to talk to or to connect with through other forms of qualitative enquiry.
Qualitative interviews

The accounts provided by individuals about their actions is an important part of an ethnographic approach. During my fieldwork in Amsterdam and Gorno-Altaysk, I interviewed media practitioners and programmers. In the table below (Table 2.1), I provide an overview of these interviews. For most of my informants, the work on *Cosmos Laundromat* or the Morevna project was one of many freelance jobs or volunteer activities they were engaged in between jobs for other animation studios, advertising agencies and broadcasters. In this sense, they were at the intersection between the sphere of open cultural and technological production and media industries. This intersection is the subject of Paper 1.

Table 2.1: Overview of the informants who were interviewed

<table>
<thead>
<tr>
<th>Programmers</th>
<th>Artists</th>
<th>Other</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of interviewees involved in Cosmos Laundromat and Blender development</td>
<td>4</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Number of interviewees involved in Morevna project and Synfig development</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Number of interviewees involved in other free software projects or Blender and Synfig users and developers not affiliated with the film projects</td>
<td>5</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>37</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There has long been a debate in social science research about what value to give to people’s interpretations of their own actions or ways of thinking. Positivist streams of thought reject subjective, common-sense accounts, whereas naturalists would consider the same as constitutive of social reality. I share a middle-ground approach in line with Hammersley and Atkinson...
(2007: 97–98), who read interview material as informative of the phenomena we are engaging with and as a valuable source for discussing the perspectives that such material implies.

I conducted qualitative interviews between 2012 and 2016. The distinction between artists and programmers that I establish in the table above reflects the interviewees’ own way of describing themselves in terms of their role in the open film productions or in software development. The term ‘artist’ therefore has a rather broad meaning here and reflects the work of individuals in creating parts of the aesthetic vision of a film rather than writing the source code of the software that underpins it. That said, some of the artists also occasionally wrote software code, and some programmers participated in forming the aesthetic vision, characters or other visual elements of the films. The distinction is therefore highly conditional and not very precise. It primarily reflects, as noted earlier, an internal division between art and craft labour as conceived by the interviewees themselves.

The informants in the category ‘Others’ include the software managers and film producers of the two open films; two animators who were not involved in free software but who provided important contextual information about computer graphics media production in Russia; and one interview with the co-founder of Autodesk Corporation, Kern Sibbald, who also provided valuable contextual information.

The number 37 in the table above reflects the number of informants who were formally interviewed and not the number of interviews. There were some informants whom I interviewed multiple times, continuously and over a longer period of time, in particular the producers of Cosmos Laundromat and of the Morevna project, as well as some key individuals involved in the development of Blender and Synfig.

In most cases, the interviews were oral, unstructured and face to face, often in the formal setting of a work situation. In certain cases, I turned to mediated interviews through Skype, Google Talk or IRC chat with certain informants. This was the case when informants were not in the same location and it was most pragmatic and more important simply to speak with them rather than insist on a face-to-face meeting.

The interviews that were mediated by software had the specific advantage of allowing more ad hoc interviews to be conducted when there was a need for more information or to find more informants, as they
required less planning.\textsuperscript{3} In many cases, they also created a less formal interview situation that helped overcome the otherwise formal situation of recording an interview.

Generally, all interviews were individual with the exception of one that took the form of a focus group. The focus group involved four schoolgirls who were attending animation classes using free software and led by the producer of the Morevna project. This particular interview did not become part of my empirical material, but was helpful as contextual information.

Most of the interviews lasted for about an hour and had a similar focus. Topics that I prompted my informants to describe and reflect upon included their experiences and encounters with free software for computer graphics, the extent to which they engaged with its development or shaping and the ways in which they did so, and the role and value they attributed to it in their work practice. I also asked about how they ended up being part of open animated films, or when they were not involved in them, the practices and contexts in which they used and shaped free software for computer graphics. As the interview progressed, I asked more specific questions that emerged within the context of the interview.

In rare cases, the informants were not comfortable with me recording the conversation, in which case I just took notes.

The processes of collecting data and interpreting it occur in ethnography and in the grounded-theory approach simultaneously. As Charmaz (2006: 11) observes, ‘As we learn how our research participants make sense of their experiences, we begin to make analytic sense of their meanings and actions’. This is a challenging process, but it leads to the emergence of categories of analysis and the development of theory.

After recording the interviews, I transcribed them, in most cases in their entirety, but in some cases only partially, deriving the parts that I considered most important for the analysis. In the case of researching the Morevna project, I did the bulk of interviews in Russian. All of them were transcribed but not translated. Instead, I chose to translate into English only those transcribed passages that were included in the analysis.

I used the software MaxQDA initially to code the interviews and identify common patterns and nuances. Coding in grounded theory means that we attach labels to segments of data and organise it according to semantic principles. Charmaz (2006: 3) clarifies: ‘Coding distills data, sorts them, and

\textsuperscript{3} Although this does not mean that it required less preparation in terms of what questions to be posed, in what order, etc.
gives us a handle for making comparisons with other segments of data’. Coding is both a process of separation from the empirical setting and an emotional attachment back to it (Star, 2011: 83). As data collection progresses, coding and more data form a cycle: ‘the researcher returns often to the data, compares it, codes it, a process that is both a detachment, a reinvocation of the research and the emotional situation of the context in which the data was collected’ (Star, 2011: 81).

This process shaped the central topics of analysis in the papers and my overall understanding of the experiences, practices and politics of computer graphics media practitioners as media-related infrastructuring practices (I develop more on this in Chapter 4).

Reciprocal communication

In the process of negotiating access to the two open film productions, I was asked by my informants to reciprocate access by making my research in progress public. To the extent that this condition was part of the negotiation of power between me as a researcher and my informants, I considered it important to try to comply with it. I therefore started a blog at phd.nordkonst.org, where I posted short reports from my field visits, writings in progress and the final drafts of my research papers. In addition, two of the research papers (Paper 2 and Paper 5) were published in open-access journals.

As a rule, I made a habit of sending drafts of the papers that I was writing to key informants for fact-checking and potential issues with my interpretation and representation of them. This form of communication is rather common and valuable in ethnographic research. It functions as an additional adjustment of power between the researcher and the informant and makes it possible to achieve greater symmetry and reciprocity between the two.

This adjustment in power also encompassed my presence in the studio in Amsterdam or research context in Gorno-Altaysk. My presence in Amsterdam was documented and put online as part of the ongoing film production and software development blog, on Twitter and Facebook, and in streamed videos of reports of my weekly progress. In this way, I was not just a participant observer but also a participant who was shaping the discourse and a subject in the communication and documentation generated about the film, creating a form of reciprocal communication.

4 I have presented and analysed these reports in greater detail in Paper 2.
When I was taking photos of my informants, they also took photos of me and published them on the film production blogs. As I was writing about them, they were also writing about me (Figure 2.6).

Figure 2.6: Excerpt from the production blog of *Cosmos Laundromat*, http://gooseberry.blender.org, announcing my arrival (2014).

I was sometimes treated almost like an employee who was part of the film productions. At such moments, it was crucial to detach myself from the empirical context and step back in order to retain my ability to be critical in my role as a researcher.

**Ethical considerations**

Any research involving people requires ethical considerations. These imply respect for, and communication with, informants after receiving their informed consent, as well as avoiding potential harm to them by protecting their identity through anonymity.

I started all my fieldwork interviews by clarifying my purposes and requesting informed, oral consent from the interviewee. As stated above, I also sent many of my informants’ texts in progress, which gave them an opportunity to disagree with my interpretation, and we could then have a continued discussion.

I have only partially anonymised the material, and I have used material in both anonymous and named form in the papers. The work of most of my informants was so public that it would have been impossible to hide their identity. Moreover, my informants insisted in many cases on being named. I have anonymised the references to my informants’ words in the papers.
when I have addressed potentially controversial or harmful topics that could have an impact on an informant’s relations with others in a community, but in other cases, when I judged that it would be of little significance, I have used their real names.

Despite careful planning, unexpected possibilities for interviewing may arise. Such moments could represent a challenge when they happen to involve vulnerable groups, such as children. In the context of collecting data about the Morevna project, I met, on two occasions, with a group of teenagers aged 14–16 with whom I discussed their interest in animation and ways in which they used free software for computer graphics. I obtained consent to interview the teenagers during a focus group interview with them and with their teacher, the Morevna project’s leader. The interview took place in his presence, and he occasionally intervened in the conversation, clarifying topics, contexts or jargon that were difficult for me to comprehend. This material has been anonymised, and I have used it as context, to better understand the context of fringe Russian media production, but it is not a prominent part of the articles.
CHAPTE R 3

Context: the role of software in media production

After having presented my empirical material and research strategy in the previous chapter, in this chapter I contextualise the role that media authoring software plays in digital media production. The first section of the chapter contextualises it in relation to industrial media production, while the second section does so more broadly and in relation to individual creative practice.

Culture today is produced and consumed through technology, with the means of cultural production, now largely software, increasing in complexity (Bolin, 2012a). In order to understand the practices and politics of media practitioners who engage in creating, integrating and making sense of free software for making computer graphics media, I wish first to contextualise the role that software plays in contemporary digital production cultures engaged in audiovisual media creation. This role can be seen as spanning across a complex set of overlapping and sometimes conflicting interests and cultures of distinct media industries, technological manufacturers and individual users and producers of media.

As a point of departure, I view software as a new production tool (Caldwell, 2008) for making digital media that oscillates between being ‘a force and sometimes a tool’ (Mackenzie, 2006: 21). As a force, contemporary media authoring software has transformed the aesthetics and practices of graphic design, motion graphics, animation and cinema, among others (Manovich, 2013). Throughout the 1990s, it permeated all areas of professional media production, remediating and aggregating ‘all individual techniques and tools that were previously unique to different media … within the same media environment’ (Manovich, 2013: 45). These transformations have, as Manovich argues, disrupted the landscape of media technologies, the creative professions that use them and media itself.

Media authoring software has destabilised both the borders of media genres and the ‘fundamental techniques, working methods, and ways of representation and expression’ (Manovich, 2013: 46). It has been argued that the distinguishing characteristics of a particular medium have become
dependent on the software applications that are used for their authoring and access rather than on general conventions of genre (Manovich, 2013: 47). Contrary to this argument, we can also see that despite this reconfiguration, media production across industries such as television, film and broadcast media or computer games have retained their genre-based distinctions and economic models of value creation, adapting to software-based production rather than transforming the genre conventions (Hesmondhalgh, 2013). In the next two sections, I briefly outline some areas of tension in relation to media authoring software for computer graphics creation in the context of industrial media production and at the level of individual creative practice.

Media authoring software and industrial media production

Media authoring software has been an important force and, at the same time, a new production tool that has underpinned processes involved in the reconfiguration of labour and the transition to the computer-based production of content in the media industries. Since the early 1990s, proprietary programs developed by the software industry have been rapidly replacing most of the mechanical tools and parts of manual work used for the creation of symbolic, cultural goods to be circulated in global media markets (Hesmondhalgh, 2013: 311–313; Sito, 2013). With software for graphic design and motion graphics proliferating in the 1990s, the large media industries such as Hollywood film production studios, television broadcasters and advertising industries began digitising their technological frameworks and reorienting their content production towards computer-produced media.

New hardware, computer workstations for graphics manipulation and software were instrumental for many broadcasting and film production companies to raise production values and make more appealing content for audiences (Caldwell, 2008: 150ff). As digital culture moved towards new computer aesthetics, digital immediacy and remediation of media (Bolter and Grusin, 1999/2003; Turkle, 1984/2005), the media industries adapted their products to match the new expectations of potential audiences.

Initially, the high cost of new hardware and software for digital media production were a substantial barrier that shaped the pace of digitisation of content production in the media industries. Manovich (2013: 50) brings up, for example, how in the mid-1990s, systems for the production of computer graphics, a Silicon Graphics workstation and software, would cost nearly
half a million US dollars and would therefore be used only by large television and film studios, as well as video effects companies. With the exception of the computer games industry, which is a cultural industry that emerged from digitalisation rather than being affected from it (Hesmondhalgh, 2013:258), for most media industries the gradual transition to software-based production implied major reconfigurations.

New production tools can come to represent ‘heightened moments of institutional realignment and opportunities for industrial advantage’ that tend to ‘upset labor relations, corporate alignments, and aesthetic practices’ (Caldwell, 2008: 154). The work of Tom Sito (2013) on the history of computer animation provides a telling example. He outlines how significant layoffs took place in the Hollywood animation production industry after Pixar succeeded in capturing audiences with its entirely computer-generated feature-length films at the end of the 1990s. Sito discusses how other studios in Hollywood swiftly moved to adopt technologies for computer graphics animation while simultaneously laying off nearly all their artistic labour, as their animators were not skilled in the production of computer graphics animation: ‘Starting in 2003 the Walt Disney Company had begun to eliminate most of the traditional animation crew trained by the golden age masters, as simply as one would dump an old typewriter in the attic’ (Sito, 2013: 265).

Such layoffs represent both moments of rationalisation on the part of industrial frameworks for media production and processes of reorientation towards new cultural formations, such as new genres of remediated digital media, computer-generated imagery and new media driven by computer cultures. The parallel entrance of new communication technologies, such as the Internet, have further aided such reorganisations of labour. Production frameworks have been fragmentised and made increasingly reliant on the outsourcing of labour (Christopherson, 2008; Gill, 2007; Hesmondhalgh, 2006; Huws, 2014; Miller, 2005). These transformations have led to the proliferation of freelancers and small production studios, and to the preoccupation of a range of scholars of media work with conditions of good, bad and exploited labour in relation to these creative workers (e.g. Banks et al., 2014; Banks and Deuze, 2009; Deuze, 2007; Hesmondhalgh and Baker, 2010; Ross, 2003/2004; van Dijck, 2009). Therefore, media authoring software has been part of, and a force in, the broader restructuring of media production practices that came with digitisation and that coincided with a general restructuring of the spirit of capitalism (Boltanski and Chiapello, 2007), according to which new ideals of productivity, autonomy and
creativity replaced old ones. As part of this restructuring, there has been a gradual transfer of responsibility over the acquisition of appropriate media production tools and skills to parts of the new creative labour: freelancers, subcontractors and small studios engaged in the creation of audiovisual media (Deuze, 2007; Huws, 2014).

If large industrial media production studios still provide software and hardware for creative workers within specific production environments and projects, freelancers and outsourced labour have been put in a position to acquire their own suitable technologies to be used in their work for each project. Even though such a transfer of – to a large extent economic – responsibility takes place at a very specific level of labour organisation, it represents one area of tension in which media practitioners are confronted with the affordances, politics of access and distribution of software that their work depends on, and that could enable them to sell their labour to the creative industries.

Media authoring software and individual creative practice

At the same time, such a shift in responsibilities and outsourcing and restructuring of labour in the media industries would have hardly been possible without the simultaneous entrance of ‘all- around’ (Masson, 1999) end-user media authoring software in the mid- and late 1990s, including programs for creating computer graphics media such as DreamWeaver Flash for web design and animation, Adobe Photoshop, Aldus PageMaker and others. Quickly gaining early popularity, the universe of uses of such software expanded both to ‘creative professionals’, including motion graphics artists, web and graphic designers, photographers and visual artists, and to new creators of participatory culture, such as prosumers, pro-ams and fan cultures (Manovich, 2001: 205). Proficiency in a range of such programs has come to be a prerequisite for employability and success in fields like animation production, graphic design and digital modelling (Kitchin and Dodge, 2011: 113).

1 My understanding of affordances is based on the development made by Hutchby (2001) on the basis of Gibson’s (1979/2015) affordance theory. Hutchby suggests that affordances are not inherent to the materiality of artefacts but can be designed into artefacts. While they do not impose themselves upon human actions, they do set limits on what is possible to do with, through or around an artefact. I do not provide an analysis of the specific affordances of particular programs. When I use this concept, I simply wish to indicate that the possibilities to change predefined affordances in software is an area of tension for creators of computer graphics media.
Of course, technology is not something that simply happens in society; rather, it is actively shaped by cultural and economic values and imaginaries that get imbued in different technological artefacts (cf Winner, 1980). As with other industrially developed technologies, much of the software for creating computer graphics media has come from cultures of engineering, industrial manufacturing and US military projects aimed at increasing productivity through the computerisation of work, not least through technologies for the manipulation of computer graphics (Downey, 1998; Henderson, 1999; Sito, 2013). As such, it has inhibited and implicitly reflected values of engineering cultures to deliver programs of universal applicability, automation and efficiency, often imagining the creative process in relatively linear terms, subjected to algorithmic, linear logic (cf Henderson, 1999).

Some authoring programs have been further repurposed from other fields, such as web design, to fit the needs of animators, 3D designers and digital artists. For example, the web animation software Flash Splash developed by Macromedia (owned today by Adobe) was reworked in 1999 into a larger animation production software called Flash. This software, Tom Sito (2013: 266) observes, became the standard ‘production tool’ of digital animation for the subsequent 15 years following its redesign and was used extensively for producing television animation. The program made it possible to achieve sufficiently high production values for broadcasting, even though it was not capable of yielding animation ‘as opulent as Pixar animation’ (ibid). Sito’s comment brings attention to the ways in which the choices of particular production technologies may set limits on, or at least create tensions around, the possibilities for software-mediated expressivity on the part of creators of digital media.

Wells and Hardstaff (2008) have expressed a concern that the domination of a very small set of manufacturers of software for computer graphics and animation production narrows the possibilities for originality of creative expression:

Whilst CGI technology has been made more widely available, it is characterised by the presence and influence of a limited number of large software developers… Arguably, this controlled and manufactured revolution, with its origins in corporate governance, finds its exponents unwittingly substituting the possible visual languages of a counter-culture for that of an ongoing succession of software releases … Artists have to find a way of working that is either complicit with the tools and outlooks that they are afforded, or find some way of subverting these models, either through a different kind
of manipulative technique, or more likely through the ways in which established image cultures might be challenged or reconfigured. (Wells and Hardstaff, 2008: 52)

Similarly, Sean Cubitt (2014: 147) notes that in serving the interests of the industries, Maya and other leading commercial software for the manipulation of computer graphics such as Adobe’s Creative Suite and Apple’s Final Cut have led to a standardisation of norms of working practice that constrain as much as they enable creators, as they can hardly be adapted to local circumstances. These arguments can be nuanced by suggesting that rather than narrowing, intangible tools for media production – media authoring programs – privilege certain uses and interpretations over others, also mirroring the ideas of technology designers about who the user is and what the use of a program should be (cf Frabetti, 2015; Gillespie, 2003). Scholars in the fields of software studies and critical craft studies have pointed out the inherent ambivalence in many programs for the creation of digital content to both enable and constrain creativity. For example, Kitchin and Dodge (2011: 122–123) argue that contemporary programs for making digital content have hundreds of functions and tools built in, but most of them come with default settings ‘that provide “acceptable” or “appropriate” results, from the perspective of the software designers and corporate vendors’ that envisioned and made them.

Using the examples of Microsoft Word, Microsoft PowerPoint and Adobe Photoshop, they point to the tension between the flexibility and relative open-endedness of such tools and the fact that they are simultaneously ‘loaded up with structures, templates, defaults settings, algorithmic normalities, and path-dependences that often subtly but necessarily direct users to certain solutions’ (Kitchin and Dodge, 2011: 122). The process of directing users to certain solutions can be related to Peter Dormer’s (1997a: 141) claim of the desire of technological manufacturers to produce a ‘workmanship of certainty’ based on the development of technical systems that give predictable, guaranteed outcomes of quality:

Wherever possible … know-how is embedded in the system rather than in individuals, in order to exchange the workmanship of risk with that of certainty (Dormer, 1997a: 141).

Popular, easy-to-use, all-around media authoring software may offer an ‘uninitiated’ creator of digital media quick results and ‘default’ ideas of quality, but coming at the price of a degree of uniformity. The latter can be
particularly evident when users use default settings, unaware of the ways in which their work is shaped by such defaults, as examples from the use of Microsoft PowerPoint and early uses of Macromedia Dreamweaver show (Gillespie, 2003; Heinderyckx, 2015; Kitchin and Dodge, 2011). Gillespie (2003) notes, for example, how in the early 2000s Macromedia Flash discursively oriented itself towards uninitiated users who were both new to the web and to the program. The software presented compelling examples that predefined the aesthetics and the notion of what a website was supposed to look like, precluding alternatives. As a result, many web pages from that period, including some commercial ones, had similar aesthetics and even the same default title page set by Macromedia. Kitchin and Dodge (2011: 123) argue as a result that ‘one needs to be wary and alert to the contradictions inherent in the ways software works in the world. Software can constrain creative practice, as well as opening up opportunities for original solutions’.

As with any technology, of course, there is space to move within such forms of standardisation or guidance of creative expression. As Wood (2015: 11) notes, popular commercial, industrially produced software for the development of computer games and animation affords certain possibilities to its users to write scripts to help with their modelling, animation, rigging and lighting. Nevertheless, the limits of these possibilities tend to be set, guided and defined by the software manufacturers rather than by the users themselves in relation to the needs of their creative practice.

The choices and uses of specific production tools can affect ‘the worker status, worker interrelationships, and the cultural significance of work’ (Caldwell, 2008: 153). In light of this relationship, concerns about the lack of diversity and openness in terms of software for the production of computer graphics media can be seen as tensions around the scope of alternatives and possibilities for modification and experimentation with technologies putting limits on innovation at the level of the medium, leaving it to explorations of form within frameworks predefined by engineering cultures.

An animator cited by Wells and Hardstaff (2008: 61) laments this development by concluding that

artists today are working with software and cameras that are rarely more than a few years old and that bothers me because it means all these artists have little choice but to essentially work from the same palette – and in animation especially, you begin to notice how everyone’s movies sort of start to look and feel the same. (Wells and Hardstaff, 2008: 61)
Whereas Wells and Hardstaff locate the problem with standardisation in corporate logics of technological production, we could also see it in light of specific articulations of engineering and design cultures that embody imaginaries and visions about certain technological futures in software. Most technologies for computer graphics visualisations, interfaces and software for media production had their origins in research projects at the Xerox Palo Alto Research Center (PARC) (see, for example, Manovich, 2013). Balsamo (2011: 53) argues that Silicon Valley, and particularly PARC, was where ‘the future – our present – was first imagined, prototyped, and eventually set in motion’.

This future, Balsamo clarifies, has been about ‘human-scale computing’, which in the 1970s reflected ideas inspired by cybernetics about seamless communication between people and machines through the use of graphic interfaces. Sherry Turkle (1984/2005: 8) refers to these ideas as a specific ‘aesthetics of emergence’, which reflected the belief of a group of technologists and engineers in the 1960s and 1970s that people should be able to interact with the computer without the need to address its underlying mechanism and without ever needing to comprehend it, while the machine does more than one tells it to do.

For many of those who shared these visions, their work was a matter of an artistic endeavour, as Sito (2013: 11) notes: ‘Their goal, if they would even deign for it to be labeled so, was a melding of human psyche and machine to achieve a new way of experiencing art.’ This vision reflected the emerging aesthetics of simulation in the wake of American counterculture in the 1970s that was encouraging people to expand their minds (Sito, 2013: 92).

Specific to the practices dedicated to imagining, designing and prototyping these new ways of interacting with computers – through software and computer graphic visual media infrastructures – is that they were organised as collaborations between computer scientists, psychologists, linguists and anthropologists, among others (Balsamo, 2011: 56). Such a multidisciplinary and collaborative approach to technological development was regarded as largely innovative at the time, and it yielded many of the fundamental digital media infrastructures that underpin contemporary digital cultures (ibid). Today, collaborations around technological development are common in industrial design contexts and are known as ‘participatory design’ (see, for example, Binder et al., 2011; Ehn et al., 2014).
collaborative work of projecting different imaginaries about technological futures is common to industrial technology development settings, as well as, to a degree, in academic practice-based research (e.g. Ratto, 2011) and often gets to involve artists or citizens who can experiment with technologies not yet available to the public, while technologists can enrich their ways of seeing computing³ (Balsamo, 2011: 57). The results of the cultural work of the technological imaginary and innovation remains in many cases at the level of prototypes, but algorithms and ideas are not infrequently picked up and set in motion by companies in the software and hardware industries (see Balsamo, 2011; Manovich, 2013).

The tension that these imaginaries and their setting in motion create is that, once out of the research lab, new technologies such as software for media authoring tend to be closed for further collaborative development and become oriented towards imagined users and consumers of technologies whose needs they are supposed to serve. Protected by copyright laws and prohibiting intervention at the level of algorithms, the imaginaries of small groups of technological and cultural elites about how creative work should be done underpin the technological frameworks of much of media practice today. In this relationship, media creators, regardless of their degree of professionalisation, emerge as ‘users’, customers or consumers rather than co-creators of the technologies that their work and practice depend on. Thus, the above-mentioned anxiety on the part of media practitioners about the creation of digital visual media within predefined technological frameworks can be further understood in terms of a sense of disempowerment that goes against the needs of creative practice to experiment and innovate through technologies. Art critic Boris Groys summarises the problem as follows:

The post-industrial ‘creative industries’ presuppose the innovative, project-oriented and, in a certain way, autonomous working process. But on the

³ This particular approach in the field of computing can be traced back to the work of modern artists who were part of E.A.T. (Experiments in Art and Technology) in the 1950s and 1960s. Turner (2008) and Wisnioski (2012) note how, increasingly since the 1930s, artists experienced sentiments of exclusion from shaping society as engineers took over this role by building and defining new computational and electronic machines. This artistic anxiety was eventually expressed in the work of E.A.T. to bring together engineers and artists to work together in experimenting with and redefining the meaning of machines (Experiments in Art and Technology, 2003: 211-226), giving a ‘human scale’ (Klüver, 1969) to the work of the engineer. Similar collaborative endeavours between artists, scientists and engineers became common in the 1960s in Germany, Japan, Sweden and the United Kingdom (Orrghen, 2015).
other hand, the artists, designers, or writers use the means of production that they do not own or control (Groys, 2013).

Feminist anthropologist of technology Lucy Suchman locates the problem in practices of technological design. She notes that designers and engineers work with preconceived models of users, constructing ideas of ‘typical users’, but disregard the situated actions and the local material and social circumstance, which are often unplanned and unexpected, that actually guide users’ actions in interacting with technology (Suchman, 1987: 181). At the same time, false expectations concerning users’ actions can eventually result in users finding problems with the performance of the technologies they use even if, in design terms, no such problems exist (Suchman, 1987: 165).

No software can satisfy the full creative and practical needs of its users, as designers and programmers cannot fully know in advance what a user may need (Nardi, 1993). Software is also unstable and in flux, constantly changing and frequently breaking down, in need of constant care, maintenance and repair (Jackson, 2014; Mackenzie, 2006). Following broader processes of commodification, many objects today, including software, are deliberately designed so that possibilities for user intervention in their repair and maintenance are reduced in advance (Verbeek, 2005 cited in Graham and Thrift, 2007). With regard to software, such limitations are particularly visible in terms of the tendency of software to fail more often than not. As Kitchin and Dodge (2011: 38) argue, usable and successful software is an exception rather than the rule, and even the most successful and popular software has bugs and is susceptible to failure in unanticipated ways.

Forming part of the affordances and politics of software, limitations on the repair or extension of software often mirror the interests of the industries producing technologies that reproduce hierarchies of power and structural divisions by separating technology production from locations of use, perpetuating distinctions in terms of producers and users despite claims that such borders have been erased (e.g. Bruns, 2008). They also impose a certain inflexibility in creative practice in which eventual incompatibilities that emerge in the meeting between individual creative practice or production needs and the functionality of the software need to

---

4 See also Frabetti (2010).
be negotiated through workarounds and changes in working practice rather than by intervening in the software’s algorithms.

These issues become more important if the process of creating digital media is approached as a form of craft work that needs to take place in close relation to materials. Craft theorists have noted that tools raise problems that span across a spectrum between determining how an all-purpose instrument, e.g. a screwdriver, can best be applied in a broad range of situations and how to learn to use very specialised tools in situations that are beyond their intended purposes (Sennett, 2008: 194-238). The latter tools, Sennett writes, come with an assumption of ‘clarity, of knowing which act should be done with which thing … And yet the cabinet of tools is not a seat for learning’ (Sennett, 2008: 194). Learning how to best use materials is based on what Sennett calls a rhythm of task-oriented problem-solving and problem-finding that often emerges from the use of incomplete tools that provoke the imagination to repair and improvise, oscillating between resistance and ambiguity.

Popular commercial authoring software tools for creating computer graphics media are conducive to a different degree to the possibilities of users to cultivate their skills by overcoming material resistance and engaging in technological repair. Software as a production tool can be oriented in such a way so as to make its users discover and repair problems or to ‘repress’ difficulties by creating a sense of ease and perfection when manipulating complex objects on-screen (cf Sennett, 2008: 43). The latter paradigm has been dominant with the emergence of the ‘aesthetics of emergence’ that Turkle refers to, and with computer graphics authoring software. Sennett notes, for example, a problem of overdetermination of design in systems for computer graphics manipulation such as CAD software, which is widely used in architecture and industrial design. In such software, ‘forms are resolved in advance of their use’ (Sennett, 2008: 43).

The latter embodies, as Sennett suggests, the implicit desire of engineering cultures for achieving ever-increasing technological perfection in ways that transfer knowledge away from practice into algorithms that provide ready solutions obscuring the practical problems that caused them to emerge. Citing MIT physicist Victor Weisskopf, Sennett argues that the functional overdetermination of software that takes place through repressing difficulties converts the user – the media practitioner – into a ‘passive

---

5 See also Binder et al. (2011) for a discussion of the problem of technological overdetermination by designers of technologies.
witness to and consumer of expanding competence, not participating in it’ (Sennett, 2008: 44). This problem is particularly relevant to the ways in which instances of free software for media production may offer ways of reconsidering this relationship through a general outlook of its production frameworks that make it susceptible to improvisation, as well as to individualised and collective repair.

We can add to this discussion that craft-like engagements with media authoring software have been strongly preserved and encouraged not only at the level of industrial software design practice and prototyping, but also among some of the Hollywood corporations producing computer graphics entertainment media. During the 1980s, for example, Pixar opposed the domination of the visual aesthetics of 3D motion graphics that was largely dictated by engineering cultures and that often took the form of flying metallic 3D logotypes or scientific visualisations of machinery. The company needed both advanced algorithms for the visualisation and processing of computer graphics and ways to embed them in recognisable media genres that could allow it to reach audiences (Catmull, 2014; Lasseter, 1987; Sito, 2013).

In effect, Pixar adopted a vision that the development of production technologies, particularly software, and the development of computer-generated animated films as an aesthetic, symbolic product to be sold to audiences needed to be integrated by bringing together artists and technicians in the design of both the technical systems and the look of films. Tai (2012) notes how these developments were a partial manifestation of the new post-Fordist discourse that was emerging at the end of the 1980s and of a desire to recuperate craft modes of creating technology and form by putting them at the core of the entertainment industries’ production practice.

As the computer graphics entertainment industry emerged from computer culture rather than from film production culture (Herhuth, 2014; Sito, 2013), it embraced an ethos of the counterculture of the 1970s that promoted collaborative forms of work and new forms of labour organisation and management. Tai (2012) argues that it is precisely the relationship between an evolving struggle for craftsmanship, a desire for a closer dialogue with materials and technologies and the mode of production, i.e. the configuration of labour relations that have been at the core of the evolution of the aesthetics of the animations produced by the US entertainment industries. In effect, actors like Pixar embraced a mode of production that was based on in-house software and a flatter organisation.
of labour between technologists and artists that continues today (even though still organised in distinct, albeit fewer, departments as inherited by Taylorism).

Such collaborative development of computer-generated form and the software for the production thereof has also been noted in game development. The desire of game players to craft their own games or make modifications to existing ones has resulted in the game engine development industry moving towards free and open-source software. As Dovey and Kennedy (2006) observe, intense policing of copyright and piracy among game players led in the first half of the 2000s to a rethinking of the cooperation between players and developers of games that was sought by the industry as a method to improve the game experience and strengthen game brands. Opening up to practices of co-creation (Arvidsson and Sandvik, 2007), game software is now distributed ‘on the assumption that players will want to customize them and create their own versions’ (ibid: 130). Dovey and Kennedy (2006) conclude that these developments led to an evolution of piracy discourse by reframing it into what they term ‘configurative practice’ as a brand loyalty that echoes modes of work in the free-software and open-source movement. The case with the game industry is particularly interesting because it suggests how pervasive software piracy can occasionally become a vehicle for adjusting the interests of the technological industries with those of media users.

In other fields and at different levels of computer graphics media production practice, such as animation and digital painting, the possibilities for such collaboration have remained more limited, even though there are some recent changes that indicate that there may be similar developments on the way. Some large entertainment studios have only relatively recently started releasing animation production software or important components of it as open-source. Japan’s Studio Ghibli released in 2016 its main, in-house software OpenToonz as free software, whereas a few years earlier, Pixar had released its animation rendering software Renderman as free to use for non-commercial purposes. These developments indicate that the animation industry is also moving towards practices of co-creation that revolve around software rather than media content, but they are still too recent to assess.
Conclusions

The brief and partial context that I have sketched above suggests that media authoring software for the creation of computer graphics media is a locus of tensions around industrially set parameters for craft practice and negotiations of artistic expressivity and cultural imaginaries of technological futures envisioned in research labs and projected on abstracted users.

Media authoring software also exists at the intersection of forceful competition of different industries: the media industries that use it for the rationalisation and reorganisation of labour and the software industries that try to both satisfy these needs and to capture new markets by producing end-user tools to be used by individual creators and smaller production studios. This dynamic is arguably conflictual and embodies the power struggles over market dominance between different industries. The individual media practitioner appears in this context as a consumer and user of technology that adapts to such changes, but with more limited possibilities to change them. Media authoring software emerges from here not just as a mediating element, a ‘force and a tool’, but as a vehicle of power or disempowerment, of conflict in visions about the future and realities of practice, and an implicit instrument of hierarchisation through the configuration of relations of production between different groups in society. I see these relationships and tensions not as determining, but as hierarchising, emerging as subtle configurations of power at distinct levels and instances of media production practice. Such hierarchisations are at the same time neither new nor inevitable. Seen historically, a division between industrial manufacturers of technologies and users is not new. It can be regarded as part of longer processes of fragmentation and differentiation during modernity, one that creates ‘disjunctures’ (Appadurai, 1990) between different spheres of practices, professions, production and consumption. Intensifying and radicalising over time (Fornäs, 1995), partitions have emerged between culture, economy, knowledge, politics and identity, and additionally fragmentised internally, such as between ‘high’ and ‘low’, ‘professional’ and ‘amateur’.

However, there can, at times, be attempts to erase these divisions and bring together alternative hierarchies and sets of relationships around the material configurations of creative practice. Howard Becker’s (1982/2008) sociology of art provides some insights into this process. He notes the lasting presence of industrial manufacturers specialising in producing conventional sets of materials needed for different artistic practices: musical
instruments, canvases for painting or photo paper. He suggests that the degree of monopolisation of each subsection of this market for materials might satisfy most practitioners in a particular medium but could potentially constrain those who wish to innovate in it, as it would provide less variety or possibilities for experimentation. The reason, Becker explains, is that if only one or a few manufacturers dominate the market for specialised tools needed for artistic practice, they might be relatively insensitive to the needs and desires of creative minorities (Becker 1982/2008: 73).

Becker illustrates this with the example of Kodak and how its monopolist position on photo paper in the 1970s led to the widespread use of such paper in artistic practice, later causing significant turmoil after a sudden corporate decision to discontinue its production. At the same time, new technologies introduced by corporate industrial manufacturers may enable new practices of experimentation that would have been impossible or inaccessible until then. Besides the degree of market monopolisation, Becker also observes that the existence of norms within each practice about what constitutes a good piece of work further limits the materials to serve such specific norm-defined standards of quality (Becker 1982/2008: 74). As Becker notes, however, the monopolisation of materials can sometimes lead artists to engage in creating their own materials, in training people in how to use them and in finding ways to innovate, experiment or simply adapt these materials to their creative ambitions and needs.

Becker’s observation is important, as it positions materials, or production tools such as software to represent part of the broader infrastructures – or as he calls them, networks of collective action – of artistic production that include relations of production and distribution, conventions of artistic practice, knowledge and skill acquisition and economic models for sustaining art practice. An infrastructural perspective makes it possible to see media authoring software not just as an instrument and a production tool or as a site of techno-power in its own right. Rather, it is a dynamic, constantly reconfiguring articulation of cultures and relations of power formed through relations of industrial media and technological production; separation between engineers, media practitioners and users; anticipations over audiences; actual needs of practice; conventions of genres and, not least, economies of cultural and technological production. In short, media authoring software is an artefact that concentrates and mediates specific infrastructural arrangements that entangle politics of technological production, economic interests and practice-related concerns.
The context outlined above also shows that different industries, rather than media practitioners, have generally dominant influence on setting these arrangements. As Becker asserts, however, in certain cases, artists and media practitioners could develop their own production tools. In these cases, this would imply reconfiguring and recreating a whole infrastructure of relations, practices and uses around these tools, be it a new instrument of artistic creativity or, in the present context, media authoring software. Considering the scale of such efforts, it represents an undeniably difficult project, though not unprecedented if seen in light of Becker’s sociology of art practice.

Against this background, it is possible to discuss media practitioners’ engagements with creating free software for computer graphics animation as attempts to renegotiate and assert influence over the means of production (cf Marx 1867/2004) that their work practice depends on through the creation of alternatives. I refer to such attempts as user-driven media technologies that reflect and are driven by the cultures and communities of practice that represent the ‘users’ of these technologies, namely media practitioners, rather than by engineers and designers in industrial media or technological contexts.
CHAPTER 4
Theoretical perspective and conceptual framework

The context that I have provided so far has positioned media authoring software in relation to media production. In this chapter, I present and elaborate on the theoretical perspective through which I have analysed the practices and politics of media creators who are involved in making and extending media authoring software, specifically free software for the production of computer animation. In the first two sections, I provide my perspective on software and relate to the media practice approach proposed by Couldry (2004; 2012). In the third section, I outline the main theories and concepts that I have used in the empirical analysis within the papers. Then, in the fourth section, I bring them together in a common framework by adapting the concept of *infrastructuring* from science and technology studies and, with its help, propose an extension of the media practice perspective with this concept. I close the chapter with a brief summary of the theoretical framework.

Software as a technology of culture and power

Software is code and algorithms and, at the same time, it is sets of unstable, reconfigurable and reconfiguring relationships. It is ‘a complex, multifaceted, mutable set of relations created through diverse sets of discursive, economic, and material practices’ (Kitchin and Dodge, 2011: 37). As such, I see it as a technology of culture and a technology that produces cultures and infrastructures around them. As Bolin (2012a: 3) writes, technology tends to form ‘cultures of technology’ that centre cultural practices and expressions on technology. As a result, Bolin suggests, cultures themselves become technologies and can play an instrumental role in justifying political agendas or actions.

Some theorists of software studies have argued that software cannot be understood through concepts of technology as advanced by social, media and philosophical theory (Mackenzie, 2006: 16). One argument is that such theories (e.g. Feenberg 1995) have tended to portray code and information
technology with alienating, instrumentalised capacities (Mackenzie, 2006: 16). Mackenzie suggests that this view is not well suited to the contemporary situation in which there exists an entire environment of education on programming, academic conferences, coding languages and practices that include a plethora of actors who compete for agency and attempt to organize the production of software along different lines (Mackenzie, 2006: 17). This argument requires precision – different kinds of software serve different purposes and domains of practice. For example, there are indeed many actors engaged in the development of operating systems and software for telecommunications, as Mackenzie clarifies (even though most of this work is sponsored directly or indirectly by large technological corporations and thereby still not detached from industrial interests, which tend to prioritise economic value above other values). However, the more specialised the domains of software application, the less multiplicity exists. As I stated earlier, software for the production of computer graphics media is largely dominated by a handful of software manufacturers, whereas it is a work tool for the majority of media practitioners engaged in the production of digital visual media. Educational conferences and programming summits in this field may debate algorithms for computer graphics, but the integration of these algorithms in actual software is far from trivial or common, and is rather generally relegated to the industrial manufacturers of specialised software. In addition, the approach that Mackenzie proposes instead, as Frabetti (2015: 13) notes, in practice largely echoes the cultural approach to technology of Raymond Williams (1974/2003), as Mackenzie studies software through the social and cultural formations that surround it (see Mackenzie, 2006: 1; Frabetti, 2015: 13). My aim is not to delve deeper into the ontology of software. What I find important is to acknowledge the embeddedness of software in industrial logics of production through which it becomes a specific technology of culture and power.

Philosopher of technology, Andrew Feenberg (2002) argues that technology is one of the major sources of public power in modern societies. Its power is constituted through the technical mediation of social activities. Reflecting dominant cultural ideas and ideologies of societies, hegemonies become inscribed in technological systems. Feenberg calls such reflection to represent a cultural horizon of technologies, after Bourdieu’s concept of doxa: it is ‘a set of culturally accepted assumptions that form the unquestioned
The spectrum of ideological choices or systems of beliefs in Feenberg’s view are established by cultural and political struggles for power rather than by any intrinsic qualities of technology. Feenberg argues further that technology is not a thing, but an ‘ambivalent process of development suspended between different possibilities’ (Feenberg, 2002: 15). As a process, technology is always ‘in the making’, remaking and unmaking. In effect, technological artefacts reflect politics (Winner, 1980), and software, as an example of such, becomes an articulation of, and the locus of, processes of inscribing or projecting power relations rather than stable cultural objects.

To the extent that technologies represent hierarchising practices of production of difference, Feenberg stresses the importance of turning to practices in order to see how individuals and social groups ‘influence and change technological design, uses, and meanings. In this conception, the very construction of technology is thus subject to democratic debate and contestation’ (Kellner, n.d.). From this perspective, practices focused on making technologies possess the potential both to establish distinctions and to reconfigure existing power arrangements exercised through technology. A practice perspective can expose how such distinctions and reconfgurations take place.

Similarly, Raymond Williams (1974/2003) saw technology as ‘cultural’ and insisted on paying attention to the intentions embedded in technological production. He engaged in a rigorous critique of technological determinism (i.e. the notion that technology produces effects on society irrespective of social context), as well as a critique of instrumentalism (i.e. when technology is seen as ‘discovered’, detached from intentionality and thereby the result of destiny). This approach is largely reflected in constructivist studies of technology (e.g. Bijker, 2010; MacKenzie and Wajcman, 1985/1999) and in some strands of media and communication research that

---

1 Feenberg’s idea of a cultural horizon is not dissimilar to Raymond Williams’s (1961/2011) concept of a ‘structure of feeling’.
2 Michel Callon (1987) equates the idea of technology in the making to ‘society in the making’ and proposes the concept of actor network as a method to understand the relationship between both. My use of technology ‘in the making’ here, likewise in the title of this dissertation, reflects predominantly, with Pipek et al. (2017), a relational and processual perspective on technology, and infrastructures rather than a method of analysis. Furthermore, I do not engage with questions of symmetry of human and non-human agencies, as actor network theorists do.
3 This aspect of software has been discussed more profoundly within the field of software studies in relation to questions of governmentality built into algorithms and code. See, for example, Bucher (2012a), Chun (2013) and Galloway (2006b).
have problematised audiences’ technological consumption and meaning-making practices (e.g. Bakardjieva, 2005; Du Gay, 1997/2013; Gillespie et al., 2014; Silverstone, 1994; Silverstone and Hirsch, 1992).

Like Feenberg, Raymond Williams maintained that intentions built into the properties of a medium imply ‘conscious, self-reflexive and planned decision making’ (Hands, 2015: 136-137) and can change only through ‘continually renewable social action and struggle’ (Williams, 1974/2003: 134). Forms of social action were to be understood, according to Williams, not through macro accounts of structure but through an attentiveness to real, material activities, to see them as ‘real practices, elements of a whole material social process; not a realm or a world or a superstructure, but many and variable productive practices, with specific conditions and intentions’ (Williams, 1977: 94 cited in Milner, 1994: 58). The value of both Williams’s and Feenberg’s positions on technology is in asserting the agency of media users in responding to industrially produced technology and configurations that come with it, opening up a horizon for engagement with technology to go beyond the sphere of technological elites such as engineers and hackers, and industries that surround the production of software. Their invitation to focus on practices of contestations of technology has emphasised the value of taking a practice approach.

A practice perspective on creating and shaping software

Therefore, my perspective focuses narrowly on practice. Nick Couldry (2004) appealed to media researchers to move away from the study of media texts and institutions and to focus instead on diverse articulations of (human) agency related to media as expressed in practice. He formulated this perspective in a straightforward manner as a question of ‘what [people are] doing4 in relation to media across a whole range of situations and contexts’ (Couldry, 2004: 110). With this formulation, media research has been called on to concentrate on ‘the study of the open-ended range of practices focused directly or indirectly on media’ (Couldry, 2004: 117).

The theoretical influences of the media practice perspective include sociology of action and anthropology of media. Couldry formulated this perspective in terms of a new paradigm in media research that detaches it from the paradigm of literary criticism. I do not regard this as a new paradigm. Rather, I have found that the value of this perspective lies mostly in

4 Italics in the original.
its inclusiveness and openness to a broad range of processes and practices that can take place in relation to media. As Couldry admits, it opens up paths to think about ‘media-oriented actions that form part of other practices’ (Couldry, 2004: 126) that have not been sufficiently addressed by media research and make it possible to discuss their role and significance for media and society.

With the grounded and ethnographic approach presented in Chapter 2, I focused on practices that appeared to be of specific significance for the participants in the two case studies that were my main object of analysis. These practices were software decommodification and its further repair and development, the anchoring of software development and repair in actual production practices of computer animations and a commitment to sharing a range of artefacts online as commons. These practices were therefore my main object of analysis in Papers 1, 2 and 3. My understanding of these practices has generally been as forms of agency that, as an extension to the media practice approach suggests, can take multiple forms of ‘acting on media technologies and infrastructures’ that manifest themselves ‘in the form of direct engagement with technical devices and systems but also occurs through interacting with different actors, through articulating viewpoints and through sharing knowledge and experiences in different circumstances’ (Kubitschko, 2017: 4).

Practices are defined in terms of routines that are characterised with regularity of action (Couldry, 2012: 33), thereby representing symbolic and ritualistic articulations of culture (Carey, 1989/2009) in relation to media. In the two cases that I analysed, sharing software, computer graphics assets and training materials, as well as making public the labour that enters this process have indeed been adopted by the Blender Institute and the Morevna project to the extent that they represented routinised activities that to a certain degree formed part of the everyday life of the participants in the projects.

Practices are also ‘social constructions that carry with them a whole world of capacities, constraints and power’ (Couldry, 2004); they are related to human ideas of needs and feature a normative outlook in terms of ideas of how we should live with media. Importantly, practices are situated and contingent, related to broader social structures (Hobart, 2010). Hobart (2010: 61) adds that practices are ‘those recognised, complex forms of social activity and articulation through which agents set out to maintain or change themselves, others and the world about them under varying conditions’. In short, practices are political and hierarchising.
The media practice approach is derived from Bourdieu’s (1993) theory of practice, and it pays attention to ways in which distinctions are created and maintained in society through forms of agency related to media broadly. It thereby suggests that researchers look at the ways in which different actors engage in the ‘game’ of changing or maintaining their positions towards existing configurations of power in a field of social action.

Even though software for making media has deeply penetrated the everyday and, as Manovich states, transformed all media into software, media research has generally been less interested in studying software production as a practice related to media (Mackenzie, 2006: 14). An exception are studies of the practices of hacking, ‘alternative computing’ and free software development (Coleman, 2013; Kelty, 2010; Lievrouw, 2011; Mackenzie, 2006). Such studies have at the same time most often focused on the practices and lifeworlds of programmers and the shaping of technologies for network communication. They have tended to neglect artists, professionals and hobbyist media creators who search for ways to shape and extend media authoring software.

Similar criticism has also been advanced by Kubitschko (2017), who restated that users of technology can today engage in a myriad of ways to reconfigure media technologies and infrastructures at a deeper, algorithmic level rather than through practices of use. I align myself with this criticism and believe that the media practice perspective can be helpful in eliciting the cultural work and reconfigurations of relationships around existing media technologies and context-specific practices that take place around media authoring software.

Conceptual framework

As noted above, I explored three key practices involved in making free software for computer graphics animation. Here, I present the concepts through which I approached them in the papers included in this dissertation, namely the decommodification and politics of value (Paper 1), online sharing (Paper 2) and repair and artful integrations (Paper 3). In addition, I leaned on the concept of autonomy in my exploration of questions related to meaning making through the development and use of free software for computer graphics animation (Papers 4 and 5).
Decommodification and the politics of value

The economic models used by the media and technology industries in the West are still predominantly reliant on the production and sale of commodities protected by copyrights (Bolin, 2011; Dovey and Kennedy, 2006; Hesmondhalgh, 2013). This refers as much to media authoring software for all-around end-use produced by corporations such as Adobe and Autodesk as it does to symbols and media texts such as films, videos and music that are circulated online and in global media markets. As Arjun Appadurai (1986a: 6) argues, however, commodities are not the monopoly of modern, industrial economies. They are valued and devalued through politics. The locus of this form of politics is the tension between existing frameworks in which commodities are circulated in society and the social and cultural tendencies to breach these frameworks: ‘This tension itself has its source in the fact that not all parties share the same interests in any specific regime of value, nor are the interests of any two parties in a given exchange identical’ (Appadurai, 1986a: 57). Commodities constantly ‘spill’ beyond diverse regimes of value and traverse cultural contexts (ibid).

The concept of regimes of value (Appadurai, 1986a) concerns the ways in which objects can traverse different cultural and economic contexts, creating commensurability between multiple systems of beliefs and economic rationalities. I use this concept in Paper 1 for two purposes. First, I use it to present and analyse the histories of development of the two instances of user-driven software for computer graphics and animation film production that are subject to my empirical investigation, Blender and Synfig. I further extend this history in Paper 5. Second, I discuss how the subsequent modes of development of such software by making open films relied on the creation of mechanisms of translation between media creators’ individual ambitions, the frameworks for the production of such software and the economies of public cultural funding and market logics. The value of this concept, as I use it, is in avoiding falling into a dichotomy of attributing the frameworks of production of free software for the creation of computer graphics into strict categories of labour exploitation or emancipation, economic commodification or the making of a public good. Instead, I aim to illuminate the complexity and contingency of these practices in a processual way that emphasises, in part, changes in values attributed to software, to creators of computer graphics media and to the cultural products that they have been making, as well as their shift between different domains of moral economies – markets and commons.
Commodities tend to dissolve links between people and things (Appadurai, 1986a: 24) and to be embedded in social that attempt to restrict and regulate commodity flows, such as through copyright licences and control over distribution that are ultimately oriented towards protecting status systems. Appadurai (1986a: 25) argues that such forms of restriction generate ‘enclaved commodities’ that provide contexts for strategies of diversion that can take multiple forms. Diversion is about taking commodities out of their original nexus and decontextualising them, putting them on other paths of commoditisation and circulation besides the intended ones, such as through theft.

In the context of media authoring software, but also the circulation of symbols, a common diversion is that of piracy. Piracy, however, is not merely an act of theft, it is also a subject for diverse politics: ‘parametric politics’ (de Zeeuw et al., 2015) that explore digital sovereignty, politics of repair that aim to bridge artificially created latency in the global systems of distribution of content and technology (Liang, 2009) and, more broadly, politics of access.

Another form of diversion is decommodification, which, as Kopytoff (1986) suggests, is one of many states in the life of an object: at one point in its life trajectory, it can be a commodity, and at another, a commons. Objects can traverse between various states over a longer time trajectory: they can be commodified or decommodified, serving different interests, politics and cultural regimes of value. Researchers on media production and digital production of culture have tended to focus more on the processes of commoditisation and piracy rather than decommodification. However, as I show in Paper 1, decommodification can be an important moment in the trajectory of software or digital artefacts generally, through which their meaning, use and value can be renegotiated and taken in another direction.

Repair and artful integrations

In Paper 3, I focus on practices of repair. Repair refers both to a practice and a concept. Most technological objects today, including media authoring software, provide their users with limited possibilities for repair, even though we cannot say that digital technological objects today have become failure-prone.

The gradual closure of software repair has its roots in the 1970s, when the software industry tried to move away from a model of providing expensive, in-house software solutions for wealthy corporations, and instead attempted to expand its markets by unbundling software and hardware,
thereby converting software into a commodity (see Campbell-Kelly, 2003). It tried instead to provide a maximum number of features to potential users while minimising maintenance obligations and costs by creating documentation and support services instead. Campbell-Kelly (2003) illustrates the logic of economic rationality that was being progressively attached to computer graphics interfaces and software in this period of software development in the following way:

So that personal computer software products could be used by many thousands of customers without any after-sale support, programs had to have intuitive interfaces and had to require no customization. This again required the development of a set of skills different from that of corporate software makers, who could rely on training courses and third parties to install and customize software (Campbell-Kelly, 2003: 8).

In Paper 3, I turn to Steven Jackson’s (2014) theory of repair and extend it with the notion of artful integrations, which I borrowed from critical feminist science and technology studies (Suchman, 1994). Jackson (2014) takes breakdown rather than growth and progress as a starting point for thinking about contemporary politics of media. Repair is a practice that emerges in the ‘aftermath’ of breakdown. It grows ‘at the margins, break-points, and interstices of complex sociotechnical systems as they creak, flex, and bend their way through time’ (Jackson, 2014: 223). It marks the limits of the practices of using technological objects, and invites creativity and craftiness in searching for ways to overcome these limits. In this sense, repair and the desire to repair are conducive to craft work (see also Sennett, 2008).

Repair as a practice is capable of producing technological differences by fitting technologies to national contexts, individual circumstances and personal stories (Jackson, 2014: 227). The work of fitting, Jackson (2014: 223) notes, involves the articulation and calibration of sociotechnical systems to interact smoothly with one another. In this sense, repair is a fundamental part of keeping technologies and the cultural and economic infrastructures that surround them operational. I have extended the concept with the notion of ‘artful integrations’ (Suchman, 1994) in order to conceptualise how the repair of technological objects, such as software, can become part of making what I refer to as ‘situated infrastructures’ by connecting diverse actors (users and producers), interests, practices and ways of working focused on technology and reorganising them to negotiate a common interest mediated through technology. Integrations reflect a
process of situating technologies across practices of use. The qualifier ‘artful’ denotes the friction-filled process of laborious reconfigurations – always partial, provisional and precarious – into familiar arrangements and modes of action (Suchman, 1994) in technological production and use. I have used the concept as a way of outlining a specific mode of repair adopted by the Morevna project that was oriented both towards broadly rejecting ‘broken’ infrastructures of piracy and towards specifically repairing software and opening it up to repair by others.

Repair has been regarded as an increasingly productive practice and theoretical approach to move the focus away from new media innovation and recast attention on the mundane, slow and broken world of new media and technologies (Graham and Thrift, 2007; Jackson, 2014; Parks, 2013; Rosner and Ames, 2014). Representing a practice of calibration and improvisation (Graham and Thrift, 2007), repair and maintenance are important parts of contemporary media infrastructures (Starosielski and Parks, 2015). They are also practices that are constitute for infrastructural development, which is defined as ‘the historical process of development of many tools, arranged for a wide variety of users, and made to work in concert’ (Star and Bowker, 2004: 34). Repair, in this sense, is both about acting on things that are broken and acts of development, customisation, appropriation and care that complicate discourses of rapid technological change and linear innovation. It brings attention to slowness, failure and frictions.

Gifting and power through the politics of debt

In Paper 2, I focus instead on practices of online sharing. I approach them through the conceptual framework of gifting derived from Marcel Mauss’s (1925/2002) theoretical work on the gift as a practice of producing relations of power through debt. I have complemented it with Jean Baudrillard’s discussion of different forms of value in relation to the production of commodities and objects that are gifted (Baudrillard, 1981; Merrin, 2005).

The sharing of files, media content or Facebook status updates online has been the focal point of vast debates about digital emancipation and the politics of labour, exploitation and expropriation. As Nicholas John (2016) argues, sharing is a metaphor that generally saturates our usage of information and communication technologies today. It traverses a broad range of contexts and meanings from sharing as an expression of the politics of the digital commons that can be observed in content and software production as in the cases of Wikipedia and Linux (e.g Benkler and Nissenbaum, 2006; Berry and Moss, 2006; Björgvinsson, 2014; Cammaerts, 2011; Fuster
Morell, 2010; Hess and Ostrom, 2011; Morgan, 2013) through practices of consumption, such as file downloading and listening to shared music (e.g. Andersson Schwarz, 2014; Andersson, 2013) to the exploitative or affective dimensions of the digital economies formed around sharing (e.g. Barbrook, 1998/2005; Jarrett, 2015; Terranova, 2000) or management and surveillance practices based on openness and sharing (Birchall, 2011; Christensen and Cornelissen, 2015; Flyverbom et al., 2015; Turner, 2009).

In my approach, I focus on the ways in which gifting or sharing diverse artefacts online has been a strategic materialisation of a ‘system that ties together interpersonal social relationships’ (Godbout and Caillé, 1998: 15). I see this as a complex of practices of the strategic production of skills, labour and power with the goal of creating a user community of media creators and programmers around media authoring software. I use the duality of the concept – as a practice of emancipation but also confrontation – in order to discuss online sharing as a strategic practice that has the capacity to organise labour relations within a media practice oriented towards producing software and how it in turn can also organise people outside of the practice.

I further regard gifting or sharing of a plethora of digital artefacts online, including software, as a routinised, hierarchising practice that can represent a mechanism to stabilise and perpetuate the production of relations between people, software and practices of creating films with them. In this sense, sharing could be seen, like ‘artful integrations’, as a mechanism to further drive the development of software, create a user community around it and form knowledge and labour that can sustain these processes over time. Gifting has the capacity to transcend oppositions between the individual and collectivity and thereby make individuals part of a larger concrete entity (Godbout and Caillé, 1998: 15). The making of such an entity through social bonding, debt and obligation can be generative of parts of infrastructures for cultural production.

Formulations of autonomy

In order to approach the question of meaning created through engagements in making and extending free software for computer graphics, I further lean on the concepts of ‘negotiated autonomy’ (Banks, 2010a) and ‘craft autonomy’ (Coleman, 2016), respectively, in Papers 4 and 5. I also touch upon meaning making in the rest of the papers that represent more focused discussions around the two empirical cases. Here, I want to briefly discuss my overarching understanding of autonomy as used throughout the dissertation.
First of all, autonomy – broadly understood as a freedom to act independently of constraints of institutions, technological limitations or social relations – is never absolute and is always relational. My thinking has been informed by Bourdieu’s theorising about autonomy in terms of the possibilities to decide one’s rules within a field of cultural production, to set ‘the rules of the game’ (Bourdieu, 1992/1996; Bourdieu, 1993). Autonomy represents ‘a pole’ against which hierarchisation between different actors who strive for legitimacy – through practices of cultural production organised around specific themes – occurs (Bourdieu, 1993). By taking technology, and software in particular, as the central theme around which creators of computer graphics media have been attempting to set, or at least intervene in, ‘the rules of the game’ of digital media production, I have taken it as the main ‘pole’ through which individual interests and ambitions for autonomy get mediated.

In terms of individual interests, I have located ideas of autonomy as expressions of specific, craft-related concerns in the relationship between technologies for media production and individual creative practice. I understand craft, with Glen Adamson (2010: 2), not as ‘a movement or a field, but rather a set of concerns that is implicated across many types of cultural production’. As Adamson continues, craft is not a paradox, or an anachronism, or a set of symptoms, but … a means of articulation. It is not a way of thinking outside of modernity, but a modern way of thinking otherwise (Adamson, 2010: 2).

Addressing multiple forms of articulation through history and diverse domains of cultural practice, Sennett (2008: 10) suggests that central concerns of craft are related to diverse materials involved in craft practice and their imperfection, in related desires to repair and improvise or to establish what he calls a problem-solving and problem-finding rhythm around technology. This rhythm tends to be reflected in an attitude towards ‘material investigation’ (Sennett, 2008: 224) based on found or imagined resistances and ambiguities in technologies, tools and practice-related problems, and of trying to improve one’s own skill in relation to them.

Such concerns have been noted as present and upheld in a range of digital-media-related practices that have demonstrated the continuous transformation of craft into new types of activity that encompass a wide range of cultural practices that go beyond narrow definitions of artistic work (cf Adamson, 2010). These range from countercultural technology building (Turner, 2006) through amateur creativity and digital maker cul-
tures (Gauntlett, 2011) to the practices and pranks of hackers (Coleman, 2014), computer game play (Liboriussen, 2013) and artistic computer animation (Tai, 2012) to practices of mother-operated hackerspaces in San Francisco (Rosner and Fox, 2016). Furthermore, studies of media industries have emphasised the persistence and importance of craftwork in all spheres of media production and its general neglect in scholarly research (e.g. Banks, 2010b). Using the concept of craft autonomy, which I borrowed from Coleman (2016), I suggest the persistence of craft-related concerns to represent primary vehicles that have shaped individual understandings of autonomy through and around engaging with free software for the production of computer graphics media.

The pursuit of individual interests towards a greater degree of autonomy is always related to, and shaped by, external pressures and structures (Bourdieu, 1993). In relation to the empirical material that I have analysed, I have located and discussed these pressures in relation to several aspects. I see them as related to a reconfiguration of ideals of autonomy and creativity in the context of the ‘spirit’ of capitalism (Boltanski and Chiapello, 2007), as well as in part in relation to contemporary media work, as I discuss in Paper 5. I also discuss them in relation to existing configurations of infrastructures of technological production and distribution, including piracy or industry-imposed limitations on software repair and development, as discussed in Papers 3 and 4. Not least, I discuss them as configured in relation to existing and new mechanisms for cultural funding, respectively, in Papers 1 and 3. In their different configurations and relations to broader structures and infrastructures of cultural production, autonomy in relation to technology takes the form of different, individual or collective formulations of possible futures and imaginaries of creative practice.

Finally, achieving greater autonomy in one aspect always creates other forms of dependencies. In some cases, these dependencies are self-imposed, forms of freely chosen obedience to new laws or ways of doing things, as ways to make and maintain differences, attempting to redefine a field of cultural practice (Bourdieu, 1992/1996: 77). Making a similar point, Becker (1982/2008) suggests that reliance on unconventional means or materials to create artworks establishes new dependencies of creating and transferring knowledge, technologies and gathering resources that can work with them.

---

5 I borrow the notion of ‘formulations of autonomy’ from the work of Olga Goriunova (2012: 7) on art platforms. She uses the term to mark one dimension of the plethora of individual experiments and projects of digital online culture that experiment with working methods, materials, contexts and outcomes.
in short, on creating and maintaining the infrastructure around which formulations and degrees of autonomy are shaped. In the empirical analysis, I do not focus extensively on the new dependencies that have been created around free software for computer graphics animation, but I nevertheless elevate the concerns of some media practitioners with such dependencies, e.g. in Papers 1 and 3.

Towards infrastructuring

If taken separately, each of the above-discussed concepts and the practices related to them have been used in media research to attract attention to tensions and ambivalent processes that surround the complex entanglement of user agency, technology and power in the contemporary digital media landscape.

One thing that the three concepts have in common is that they reflect specific modes of binding artefacts, economies and people together. Gifting creates bonds and power relationships between people, obliging them to produce and give away objects in public in a competition for status and recognition. Repair requires improvisation and involves the combination of sometimes unexpected things, people and cultural and economic practices that do not fit together naturally. Politics of value involves moving through and negotiating among different economies, value systems and interests. Such negotiating can both dissolve existing bonds and create new ones over time and over the life trajectories of people and objects.

In this sense, each of these concepts and practices can be seen as constitutive of infrastructures and representative of practices of infrastructuring. The concept of infrastructuring comes from the field of science and technology studies, and the specific area of participatory design, where it was developed by Karasti and Syrjänen (2004) in the context of a study of the practices of development of software by non-professional designers, such as a dog breeding community in Finland. The notion of infrastructuring, also combined with the concept of ‘artful integrations’ (Suchman, 1994, 2000), which I presented earlier in relation to repair, was derived from a specific social constructivist understanding of infrastructure not as large technical systems and material objects, but as relational and emerging ‘for people in practice, connected to activities and structures’ (Star and Ruhleder, 1996: 112). This relationality advanced an understanding of infrastructures not as specific objects or things but as relations between things. As Star and Bowker (2004) and later Larkin (2013) write, we should not ask what an
infrastructure is but *when* it is. Before developing more on *infrastructuring*, the next section will briefly outline some key ways of thinking about infrastructures.

**Infrastructures**

The notion of infrastructure was more systematically developed in the early 1990s within science and technology studies (STS), after which it was taken up and developed within anthropology and media and communication studies. Infrastructures are commonly understood as large technical systems and material structures that stand for ‘the forgotten, the background, the frozen place in technologically mediated practices’ (Star, 1999: 379) that form the background for other kinds of work. They represent matter that enables the movement of other matter, establish relations between things and people and have the capacity to operate on the level of fantasy and desire (Larkin, 2013).

The concept was developed more intensely within social constructivist studies of technology, particularly through the work of Star and Ruhleder (1996), Star (1999) and later Bowker and Star (2000). While researching the development and implementation of a large software system in a community of scientists, Star and Ruhleder (1996) came to define digital infrastructures not as fixed tools or hardware, as common understandings imply, but as ‘something that emerges for people in practice, connected to activities and structures’ (Star and Ruhleder, 1996: 112). They defined infrastructures as relational, emerging in relation to organised practices and contexts of use and with the power to include or exclude certain groups of users. This relationality underscores the rather abstract ontology of infrastructures: they are not specific objects or things but *relations* between things. I will return to this point below. This conceptual vagueness also represents a ‘productive instability’ (Larkin, 2013: 339) that makes it possible to conceive of and analyse infrastructures in terms of a broad variety of methods and objects.

Despite the fact that infrastructures do not have a specific form, they do have a number of qualities (Star and Ruhleder, 1996). They are embedded in other structures and social arrangements and they reach beyond a single event or practice. Infrastructures are also anchored in communities of practice (Lave and Wenger, 1991) and in existing conventions of practice.6

---

6 For an extended list of qualities, see Star and Ruhleder (1996) and Star and Bowker (2004).
This means that, for some groups in society, certain infrastructures become an object of work and care, while, for others, they remain abstract and often invisible. When infrastructures are taken up in specific practices, new relationships between artefacts, organisations and practices are established. John Durham Peters (2015) called this relationality in terms of media ‘logistical media’ or media that has ‘the job of ordering fundamental terms and units’ (37). Creating a bridge between how infrastructure is understood by both STS and media and communication studies, Leah Lievrouw (2014) explained the concept most broadly as the dynamic interrelations and organisation between artefacts, practices and social arrangements. She specified each of these categories, respectively, as the material devices and objects that enable, extend or constrain people’s abilities to communicate; the specific ways of describing communicative action; and the processes of making and remaking patterns of relations and institutional structures.

Anthropologists and media researchers have further deepened this understanding by emphasising questions of power and politics of infrastructure. In the context of urban infrastructure, Graham and Marvin (2001: 11) noted how infrastructure unevenly links systems and practices of production with systems and practices of consumption, being imbued with struggles for ‘social, economic, ecological and political power’ (ibid). In a turn to infrastructuralism within media studies, Parks and Starosielski (2015) have similarly argued that media infrastructures are at the centre of diverse imaginaries of how the production and distribution of media content moves and should move in the world. With examples ranging from cable infrastructures (Starosielski, 2015a) to infrastructures of production of consumer electronics for digital entertainment consumption (Acland, 2015), they add that infrastructures represent the ‘material forms as well as discursive constructions’ that make it possible to ‘understand the materialities of things, people, and processes that locate media distribution within systems of power’ (Starosielski and Parks, 2015: 5). Brian Larkin (2013) likewise states that infrastructures are about technopolitics, part of a liberalist tradition that aims to organise populations, practices and territories through technological domains that may seem detached from politics. Infrastructures create opportunities and limits, favouring certain interests over others (Edwards, 2003). Such systems of power operate, as Parks and Starosielski (2015) note, at multiple scales of relations and are
sustained through the labour, maintenance and repair that surround them across these scales.

Infrastructuring and media-related infrastructuring practices

The processes of sustaining and creating new infrastructures across scales and contexts can be referred to as practices of infrastructuring, which Karasti and Syrjänen (2004: 21) suggest is ‘the integration of new tools and technologies with existing people, materials and tools’. It means ‘the negotiation and sociomaterial configuration of how local needs can be adjusted and aligned to shared needs’ (Björgvinsson, 2014: 190).

Infrastructuring is a tentative and open process that, Karasti and Syrjänen (2004) argue, is about technology development beyond typical professional sites and that blurs the boundaries between making and envisioning technology and its use. It is about making technology through and within practices of its use. At the same time, infrastructuring is not only about making technology. It has a deeply socio-technical nature, meaning that the social shapes the technical, and vice versa; it is contextually embedded and socially situated (Karasti, 2014).

Infrastructuring takes time and includes the alignment of disparate interests and practices, emerging as a way to advance specific community interests (Karasti, 2014). It is about creating infrastructures through ‘situated politics as agreements and stabilizations are negotiated and performed by the various partners gathering around a particular sociomaterial issue’ (Björgvinsson, 2014: 190). Bringing the concept of infrastructuring to media and communication studies, Löwgren and Reimer (2013) have argued that moments of media production and consumption can get entwined in the design of infrastructures that support these practices.

For Löwgren and Reimer (2013), references to the concept of infrastructuring, in its gerund form, have been useful to bring attention to technological design processes and the role of a designer in them. Through this focus, they introduce the notion of ‘collaborative media’, or media that, they suggest, represent a specific cultural form for collaborative, mediated practices (Löwgren and Reimer, 2013: 16). Using the concept of infrastructuring, they problematise collaborative media infrastructures as non-human actors that change the role of professional designers, and the linking between human and non-human actors (Löwgren and Reimer, 2013: 146ff). For my purposes, I have not engaged in the question of imbrications of human and non-human actors and agencies that emerge through infra-
In light of the broader and rather open definitions of infrastructures that I discussed above, I am reluctant to steer infrastructuring into the domain and problems of design or to suggest the form it can take. Design of technologies can be one expression of infrastructuring, but there could be other expressions as long as they emerge in relation to perceived or imagined needs and problems around technological artefacts and are bottom-up, following Karasti and Syrjänen (2004).

Such a broader understanding makes it possible to see the configurations of practices of software repair and the sharing of artefacts online and the decommodification of software as practices of infrastructuring focused on building and configuring arrangements between creators of computer graphics media, software and practices of media content production. Infrastructures manifest themselves through usually small, mundane interfaces – an electrical outlet, a mobile phone, a computer screen – obscuring the potential scale of work, resources and sociotechnical arrangements behind them (Durham Peters, 2015). Through an infrastructural outlook at software, it can be seen as more than a mere production tool, but rather as an interface for cultural, economic and labour infrastructures that support its creation and distribution. As Gillespie (2003) comments in relation to the early software for website production and animation Dreamweaver:

Dreamweaver is not a program; it is a tool, a community of designers, an array of users, a medium, a corporation, and series of cultural expectations; its implications can only be made clear once this ‘system’ is brought into focus.

In short, it is part of larger arrangements of labour, skills and knowledge, and practices that altogether make the infrastructures for digital media production. Art sociologist Howard Becker (1982/2008) has also noted such an infrastructural outlook in materials for artistic work around which webs of collectivity are generated, constituting a vast range of social and economic activity into ‘art worlds’ as ‘collective action’. These webs of collectivity include, among other things, the people who produce materials for creative work, the knowledge frameworks that exist around these materials to make practitioners actually learn how to use them, the forms of production and distribution of these materials and the conventions surrounding both materials and works of art created through them. In short,

---

7 For a good discussion of these concepts and processes of imbrication, see Leonardi (2011).
the material base of creative work emerges as a centripetal force that can generate large-scale infrastructures around a specific creative practice.

The concept of infrastructuring presents a theoretical potential to extend the media practice perspective from action in relation to media to the specific and strategic establishment of new relations or the maintenance of existing relations between technologies for media production, users and practices around which they converge and are stabilised. Such a perspective resonates with recent calls made by Lievrouw (2014) and Löwgren and Reimer (2013) to attempt to reorient media research beyond established divisions of text production, consumption or representations and instead conceptualise them as integrated processes in relation to media infrastructures.

From the point of view of practice, the notion of infrastructuring brings attention to the ways in which webs of relations and social arrangements are formed around specific cultural practices and technologies related to media. The concept also makes it possible to see these structures as spaces of action in which different actors work to create links or disconnect existing links between people, practices, artefacts and ideas at different scales. It prioritises a micro-level analysis (Edwards, 2003) not of existing infrastructures but of the practices and processes of infrastructures in formation through which individuals attempt to negotiate individual goals by arranging new and rearranging existing relations between people, things and social actions related to media. Such an extension is similar to Kubitschko’s (2017) suggestion to focus on the ways in which different actors reshape media technologies and infrastructures. The concept of infrastructuring helps, however, to ground focus even further, on the bottom-up, micro-scale analysis of ‘the integration of new tools and technologies with existing people, materials and tools’ (Karasti and Syrjänen, 2004: 21).

I understand infrastructuring as cultural, economic and technological practices that are oriented towards the reconfiguration of existing hierarchising arrangements brought about through media technologies and infrastructures. Such practices may or may not involve writing computer code, for example, but they are fundamentally based on, and result in, shifts in the arrangements between technologies and the users of these technologies. They also rest upon the creation of new technologies. As such, rearrangements are always in flux and provisional, they are forms of contestation of established modes of doing things, they are always ‘in the making’.
As opposed to the majority of studies of media infrastructures that have focused on large-scale, industry-driven projects, the practice perspective has grounded my analysis at the micro-scale level. My focus is, hence, on the formation of infrastructures through the practices of the creators of computer graphics and animation media. Such a micro-focus allows me both to further develop knowledge on digital infrastructural formation and to locate it in the techno-politics and agency of media users that engage in the creation of new technologies for digital media production and the infrastructures around them.

From there, I have seen the practices of media creators who engage with user-driven software for the creation of computer graphics as practices of infrastructuring, of making and repairing new means for media production that reconfigure existing relations and by creating new relations, of ‘expressing’ (cf Kelty, 2008) new infrastructures through which digital media content, such as computer graphics media, can be developed and circulated.

Summary

The conceptual framework that I outlined above is composed along the nexus of regarding software for the production of computer graphics media in terms of a technology and an interface for an infrastructure that are imbued with politics and interests. Taking as the point of departure Raymond Williams’s (1974/2003) notion of intention and the assertion of agency to criticise the intention in technologies, as well as Feenberg’s conception of such practices as contestations of power and hegemonies built into technical systems, I have framed my theoretical enquiry as an extension of the media practice perspective through the lens of infra-structuring.

This framework has allowed me to turn my attention to practices through which user-driven software emerges, as well as the cultural and economic infrastructures around it. The concepts of repair, gifting and politics of value have brought further attention to ways to approach important forms that infrastructuring can take in the context of digital media production. Taken together, these three concepts complement one another and illuminate specific processes and practices of creating relationships between artefacts, people and existing structures, such as the capitalist market, or the media industries.
CHAPTER 5
Results and discussion

The research questions of this dissertation focused on exploring the cultural, technological and economic practices through which freelancers, aspiring digital media creators and small media production studios form alternatives to popular commercial software for the production of computer graphics media, the politics of such practices and the ways in which they matter for the field of digital media production and relate to existing structures such as the capitalist market. The objective was to add to the knowledge base in the field of media and communication studies about the technocultural politics that underpin the production of some of the material preconditions for creating digital media, such as software, and infrastructures that support and produce it.

In this chapter, I will first summarise my main empirical findings in relation to the two research questions that I posed in the introduction. I will then summarise the main theoretical results in relation to the theoretical framework and the areas of media research that I wanted to contribute to as outlined in the introduction.

Empirical results

In this section, I summarise the main findings that are reported in the articles. As each of the papers provides only partial answers to the research questions, my aim in the following section is to present my empirical analysis and the papers together in a more coherent narrative organised in relation to the two research questions that I have posed. The first question concerned the making of alternatives to industrially developed media authoring software for 2D and 3D computer animation production.

Making user-driven media authoring software

As already explained in the introductory and methodology chapters, my analysis was based primarily on two case studies: the work of an animation studio in Amsterdam in the Netherlands and that of a loose collective of
anime fans in Gorno-Altaysk in southern Siberia, Russia, that tried to create and shape the direction of the development of two programs, the free software Blender and Synfig, for the creation of 2D and 3D animation.

The analysis starts with Paper 1, which takes as its point of departure the decommodification of the two programs. Presenting the histories of Blender and Synfig and their move from proprietary to decommodified software, I outlined the trajectories of software development in relation to the creative ambitions of the industry designer who founded the Dutch Blender Institute and of the self-taught animator who launched the Russian Morevna project. These ambitions made them into strong initial drivers behind the development of the two programs. Instead of using available proprietary production tools, each experimented with various ways of developing a program that they wanted to be driven by their own production needs and ambitions and to fit their own production realities.

In the case of the Blender Institute, the intention was to mimic Pixar’s model of producing original films through software that was internally developed and extended in the process of making the films. In the case of the Morevna project, the intention was to reject, through software, the culture of, and dependency on, piracy, as well as to gain greater control over the affordances of software as a production tool.

In both cases, these intentions took the form of anchoring each program in the practice of producing films that were shared online as digital commons, and through which the functionality of the software could be redefined and given direction ‘from below’. However, since the films that the Blender Institute and Morevna project wanted to make could not be realised without the work of animators, technicians and other forms of artistic and craft labour, a crucial part of these experiments involved the creation of mechanisms for producing such labour and skills around these programs. These mechanisms were based on politics of value and power enacted through gifting, repair and artful integrations, all of which involved negotiating values and creating commensurability between different interests, as discussed in Paper 1.

The Blender Institute

Paper 2 focuses narrowly on the practices of the Blender Institute, which could be seen as spanning across three axes: regular, continuous sharing or gifting of diverse artefacts online, including software developments in Blender, in the course of producing its open animated films; continuous management and integration of the labour, skills and software improve-
ments made to Blender as a result of this sharing; and experimentation with integrating new economic models and the rationalisation of labour that could support the other two axes.

I show how gifting multiple artefacts online represented a strategic and not a benevolent way for the animation studio to attract creators of computer graphics media to use Blender, to create an audience for its own animated films and to enforce links between software users and developers.

Using gifting, the animation studio confronted the software industry and the Hollywood animation industry’s protectiveness of its technologies by producing and gifting films with high production values and production software that afforded these values. This lent the Blender Institute a countercultural dimension and turned gifting into a positive act of communication through which it criticised the established models for producing digital media and culture by making and showing working alternatives.

Simultaneously, as the studio needed creators of computer graphic animation and developers who knew how to work with Blender, it created a gift economy through which it would attempt to encourage others to embrace Blender software and share their work in public in the same way as the Blender Institute did, by producing and gifting a plethora of artefacts online. Using Marcel Mauss’s (1925/2002) work on the gift and Jean Baudrillard’s (1981) work on forms of value in symbolic production, I show how gifting created a cycle of software production integrated within practices of media production based on the subtle enactment of debt, obligation, status, discipline and social hierarchies through the exchange of a variety of digital artefacts of different value, such as software, culture and labour. Of specific value was Baudrillard’s observation of the duality of the gift that simultaneously represents a form of positive communication and agonistic confrontation that subtly obscures social struggles for power, prestige, transformation and humiliation under the positive veil of gifting.

The article argues that gifting revolved around the Blender Institute’s struggle for power, in relation to both media industries and its growing community of Blender software users. The preservation of power was contingent on the reproduction of the gift economy through regular, perpetual creation and sharing of Blender software improvements, training and films online.

Another important finding reported in this article was the existence of parallel, non-shared aspects and capital that were part of the productions of the Blender Institute and that have played a complementary but crucial role
in the development of the Blender software, as they helped make the open animated films on which the software depended reach completion. These included the subtle entering into barter relationships with the hardware industry, which donated important equipment to the studio for testing purposes; the strategic deployment of management techniques, which improved the productivity of the team working on the film by making their work public while keeping conflicts out of sight. Not least, as shown in Paper 1, the studio mobilised capital from the market, public sources of funding and its own community of users and audience, making the production of open films and thereby software into creative work embedded in a relationship of employment.

In doing this, as argued in Paper 1, the Dutch animation studio entered into a dynamic shift in its relationships with the users and developers of the software that emerged as a result of gifting. At certain times, Blender users and developers would be hired by the Blender Institute and thus become employees in film productions. In these cases, they had a great deal of influence over imagining what new features they needed and wanted the software to have as it emerged through the needs of practice. At other times, the same people could be volunteers, co-funders or users of Blender in other production contexts, such as freelance projects or professional media production in advertising agencies or studios that produce animation for television broadcasters. These shifts in relations required careful management and negotiations over values, as mentioned earlier and discussed in detail in Paper 1.

These relations and the complex economy in which they became embedded helped the animation studio create a cultural, labour and economic infrastructure that surrounded and drove the development of Blender at scale.

The Morevna project

The third article, Paper 3, shifts its empirical focus away from Western media production contexts and looks at the practices of the Morevna project to repair Synfig as a way to overcome the strong reliance on pirated software and the culture of piracy in the project’s creative practice.

Unlike the Blender software, Synfig became obsolete soon after its decommodification. As a result, it had to be repaired in order to become a production tool. In Paper 3, I show how the lack of hidden resources and capital that could complement an eventual gift economy that the Morevna
The Morevna project embraced reoriented the project towards finding mechanisms to find money, labour and skills by ‘artfully integrating’ (Suchman, 1994, 2000) available resources from the Internet and from the project’s local surroundings.

In this article, I took as the point of departure the role of frictions, failure and practices of repair as catalysing the formation of non-pirated, non-proprietary software and infrastructures to maintain and drive it further. My analysis focused on the process of the continuous mobilisation of economic, creative and technical resources from the local context of the Morevna project in Siberia, and from the Internet, over a period of 10 years. I showed how the careful and strategic integration of these resources with online resources produced in the end a fragile, non-pirated infrastructure for media production that became reliant on Synfig as a production tool for Morevna’s creative projects, and which in turn pushed Synfig’s development further.

This paper discussed how common local problems facing media practitioners, such as software piracy, can drive strategies to disentangle media practitioners from such relations and to bring together other groups of people – hackers, oligarch, and hobbyist media creators – who, in various ways, enable the development of user-driven, non-pirated media authoring software. I showed how the process of integrating local and online resources is crucial for these alternatives to become an actual infrastructure for media production.

I also indicated how the anchoring of these efforts in practice, such as animation film production, leads to situating the emergent infrastructure to fit the needs of the local practitioners who set the direction and functionality of software, but who occasionally get to trade their influence on this matter in exchange for financial resources that support the broader infrastructure around the software. In practice, this has meant, for example, that the key figures behind the Morevna project occasionally had to put aside their own creative ambitions and the needs of Synfig as a production tool, and temporarily traded their influence on this matter in exchange for financial resources that allowed them to hire a developer on a monthly basis to work on the software. Therefore, like Blender, the Morevna project also had to navigate complex politics of value and relations with different actors connected with the software, as discussed in Paper 3 and, in part, in Paper 1.
Making sense of and further shaping Blender and Synfig

The practices of gifting, repair and artful integrations that I examined and reported in the first three empirical papers were initiated and managed largely by the Blender Institute and the Morevna project, respectively, for their own purposes. However strategic they were, these practices did not have the power to force others to use the respective software. In order to use Blender and Synfig, creators of computer graphics outside of the respective film productions had to find their own reasons to use these programs in their creative practice, so as to want to engage in developing and shaping them further. These reasons are the subject of Papers 4 and 5, which expand on the exploration of the first research question and also provide answers to the second one.

Paper 4 sketches out some of the ways in which freelance computer graphics animators, digital painters and 3D modellers value the Blender and Synfig software projects in relation to their work. Using the concept of ‘negotiated autonomy’ (Banks, 2010a), I discuss the value of Blender and Synfig as evolving in line with the development of freelancers’ professional careers. It emerged that in the early stages of media creators’ careers, they often start with pirated software, partly for economic reasons. As their skills evolve, however, their choice of working tools becomes an increasing concern in terms of needing to account for proprietary regimes, costs and problems of upgrades to newer versions, as well as the specific affordances and possibilities for the extension of software.

In this context, some freelance media creators generally try to find free software as production tools such as Blender for 3D modelling and animation or Synfig for 2D use because of the greater possibilities they provide over their frameworks of production, their affordances, the responsiveness of software developers to everyday problems with the programs that emerged in use and, not least, the lack of expense associated with them. The article concluded that creative autonomy can be negotiated by artists and media creators not only in relation to institutions of employment or national politics but also through deliberate choices of tools, the digital technical toolset that they select and embed in their practice, an approach largely inspired and practised by some forms of hacker culture.

The last paper of the dissertation, Paper 5, extended the discussion and suggests that for creators of computer graphics media who work as freelancers for various industries, the two programs have become a locus of politics about finding material, or rather infrastructural, security in late
capitalism. I brought in Boltanski and Chiapello’s (2007) work on the ideological restructuring or ‘spirit’ of capitalism over the past six decades. Post-Fordist work in networked capitalism is, according to them, associated with promoting the cultural values of ‘creativity, reactivity and flexibility’. These values rest upon assumptions of normative and moral rules that make it possible to justify society’s engagement in capitalism and therefore need to promise some form of autonomy and security for individuals while serving the common good. Security, however, is precisely what post-Fordism does not offer. They argue that what it offers are simply more possibilities for developing one’s employability.

I discussed in the article how this spirit has been echoed in scholarly debates around media work in digitised media industries, and how free software for computer graphics animation gains meaning in media creators’ practices as a form of material capital that provides them with security and, eventually, greater employability by allowing them to mould their work tools in ways to meet their needs and to adjust to changing demands in work practice.

The empirical analysis in this paper further illuminated how creators of computer graphics media who have encountered Blender and Synfig have tried to establish links with programmers or with the Blender Institute or the Morevna project, respectively, who could help them mould these programs to fit their needs and the needs of their employers. In their role as artistic and creative labour, freelancers seek in these programs possibilities to improve their productivity and develop their creative portfolios. As a result, I argued, whereas they have gained a form of infrastructural security through greater control over their production tools and the direction of their development, they have also replicated precarity, replicating the work relationship they have with media industry contractors onto programmers.

The politics of these practices were thereby largely pragmatic: Blender and Synfig afforded them greater advantages in a highly competitive media production environment by bringing their work closer to forms of preindustrial craft.

Summary

The empirical part of this dissertation has illuminated some of the ways through which an animation studio in Amsterdam and an informal collective in Siberia have experimented with diverse ways of making and repairing software for the production of computer graphics media. Over a decade, these two projects and their experiments resulted in the making two
user-driven public programs to be used as production tools in the creation of computer graphics animation, creating at the same time *infrastructures for the skills, labour and funding that sustain them*.

The significance of these cases lies, on the one hand, in the production of non-proprietary software as a production tool that is aimed at bringing digital creativity closer to the material, algorithmic layer of digital media production and, through it, to craft practice and the individual needs and changing demands of practice. They also represent, more narrowly, forms of agency against broader tendencies of the displacement of specific cultural values of repair, exploration of the limits of the medium at the level of algorithms and the detachment of the software end-user from shaping and envisioning the direction of its development. These tendencies have a longer history that goes back at least to the development of graphical user interfaces, the commodification of software and the reorientation of forms of engaging with the computer as a medium by looking at surfaces rather than by addressing its code (Friedberg, 2009; Schaffner and Roberts, 2006; Turkle, 1984/2005).

On the other hand, rather than just representing production tools designed to be used to best advantage, the Blender Institute and the Morevna project have also been asserting and incorporating these values in Blender and Synfig through the strategic creation of direct, interpersonal relationships between funders, programmers and media practitioners. The practices of the gifting, repair and creation of cultural artefacts such as open animated films that test and further propel the development of software have been oriented towards anchoring software development in emerging needs of practice. As noted in Chapter 3, such approaches are not new. What is new, though, is the ways in which these practices have partially delegated greater power to software end-users – media practitioners – over the construction of an imaginary of the directions that these production tools should take. They have also created mechanisms for the reification of this power through the regular production of open-source animated films and a strategic commitment to sharing.

However, the creation of these new possibilities does not mean that their potential has been fully made use of. As I argue in Paper 5, the creators of computer graphics media who have adopted Blender and Synfig as production tools in their practice have used these possibilities predominantly for solving immediate problems or needs in their everyday production work. That is, they have adopted them more instrumentally to increase their own productivity, advance their own individual positions in the field or achieve
greater technological control over their practice. Therefore, even though computer graphics media creators could change some of the cultural values and power arrangements that surround their production tools today, these possibilities have been used in a rather limited way, as individual strategies to react to the changing labour relations and increasing precarity and competition in media industries.

**Theoretical discussion: Participatory cultures and the politics of technological unevenness**

As media authoring software has come to permeate the production of digital culture today, it has become an intrinsic part of the material infrastructures of cultural production. Similar to how new communication technologies like the Internet have provided a new arena for communication and self-expression, media authoring software has become a fundamental part of the new means through which symbolic cultural products are made.

The empirical material that I analysed focused on key practices through which three different but related groups of cultural producers attempt to create and influence the development of software for computer graphics animation and to make it useful across diverse media production practices and contexts. These three types included an independent animation studio in a Western production context; a loose hobbyist collective of anime fans in southern Siberia, Russia; and freelancers who generally work on short-term contracts for various media industries that require computer graphics production, ranging from Hollywood animation studios through game design and advertising. These have also included programmers to a limited degree.

The kinds of media production that I have analysed in this research have broadly pertained to the domain of open or public technological and cultural production. Suggesting, in the theoretical chapter, *infrastructuring* practices as an analytical perspective, it is fruitful here to bring up the observation made by Parks and Starosielski (2015: 11) that infrastructures emerge ‘in relation to conditions of difference and unevenness, they are fraught within relationships of power. The organization and use of infrastructures have the potential to reinforce or reverse unjust social relations.’ They further argue for the importance of developing a sensitivity to the ways in which different infrastructures function across contexts and locations around the world by attending to the local contexts and imaginations that guide the production of media infrastructures.
Much of the enthusiastic discourse on participatory cultures that emerged in past decades hailed the power of amateurs and popular-culture fans to create digital media with inexpensive, affordable and widely available technologies. As Jenkins (2006: 5) famously wrote in 2006, ‘everyday people have gotten their hands on the tools of media production and distribution’, adding that ‘new tools and technologies enable consumers to archive, annotate, appropriate, and recirculate media content’ (179). While the debates around participatory cultures have strongly oriented themselves in the direction of so-called Web 2.0 venues in which digital culture gets shared, governed and appropriated (e.g. Andrejevic, 2008; Gehl, 2011; Langlois, 2012; Teurlings, 2013), I have instead problematised some of the material aspects that surround the production side of such culture.

The way in which the sudden availability of tools – including software – for media production has been relatively uncritically taken for granted has tended to downplay the diversity and need for specialised production tools for specific kinds of increasingly technologically complex media production practices; the persistence of differences in the conditions of access to some types of tools necessary for digital media production, such as desktop media authoring software; as well as the real or perceived limitations in the affordances of such technologies to fit diverse ambitions and contexts of practice. Not every type of media can be made online or through industrially available online platforms. Also, not every digital tool fits the creative ambitions of every media creator.

For many of the ‘everyday people’ outside of Western contexts, as I discuss in the article on the Morevna project, the new software tools for making fan fiction and anime are often made available at the intersection between extensive and sometimes state-supported infrastructures of piracy and national attempts to crack down on piracy. In a technology-intense field such as computer animation, but also more broadly in the production of digital visual media, technology and technicality are crucial ways to establish differences and improve one’s status. Frameworks of piracy allow creators of digital media to acquire digital tools, software, and help them connect to the global, but they can also be experienced as equally constraining on the establishment of such connections, or they can establish differences through technology, provoking searches for new, non-pirated technological alternatives.

Existing as ‘infrastructures of breakdown’, as I refer to them in Paper 3, networks of piracy break down not because of the legal regimes that define what piracy is, but because the creative practices that emerge through such
infrastructures operate based on the premise of pre-existing and perpetuated distortion. Such distortion can take the shape of difference and distortion in media form (Larkin, 2004), but it can also be in terms of adding layers of hierarchisation that cause media producers to experience limitations on professionalisation, on experiences of artistic autonomy or on participation in a transformed global creative labour market. As the case of the Morevna project shows, with access to software through networks of piracy, individual ambitions for developing greater mastery in the anime genre, gaining status and recognition can also grow, and through them a need to establish differences through technology (Paper 3). The insights from Paper 4 suggest that piracy as a regime that establishes technocultural unevenness can be experienced as a barrier to building a career as a freelance artist working for film, game and television productions that rely on the production of 2D and 3D computer graphics media. These constraints should not be seen as solely confined to issues of legality in terms of how just or unjust contemporary copyright regimes are, as, for example, Lessig (2004) has argued. Rather, they reflect differences in politics of value (Appadurai, 1986a) that different cultures of production and communities of practice share. Attending to such differences at the level of technology and the material conditions for creating digital media in actual contexts and locations of practice is important for getting a more nuanced picture of the technological limits and struggles to overcome them that participatory cultures face.

Infrastructures of media piracy are also a good example for nuancing a general understanding of infrastructures as ‘invisible until breakdown’ and of logistical media that stand ‘under’ (Durham Peters, 2005: 30–33). As Paul Edwards (2003) comments, the notion of infrastructure as running smoothly reflects a Western bias: in the global South, norms of infrastructure are different and profoundly anchored in failure, disruption and corruption. Larkin (2013) provides examples of this from India, Mongolia and Zanzibar, making the case that, in these contexts, infrastructures such as power networks are made to be visible and spectacular, exhibiting status and power, or to produce political effects and senses of what it is to be modern and part of a specific future. Infrastructures of piracy, as I suggest in Paper 3, operate on the basis of a condition of permanent breakdown and relative visibility, and as such can also be generative of practices of repair.

In Western production contexts, as shown in the case of the Blender Institute, unevenness and differences in relation to media authoring software can take a different form in terms of subjective experiences of
limitations on engaging with software at the algorithmic level, repairing it and extending its capabilities and affordances. In a revisit to her earlier work on computer cultures of simulation, Sherry Turkle expressed a concern with a cultural shift that occurred with the entrance of new simulation software beginning in the 1990s. She described this shift as a move towards widespread ‘artful navigation of opacity’ (Turkle, 1984/2005: 14) that encouraged media software users and consumers to engage with the exploration of surfaces within software frameworks created by others rather than themselves. The proliferation of various computer graphics media content in online environments as a result of the products of creativity of the ‘people formerly known as the audience’ (Rosen, 2006) most often happens today within algorithmically predefined and industrially provided frameworks of creativity.

At the same time, the scholarly discourse on participatory cultures has tended to downplay the continuous growth in the ambitions of creators of digital media to improve their skills and positions in the field of digital cultural production by pushing the limits of the available technology. We cannot assume that the amateurs creating memes or digital art on platforms like Deviantart will always want to remain amateurs. The case of the Morevna project shows how technology for media production can be as important for amateurs as it is for technological elites like hackers or engineers. Further, the case of the Blender Institute shows how reaching limitations in engagement with software at the level of algorithms may be satisfactory and productive until a certain degree of professionalisation and practice is reached. However, it can also be experienced as a hindrance for creators of digital media who attempt to engage in high-end production, to create digital media with higher production values or to establish links of equivalence with the media industries.

In such cases, the ‘artful navigation of opacity’ (Turkle, 1984/2005: 14) through pirated or industrially predefined software frameworks illuminate the broader technocultural arrangements that produce unevenness in the field of digital media production, the dominance of the software industry in envisioning and setting the conditions, affordances and production frameworks of creativity, the power of piracy networks to spread these visions and conditions across the world and the struggles of creators of digital media to contest and negotiate these conditions.

In reiterating the argument put forth by Langlois (2012), suggesting that participatory cultures are governed by technocultural, algorithmic power formations, and that we should pay greater attention to the apparatus
through which communication takes place, the results of this dissertation emphasise the importance of also attending to the apparatus for producing digital media and the efforts for agency and creation of alternatives to conditions of technological unevenness.

The two cases that I have examined are arguably rather radical examples of reactions to some of these conditions of unevenness – most creators of computer graphics media and digital culture would admittedly not experience these as problems. However, while being extreme examples, the form and scale of reactions that they have taken provide ideas of the possibilities for user agency on technologically shaped limits of creativity based on rearranging and bringing together not forms, but available resources for economic and cultural production from the Internet in order to create user-driven and practice-driven authoring software for computer graphics animation.

Conceptualisations of user driven practices of media creation have been strongly related to a discourse of ‘user-led innovation’ (von Hippel, 2005), which ultimately also shapes the basis for new models of generation of value and exploitation (Terranova, 2000; van Dijck, 2009). The empirical results of this dissertation bring to the fore, with Jackson (2014), the value of turning attention away from innovation and focusing on failure, decay and breakdown in order to understand processes of new media development, and thereby of renegotiating some of the politics of technological unevenness. Software decay, decommodification and obsolescence can make software into a form of residual media (Acland, 2007) that, as argued in Papers 1 and 3, can become the site of reinvention and renegotiation of meaning, values and power arrangements.

Such reinventions should not be thought of as happening through fast and spontaneous processes of change enabled by networked technologies of communication – they are bound to slowness (3), strategy and, when possible, hidden capital (Paper 2). Writings on new forms of the organisation of production based around ‘commons’ and free software have advanced an understanding of the somewhat organic growth of communities, technologies, knowledge and economic wealth once software or culture gets free of its commodity form (Benkler, 2006; Shirky, 2009). However, as I show in Papers 2 and 3, it is far from given that the availability of public technologies or cultural artefacts shared as commons will actually organically lead to large-scale projects of transformations of technology, organisation and culture. Instead, strategic and long-term engage-
ment are needed in equal measure to reinvent and establish a software, a community of users around it and integrate it in practice.

Strategic engagement and integration is what I refer to as media-related infrastructuring practices. Infrastructuring is not about egalitarianism or a better social model for capitalist production, as opposed to notions such as commons-based peer production (Benkler, 2006; Benkler and Nissenbaum, 2006), but about local, user-led rearrangements of power around technocultural artefacts. From there, infrastructuring reflects an enabling process, a set of continuous practices and arrangements grounded in local contexts and ambitions that revolve specifically around technology that can enable other kinds of activity to take place, forming relations of power between people, artefacts and practices.

The forms that such infrastructuring can take may not necessarily either be radically new or representative of historical ruptures. In the two cases that I have analysed, they have consciously or unconsciously mirrored the ways in which corporations have, at least since the 1990s, been converging the production of media with that of technology in order to sell and develop the latter. Here, we can be reminded of the case of Sony, which redefined the cultural meaning of entertainment media in the 1990s in order to provide hardware to consumers (Negus, 1997). Similarly, the history of the radio industry in the 1920s in the United States reminds us of how sales of radios to the broader public were promoted by making a daily program service available (Barnouw, 1978/1979: 11ff), creating synergies between the production of technology, content and technological consumption. In industrial contexts, such approaches have exhibited the idea that a monopoly over the ownership of the technical process could lead to greater abilities to shape processes of cultural production (Negus, 1997: 87). In the two cases that I have analysed, the goal has been the reverse: to create public alternatives to monopolised software that makes it possible to avoid piracy and limitations to repair while engaging at the level of the software’s algorithms. In these cases, there could be noted a difference in the values that have been privileged: instead of economic value favoured by the media and technological industries, values such as repair, individual creativity and craft autonomy are more dominant (although not rejecting economic value and still considering it of importance for infrastructural maintenance). Nevertheless, these cases do not necessarily represent examples of innovation or new forms of social, or a better kind of, production (cf Benkler, 2006), but rather forms of user-driven, rather than industry-driven, exploration of the possibilities for converging technological production.
with that of forms of entertainment media through attempts to gather labour, cultural and economic resources from the Internet, markets, public cultural funding and their immediate local production contexts in order to create and ‘negotiate “one’s own technology”’ (Suchman and Bishop, 2000) within.

In the years of the rise of free software as a cultural phenomenon in the early 2000s, Mathieu Fuller (2003: 24) described programs licensed as free software to represent forms of ‘social software’, in which sociability was an important, dominant value. He meant social in the sense that it was developed as a result of an ongoing sociability between users and programmers, potentially reconfiguring the otherwise traditional hierarchical relationship between both: ‘It is software built by and for those of us locked out of the narrowly engineered subjectivity of mainstream software’, he wrote (2003: 9). Fuller also noted a recurring problem with free-software projects that stemmed from the fact that users and programmers were often the same people, with programmers envisioning the needs of non-technical users, whereas the latter were ‘normalised by proprietary software’ (Fuller, 2003: 27). This comment also reflects one of the reasons why Manovich (2013: 50) suggested that free software for media authoring still remains marginal.

However, the two cases that I have examined provide examples of the ways in which a reversal of the symmetry between programmers and users can be beneficial for creators of computer graphics media content to assert values of repair and sociality in such software as a way to serve practice needs rather than programmers’ imaginary of such needs (see Papers 3 and 5). Indeed, it is often assumed that it is hackers, programmers, or engineers – technological elites – who have the power to arrange and envision the contemporary material, technological infrastructures for digital media production. Media users and consumers are undeniably important agents in appropriating technologies in different ways (Feenberg, 2009; Silverstone and Hirsch, 1992) and in getting involved in important practices of ‘infrastructural contestations’ (Parks, 2015a: 365). But, as I show, we can add that users of technology can also claim power over developer communities through micro-employment and rhetorical power of diverse kinds (Papers 1, 3 and 5) and by integrating them into actual practices of media production by bringing them closer to the realities and needs of creative work. The concept of infrastructuring is productive in this situation to accentuate not only the processes through which software and infrastructures for computer graphics media in the present study emerged, but
also the fact that it was users – creators of computer graphics media – and not technologists who led these processes.

Values asserted and created in media authoring software through infrastructuring practices can be seen broadly in light of needs to establish artistic and craft autonomy in relation to the intangible materials for media production, i.e. software, and in enabling other creators of computer graphics to assert them too. Craft and artistic autonomy include the possibility to attend to the non-linearity of the creative process, which is in conflict with the necessary linearity and limitations imposed by algorithmic tools for creative work (cf Henderson, 1999), the unpredictability of the needs of work and creative practice and the possibilities to actively participate in technological, aesthetic and knowledge change related to technology.

Of course, creating such possibilities comes with greater responsibility and the need for mediation between different interests, or politics of value, as Appadurai (1986a) terms them. Making an infrastructure that surrounds more flexible production tools for digital media that are open to change implies the need for care and maintenance. At the same time, to the extent that value is relational, and, as Appadurai (1986a) argued, technological objects can traverse different cultural and economic contexts, values inscribed in, and ascribed to, software become contingent on change and potentially a source of tension and conflict. I have briefly touched upon the topic of conflict when observing how the production of an animated film can be a way to resolve tensions over values and priorities in software (Paper 5). Embedding such production in practices of gifting films, assets and software produces and affirms power hierarchies (Paper 2), not between users and developers of software but between diverse interpretations of autonomy, skill and practice-related knowledge on the part of media practitioners.

What can be concluded from here is that user-driven, rather than programmer- or industry-driven, software for making digital media needs to reconcile the value logics of two different spheres: that of making technology and that of cultural production. When subjecting software development to the value system of cultural production, it becomes dominated by the value mechanisms of that sphere: the building of symbolic capital through the production of ‘art’ in the broad sense (Bourdieu, 1986). As a consequence, even though the development of free software alternatives to proprietary and pirate media authoring software may be an act of agency in relation to inequalities of access or limitations in affordances, as
discussed in the previous section, its value for creators of computer graphics media is ultimately produced through the potential possibilities for gaining symbolic capital and creating differences through technology.

Conclusions

As Lisa Parks (2015a: 364) notes, the process of infrastructural formation involves particular arrangements of resources, which can include technical objects, natural resources and people. Together with Starosielski, she also accentuated the labour, maintenance and repair that are required to build and sustain them (Starosielski and Parks, 2015). The resources that I have addressed in this dissertation are somewhat different: hobbyists and freelancers who work or aspire to work in the field of computer graphics media production; oligarchs and companies; obsolete or underdeveloped software for 2D and 3D animation available online; and new economic models for creating economic, sign and bonding values from the Internet through online sharing and the creation of digital commons.

Approaching the combination and strategic integration of these resources as media-related practices of infrastructuring has been productive for accentuating the processes through which software and infrastructures for computer graphics media emerge and are stabilised through the ‘artful’ integration of new and old resources available in the digital media landscape. It has also been important in order to stress that it has been users – creators of computer graphics media – and not technologists who led these processes in two different geographical and digital media production contexts.

The value of a focus on practices of infrastructuring or technologies and infrastructures ‘in the making’, as Pipek et al. (2017) put it, has been increasingly recognised by scholarship focused on infrastructures within science and technology studies. As this focus and perspective start to penetrate the domain of media and communication studies and digital platform studies (Löwgren and Reimer, 2013; Menendez-Blanco et al., 2017), it opens up possibilities to complicate existing perspectives and dominant debates that concern digital media and cultural production. I will conclude this theoretical reflection by bringing up several such opportunities that have emerged through the research presented in this dissertation.

An infrastructuring perspective makes it possible to establish links between somewhat disconnected subfields and objects of study within the
greater umbrella of production studies of media if we refer back to the provisional division that I outlined in the introductory chapter. To the extent that infrastructures refer to specific arrangements between practices, artefacts and existing structures, their formation and rearrangements will always concern digital-media-related practices at multiple levels and in multiple sites and contexts. Realising this interconnectedness in the course of empirical research has, for example, presented me with the limitations of leaning on existing terminology that is often used to refer to digital media creators today, such as pro-ams (Leadbeater and Miller, 2004), produsers (Bruns, 2008) or media workers. Such divisions are, as Balsamo (2011: 3) notes, about legitimacy in the field of cultural production, but they tend to fall short in accounting for the shifts in creators of digital media between different categories as they engage in the repair of software, sharing media texts online and in creating or stabilising infrastructures for cultural production around technologies that they have control over. At certain moments in time, creators of digital media can be pro-ams, at other points media workers and then volunteers, as argued in Paper 1. An infrastructuring perspective helps illuminate the difficulties in separating industrial studies of media production, digital media production practices and infrastructure studies, and at the same time suggests that a focus on diverse infrastructures in formation around digital media can complicate our understanding of the interconnectedness and disconnections that exist between these different subfields of media studies.

Through infrastructuring practices creators of digital media establish new or reject existing labour, economic and skill development relations over time, redefining their meaning in relation to artefacts such as software and specific practices around it. One pressing conclusion that each of the papers subtly illuminates is the difficulty of thinking of practices that employ gifting, that engage with repair and commodification or de commodification of software and computer graphics films in dichotomous categories such as emancipation or exploitation, activism and resistance or reproduction of the status quo. They can be hard to qualify as either, as much as they have been hard to see in terms of either potentially new ways of organising media production or as new forms of software development. However, this difficulty can be productive for outlining new problems and complexities around digital media production. For example, Hesmondhalgh and Baker (2010: 56) have expressed scepticism about whether open-source models of production can offer better models of labour. From the perspective of labour and debates about media work, the case of the Blender
Institute suggests that it is difficult to provide a simple answer to that question. As the studio experimented with new ways of gaining revenues to support its software and studio infrastructure not from copyrights, but through sharing, it implicitly created less alienating conditions for the creative workers and programmers employed to work on an open film by making their work visible and sharing it online, as well as sharing the improvements in the software needed to make such work. At the same time, this also implicitly produced new tensions, as sharing became an expression of new management and disciplining practice, increasingly present in the software industries and public institutional contexts (see Christensen and Cornelissen, 2015; Flyverbom et al., 2015; Garsten and Jacobsson, 2011). Therefore, attending to specific infrastructuring arrangements can enrich the understanding, within production studies of media, of new attempts and experiments to develop criticism of the organisation of work in the new ‘spirit’ of capitalism that penetrates the digital media industries today, while also showing new, potentially problematic configurations.

Finally, a media-related infrastructuring practice approach can potentially enrich the growing field of critical studies of media infrastructures by extending the scope of its analysis from established infrastructures for distribution of media content and communications to ongoing and emerging practices of the formation of different kinds of infrastructures organised around new digital media artefacts or those that are becoming obsolete. Software, as I have shown in this dissertation, can be one such object, which, although intangible, is nevertheless an important interface for practices of infrastructural formations.

Limitations

This dissertation focused on digital media and software production in a very specific context and subfield of practice: the creation of non-proprietary computer graphics animation software. The empirical material that I used has been rather narrow, and it does not reflect the diversity of software alternatives or possibilities to shape them across an otherwise extremely diverse and vibrant field of practice that includes the production of games, advertising and television. I have also not engaged with practices of use and development of more popular, commercial software for animation production. These are limitations that clearly narrow the breadth of claims that I make to smaller and potentially rather extreme cases. On the other hand, the particular marginality of these cases makes it possible to enrich
and illuminate broader in the field of digital media production and shed light on possible alternative paths explored by creators of digital culture.

Another limitation of this research is the relative lack of historical perspective on the development of software for computer graphics generally. This is a notable shortcoming that is part of a broader problem of the scarcity of research on the cultural histories and recent changes in the political economy of computer graphics software, in comparison to the knowledge within media and communication studies on communication technologies. To overcome this limitation, this would have required conducting archive-based, historiographical research that would have been difficult in the time frame of the project. This is, however, an important possibility for future research that I outline in the next chapter.

In light of these limitations, the analysis and empirical findings are indicative of local and, to a degree, marginal processes of reconfiguring the material conditions for making digital media in a very specialised domain of media practice. Nevertheless, as I hope to have shown, they provide fruitful ground for deepening our understanding of some of the problems around the materialities of media production that creators of participatory culture face, and the possible opportunities and limitations that the online sphere, open technologies and practices of sharing provide for addressing them.

---

1 This problem has also been mentioned and partially started being addressed by Manovich (2013).
CHAPTER 6
Towards an infrastructural media
and communication studies

Contributions to media and communication studies

This dissertation was written within the field of media and communication studies. In this chapter, I summarise my main contributions to the field.

In the introductory chapter, I indicated a certain reorientation of media and communication studies towards questions and objects of research that concern the materialities of digital communication technologies: material infrastructures, algorithms, hardware and software, among others. This dissertation has connected to this general reorientation of media research through a focus on the practices and politics of creating one specific part of the intangible technologies that form part of media production infrastructures, free media authoring software for computer graphics and animation.

Whereas there is a vast understanding within media and communication studies about the organisational and cultural frameworks of the production of media texts, and likewise their reception, much less attention has been paid to the making of intangible, digital technologies that underpin the creation of digital media in the contemporary media landscape. These have been studied in other fields, such as software studies and science and technology studies, but they have been more marginal in media and communication studies.

I have contributed empirical material that sheds light on user-driven practices of making specialised media production software for 2D and 3D computer graphics in non-professional and industrial contexts. The specificity of the empirical material has further contributed to a deepened understanding of the ways in which open cultural production and obsolete or decaying digital objects, like software, can be an important and integral part of such practices. Through an empirical case from Russia, I have enriched debates on piracy and participatory cultures in non-Western contexts, deepening the significance of the practices of making non-pirated
digital media production infrastructure. One more contribution is in
deepening the understanding of media and communication studies about
emerging forms of non-industrial experimentation with new economic and
organisational models for computer graphics motion picture production in
digital environments.

I have further contributed a theoretical development in terms of the
media practice perspective (Couldry, 2012) by extending it with the concept
of *infrastructuring* (Karasti and Syrjänen, 2004) from science and
technology studies. Through this extension, which I refer to as ‘media-
related infrastructuring practices’, I have indicated that there is potential to
think of common practices of digital culture, such as sharing artefacts
online, in broader terms and in relation to how they are relevant to the
politics of the formation of some of the material infrastructures for cultural
production. I have found such an extension to be potentially fruitful in
adding a new layer of complexity to debates about digital participatory
cultures and their practices and moving beyond the now well-established
polarity of the emancipatory and exploitative dimensions of digital media
production.

Methodologically, I have emphasised the usefulness of ethnographic,
multi-sited and shadowing approaches to studying practices of digital
technological and cultural production. Much media and technological
production still happens in site-specific locations in which people, at least
occasionally, meet and work together. Therefore, there is still important
value in doing participant observation even in contexts of decentralised,
dispersed and temporally prolonged processes of media production.

**Why should we care?**

In this dissertation, I have empirically addressed the development of two
non-mainstream programs for the creation of computer animation, with
Blender being more broadly popular to date. I have also emphasised the
value of studying the practices of non-programmers for driving the creation
of such programs. Even though the software and the environments in which
it is produced that I have analysed might be seen as marginal, they are
important for shedding light on one significant and still undertheorised
dimension of contemporary digital culture: its dependency on, and
embeddedness in, software for producing the visual experiences that we
encounter in our everyday interaction with media of all kinds, e.g. television
advertising of shampoo, cosmetics or drinks. While selling the dreams of
better products, a better personal look, their imagery and appeal rely on complex physics and hair and fluid simulation algorithms, sometimes developed within large-scale computer graphics film productions, such as Pixar (Froemling et al., 2007; Petrovic et al., 2008). When we watch television, videos on YouTube or browse the latest furniture catalogues, we rarely think of the software used to make them, tending to read them at the representational level instead.

We live in cultures and aesthetics of simulation (Turkle, 1984/2005), in carefully constructed experiences of digital immediacy (Bolter and Grusin, 1999/2003). However, the remediated, familiar genres and media texts that we consume obscure the vast and complex technological apparatus – the software and hardware beneath – and the work of the people who create and envision it. Like undersea Internet cables, communication protocols and mobile telephone networks, media production software is ‘media that stands under’ (Durham Peters, 2015: 30–33), an important part of the infrastructure through which we live and experience media. Media and communication scholars have started to problematise media distribution infrastructure (Parks and Starosielski, 2015) and the complex politics of media technologies as sociomaterial phenomena (Gillespie et al., 2014). In affirming the importance of such studies and their call for greater focus on media infrastructures and materialities, I add that if we are to understand the role of media in culture and society – which is one of the central aims of media and communication studies – we also need to denormalise the constructed nature and politics of technologies that underpin everyday media beyond the Internet, including software for the production of computer graphics media.

As I have discussed in this dissertation, such software, in its varieties, is an object of work, care and tensions for amateurs and participatory cultures, but it is also a driver of change in the digitised production frameworks of the entertainment media industries. The emergence of infrastructuring practices that attempt to establish alternatives to dominant software are further indicators of the importance of such software for different cultures of production across the world. Lev Manovich (2013) has already made a call for more research into the histories of ‘cultural software’ in the field of software studies. Charles Acland (2015) suggested that the material conditions of our audiovisual experience today constitute a field in which value and distinction emerge, calling for greater attention to exposing mechanisms of technological and cultural power. In responding to these calls, I have made a further contribution through the histories and practices
of the development of two user-driven, free software programs for the
creation of computer graphics, specifically computer animation. Extending
these calls, I add in the next, final section a range of possible directions and
aspects that future research could address.

Future research

On the one hand, future research could explore the potential and limi-
tations of the infrastructuring approach in media and communication
studies by identifying and studying a broader scope of practices and
processes through which creators of digital culture reappropriate or
integrate underdeveloped software and hardware tools with existing people,
practices and artefacts. What kinds of media production or consumption
are enabled through media infrastructuring practices? Who engages with it
and why? In what contexts, and what politics do they have? How do they
relate to existing technocultural conditions for media production in local
contexts and at specific times? In answering such questions, it would be
important to consider the politics of technological difference across con-
texts, gender dimensions and practices that are not always visible online.
The domain of free software development provides a rich arena for studying
such questions. For example, similarly to how I have approached free
software for computer graphics media, communities of music producers
who develop free software for music recording, editing and mixing could be
studied, like Ardour, or programs for digital painting, like Krita.

Within science and technology studies, infrastructuring is often associ-
ated with the potential to make more participatory and democratic practices
of technological development. My goal in this dissertation has not been to
examine the extent to which media-related infrastructuring practices can be
participatory or democratic, and I have indicated in the conclusions that it
may be difficult to assess their emancipatory dimensions. Nevertheless, it
could be an important part of future research to have a more sustained
discussion about these possibilities in other practices of infrastructuring
digital media.

Furthermore, there could also be other domains of practice, such as
infrastructuring around refurbished or second-hand media hardware or
around other kinds of media materialities. Considering the richness and
extension of domains that this approach has seen in the field of science and
technology studies (Karasti, 2014) and its outlined potential for integrating
studies of media production with technological design and consumption,
Löwgren and Reimer (2013) suggest that further research can develop new methodologies for studying such integration. The present dissertation encourages further to ask how can varieties of infrastructuring practices be captured over time and across locations that stretch both across mediated online and physical contexts?

Another direction of future research could be to develop more empirical studies anchored in genealogical and historiographical approaches that could shed light on the histories of computer graphics software and hardware development within major media industry contexts, e.g. by studying their development in studio production contexts in corporations like Pixar, Dreamworks, Sony Entertainment and Japanese studios like Ghibli or in local and non-Western production companies. Such histories and accounts of ongoing practices are strikingly absent, but they would enrich our understanding of the production of materialities and infrastructures of media and extend the scope of research in subfields like infrastructure studies and media industries production studies.

Finally, further research could also address the important aspect of the hardware that is necessary to render and process the ubiquitous computer graphics media that saturate the digital media landscape and everyday life today. Computer graphics are produced through computation processes of rendering that, depending on the desired production values, may require from several to thousands of computers. Increasingly a part of large data centres and cloud computing infrastructure, online rendering farms have been rapidly emerging in the past few years, integrating the production of computer graphics media with the infrastructures of data and cloud computing. Research in this direction could connect computer graphics media production with research on the environmental consequences caused by the materialities that surround media production and consumption (Gabrys, 2015; Hogan, 2015; Maxwell and Miller, 2012). A critical enquiry in this direction could potentially bring into relief some of the glamour surrounding the aesthetics of simulation and computer graphics media as they have become an intrinsic part of everyday media culture.

The human, software and hardware infrastructures that surround computer graphics media production are deeply integrated with multiple dimensions of concern for media and communication research. This dissertation has contributed by addressing only one minor part of these infrastructures. My hope is that, as the field of infrastructure studies keeps growing, this domain of media practice will become an important part of more sustained enquiry in media and communication research.
PART 2
The Papers
At the Intersection of Commons and Market: Negotiations of Value in Open-Sourced Cultural Production


Authors: Julia Velkova and Peter Jakobsson

Abstract
This article explores the way in which producers of digital cultural commons use new production models based on openness and sharing to interact with, and adapt to, existing structures such as the capitalist market and the economies of public cultural funding. Through an ethnographic exploration of two cases of open-source animated film production – *Gooseberry* and *Morevna*, formed around the 3D graphics Blender and the 2D graphics Synfig communities – we explore how sharing and production of commons generates values and relationships that trigger the movement of producers, software and films between different fields of cultural production and different moral economies: those of the capitalist market, the institutions of public funding and the commons. Our theoretical approach expands the concept of ‘moral economies’ from critical political economy with ‘regimes of value’ from anthropological work on value production, which, we argue, is useful to overcome dichotomous representations of exploitation or romanticisation of the commons.

Keywords: animation, Blender, commons, cultural biographies, decommodification, moral economies, open-source cultural production, regimes of value, Synfig, value
Introduction

New models for digital cultural and creative work based on openness and sharing have, during the last decade, enriched the field of cultural production, as well as production within other sectors such as software and technical innovation (Benkler, 2006; Thrift, 2006; von Hippel, 2005). The hopes and expectations for these production models are many, ranging from the fulfilment of economic goals of efficiency to cultural and democratic goals of inclusiveness and participation (Bruns, 2008; Jenkins, 2006; Tapscott and Williams, 2008). Whatever the long-term effects of open-source, crowdsourcing, open innovation systems, etc. are going to be, there is a growing realisation that not only are these models here to stay, but that they are also already interacting with the wider fields of cultural and knowledge production. As public funding institutions and the media industries are adapting to open production models, so are cultural producers within the new production models adapting to, and interacting with, existing structures. In the theoretical discussions concerning these phenomena, there are disagreements about the implications of the interaction between markets and commons, and there are considerable concerns about what processes of commodification will mean for open production (Jakobsson, 2012; Prodnik, 2014). Whereas some argue that the logic of the market is exploiting open-source and commons-based cultural production, others argue that these new production forms are going to have politically radical effects on societies and the economy (Hardt and Negri, 2009; Söderberg, 2012).

This article extends these debates through an empirical analysis of the interaction between market and commons observed in two cases of open-source and commons-based cultural production through an investigation of open-source animation film production within the 3D graphics Blender community and the 2D graphics Synfig community.

There are surprisingly few empirical studies that try to analyse the implications of such interactions. While there exist several theoretical models of cultural production that take into account the potential interactions between market, the institutions of public cultural funding and commons-based producers, and which we briefly review in the next section, these models have often had relatively little to say about the outcomes and the forms that these interactions can take. It is our claim in this article that we need to study these interactions within concrete open production practices, as they will both provide valuable lessons for anyone involved in
open-source and commons-based production, as well as producers within 
other spheres, and are crucial for constructing encompassing theories of 
cultural production, media industries, commons-based production, etc. 
This article proposes a theoretical and methodological framework for 
conducting such studies.

Research on commons-based production 
and its relationship to the market

The British critical political economist Graham Murdock (2011) suggests 
that a useful way of conceptualising the relationship between the economy 
of the market and the economy of the commons is to think of them as 
distinct moral economies. Economic systems, he argues, cannot be con-
sidered only as systems for managing resources, they also entail a moral 
outlook that corresponds to the economic rationality of the system and 
legitimises the functioning of the system. In a market system, actors are 
morally obliged to act as rational utility maximisers, whereas in a com-
mons-based economy actors are supposed to act according to a morality of 
mutuality. While we agree on Murdock’s general framework, and particu-
larly his insistence on including both economic systems and systems of 
beliefs and values in the analysis, we think that the model suffers from a 
dichotomous thinking that recurs in a lot of the recent work on cultural 
commons production and its relationship to the market. Much of the 
research on the interactions between different moral economies with regard 
to commons-based and open-source production has concentrated on 
theorising the exploitative powers of markets and capital (Andrejevic, 2008; 
Arvidsson, 2008; Cova et al., 2011; Firer-Blaess and Fuchs, 2014; Roig et al., 
2014) or, conversely, on the gains that the market can make by initiating 
such relationships (Benkler, 2006; Leadbeater and Miller, 2004; Weber, 
2004). In both cases, it is, however, assumed that the agency and will to 
establish relationships between the market and commons rests within the 
market, whereas relatively little is said about the actors within the sphere of 
the commons. Critical political economy approaches have also had a 
tendency to romanticise commons-based production, and accounts of, for 
example, how commons-based cultural producers initiate relationships with 
the market and the media industries are therefore not very prevalent. The 
macro-perspective favoured in many of these studies, even when combined 
with qualitative and even ethnographic methods, has also tended to result in 
generalisations that obscure the variety and diversity of practices, social
organisations and exchanges taking place in commons-based production. By focusing on dichotomous relationships at the macro-level, previous studies have often ignored the organisational sociologies of free and open-source software and thus failed to understand the often mixed and conflicted ethics, politics and economics of open production¹ (Coleman, 2013: 207–210).

There is, of course, a range of other theoretical frameworks besides critical political economy that try to take account of the interactions between different regimes of valuation. Manuel Castells (2009), for example, argues that the existence of global networks (military, financial, media) in the network society is predicated on the production of value, and that they are competing over which value will come to dominate over the other values. Once again, however, there is not enough consideration of the micro-levels of the competition between different regimes of value, and it is difficult to say, through such approaches, what forms these competitions take and what their outcomes are. In the following sections, we therefore suggest that these macro-theories can be beneficially complemented with an anthropologically inspired approach that pays attention to the intricacies of the negotiations between different regimes of value at both the organisational and the individual level.

Regimes of value in cultural production

Our approach to how to analyse the establishment of relationships between commons and market is to follow objects and people as they move between what Arjun Appadurai has referred to as ‘regimes of value’ (Appadurai, 1986a: 4), and what, in other literature, has been discussed as ‘systems of belief’ (Bolin, 2009; Bolin, 2011; Bourdieu, 1993), and to map the negotiations that these moves trigger. This approach is inspired by Igor Kopytoff’s (1986) suggestion that the production of a commodity should not be regarded only as a material process but also as a cultural process, which consists in marking certain things as commodities. By replacing the word ‘commodity’ with ‘thing’, he turns our attention towards the cultural and social processes of attribution of value. This perspective invites us to note the potential shifts of value that occur when an object is inserted, taken out of or reinserted into the circulation of commodities, and suggests that

¹ It should be noted that there is a slight preponderance of empirical studies focusing primarily on the Linux or Wikipedia communities, meaning that other examples are needed to construct more encompassing theories of cultural production.
neither commodification nor decommodification necessarily marks the end point in the biography of a ‘thing’. In this sense, commodification is ‘best looked upon as a process of becoming rather than as an all-or-none state of being’ (Kopytoff, 1986: 73), and the biography of an object can occasionally contain and reflect the movement of a thing between different regimes of value, being at one moment of its biography a commodity and at another moment a part of the commons. We find this important in order to move beyond the dichotomous conceptualisations mentioned in the previous section.

In our analysis that follows, it is also important to note how actors who are, in a certain sense, rooted in the economy of the commons initiate shifts between different regimes of value in order to maximise the value(s) that can be extracted from their products, and which they themselves also exploit. Also important are the conflicts that this brings to the community. Objects produced within the community are experienced by some members as ‘singular’, meaning that they are perceived as exempted from exchange value and thus should not be exchanged in the market. Other community members, however, attempt to make the products produced by the community commensurable with the values of other regimes of value (e.g. market or public institutions) and thus exchangeable (Comaroff and Comaroff, 2006). These conflicts are political in the sense that they concern the underlying rules and values of the community, and the outcomes of the conflicts tend to reproduce the relations of power and influence between community members. This, we argue, allows for a nuanced analysis not only of the relations between different regimes of value, but also of how these are constructed and negotiated within the different spheres of the regimes themselves.

For those familiar with Kopytoff’s and Appadurai’s writings, we should perhaps underline that methodologically our biographical perspective is not restricted to artefacts but also includes, more conventionally, people. Kopytoff’s remark that production is a cultural process that marks objects as belonging to different regimes of value is also relevant in relation to the producers themselves. Through the act of production, people are marked as either waged labourers or amateurs, as employees or members of more informal communities. This process of labelling determines, in turn, their relation to, and position in, regimes of value. We have also adopted a broader definition of what constitutes an object, since digital objects are somewhat different from the objects that Kopytoff discusses (Lesage, 2013). The ontology of immaterial objects such as software, algorithms, code,
media and images presents some problems for a biographical analysis. Are we, for example, to follow a single copy of a software, if one can speak of such a thing, or is it the code as such that is to be followed biographically? This is a question of method, and acknowledging the challenges to ethnographic research in digital media contexts (Markham, 2013), we have favoured thinking in broader terms and speak about ‘entities’.

Method and material

Below we develop the theoretical points discussed above in an analysis of open-source production of two feature animated films with the code names Morevna project and Gooseberry project, formed around two open-source graphics communities: the 2D animation Synfig Studio community and the 3D Blender animation software community. What we take as ‘entities’ to follow biographically are the production software, the animations produced with that software and the people participating in the production. It is important to emphasise that the Blender community is to date the largest and most mature in the domain of open-source digital computer graphics and media production. Its existence as an open-source project since 2002 made available far richer material for our study in terms of analysing the shifts between different regimes of value than Synfig/Morevna. While for our purposes it was important to have a comparable case to suggest some generalisations, Synfig and Morevna represent a smaller and newer community that has only been active since 2008 and is still experimenting with models of scaling up and developing funding models. Recognising this difference is important in order to emphasise the time it takes and difficulties that open-source projects face in developing sustainable platforms for community, media and software development.

The material has been collected through a ‘multi-sited’ (Marcus, 1995) ethnographic approach, where understanding of cultures is built through tracing the changing nature and use of things in different contexts (1995: 105–108). This has involved tracing documents and relevant data in both online and offline settings, performing face-to-face and Internet-mediated qualitative interviews with 35 individuals and conducting participatory observation in online settings and in situ among the producers of the two animated films. When speaking of ethnography, we have adopted the view

2 For the projects, see: www.morevnaproject.org and gooseberry.blender.org; for the communities: www.synfig.org and www.blender.org.
from media studies research that short but regular periods of immersion in geographically dispersed cultures can be equally fruitful as long, continuous observations (Bolin, 1998: 26). Julia Velkova has been immersed in different ways for a period of one year in the production of one of the films, Gooseberry, and for about a year and a half in the production of the other, Morevna.

The Blender and Synfig software projects: from commodities to commons and beyond

Our empirical investigation starts with the histories of the Blender and Synfig open-source graphics communities, and, in particular, the ‘biographies’ of the Blender and Synfig software projects used for the creation of Gooseberry and Morevna.

The Blender 3D animation software had its inception in the early 1990s within the small, independent Dutch animation studio NeoGeo. It was initially developed as an in-house, proprietary tool. Made by people with predominantly artistic and design backgrounds, it responded to a need at the time to have cost-efficient tools under the control of animators. As one of the founders of NeoGeo, Ton Roosendaal, explains:

it worked extremely well for our own work because you could tweak the software in a way that would work for you really fast, and get everything [done] well and controlled. (in Niederer, 2009)

The need for such controllable tools was the foundation for the further development of the software and established the premises for a later transition from a proprietary to an open-source model. In 1998, the software went online and, while remaining proprietary, it shifted to a freeware model that led to the gradual formation of a user base. During the years of the dotcom bubble, the software faced an uncertain future as the studio went into bankruptcy. To resolve a debt issue with investors, NeoGeo attempted in 2002 to raise €100,000 from its users in order to finance the release of the software as free and open-source under a GNU/GPL licence. The campaign, which may represent one of the first examples of online crowdfunding, succeeded, and since then Blender has been a free software project. This example demonstrates how a community of users can take an object – a software tool – from the market and convert it into common property, a

---

3 For more information on this time in the Blender software history, see Neus (2002).
process that has been labelled as ‘socialisation’ of tools (Suoranta and Vadén, 2008: 161), and which, at the same time, illustrates the move of a commodity from the sphere of the market and one system of valuation to the sphere of commons and a different valuation (Kopytoff, 1986) and morality (Murdock, 2011).

The process of open-sourcing the software involved a shift in the status of the initiator and main developer of the software, Ton Roosendaal, who became recognised by the Blender user community as its ‘benevolent dictator’ for life. The role of benevolent dictator in free-software projects is usually assumed by individuals with a strong reputation, charisma and authority among the community members and who signify a strong identification between projects and their founders (O’Neil, 2014). In the case of Blender, there was an additional peculiarity: the role of benevolent dictator was supported by the economic exchange through which a renegotiation of decision-making and authoritative power took place. While, in most free-software projects, the community creates mechanisms for self-regulation, organisation and decision-making (Coleman, 2013; O’Neil, 2014), in the case of Blender its initial founder set the framework of this relationship, navigating between his personal agenda and the wishes of the community. As he stated: ‘this makes me need to listen, see where there are issues in Blender, try to [resolve] them, but also try to move them’ (in Niederer, 2009). During this process, Roosendaal also founded a new commercial entity in the form of an animation ‘studio for open projects’: the Blender Institute. In addition, a non-profit organization, the Blender Foundation, was established in order to take care of the legal and economic aspects of the free-software project. The establishment of these three entities – the Blender Institute, the Blender Foundation and the community of artists and developers surrounding the Blender software – suggests a very intricate web of relationships involving many negotiations over values, and production of new values and goals. The aim of the commercial animation studio has since been to develop open-content animated films (predominantly shorts) of industry quality in order to speed up the development of the Blender software. This has been tested so far through four short productions, with Gooseberry being the fifth and most ambitious one, aimed at creating a feature film. The animated films and the assets (graphics, artwork, animation, software) that the studio produces are released under an open licence, but the studio still manages to generate and circulate money to try to make the production viable, something that we discuss in detail in the next section.
The other software in focus, Synfig – a 2D animation software – was developed in the early 2000s as a proprietary in-house animation tool within a small, US-based animation studio called Voria Studios. Like Blender, it also faced bankruptcy and in 2005 released the code as free software under a GNU/GPL licence (Synfig Studio Documentation, n.d.). This was a way for the initial founder of the software, Robert Quattlebaum, also an artist and designer, to give it a chance at further life:

> While we were a company without customers, we are not a company without a product – and our product is quite powerful … I refuse to just let this software evaporate into oblivion. (Quattlebaum, 2004)

Thus, the Synfig software tool also went through a process of decommodification, but in this case the process did not involve any monetary exchange. Nor did the author and owner of Synfig retain an active role in developing the software or in Synfig-based animation projects. Nevertheless, in 2013, a transaction consisting of a small grant of $5,000 from the private fund of the philanthropic Shuttleworth Foundation also shifted the power relationships in the community by making an individual based in Siberia, Russia, Konstantin Dmitriev, the de facto benevolent dictator in the community. As was the case with Blender, Dmitriev also runs an ambitious open animation film project for creating a 2D feature-length animated film, Morevna, based on the Synfig software. The two communities and software projects thus share a similar background story but, as we will show next, the differences in how these communities developed highlight two different, and in some aspects even opposite, relationships between commons and market. The Blender community, with its benevolent dictator and surrounding legal entities, was substantially influenced by its origins as a commercial product, whereas Synfig veered in a more unstructured and self-organizing direction after its decommodification:

> Open-source started with communities, Richard Stallman, the Linux and so on. This is not the way Blender started. This is a very big difference. Because the … other open-source projects do not look at the industry. Blender is not typical, it is not coming from this movement. It is the other way around. (Interview with Ton Roosendaal, August 2014)

The Blender project and community actively sought ways to enter and maintain relations with the market – Blender exists ‘between community
and market’, as Roosendaal puts it¹, while for Synfig, these relationships have been less obvious. These differences can only be understood in the context of the broader biographies of the Synfig and Blender software and communities, which we develop further in the next section. As will become clear, the different life paths of the two communities have also laid the ground for the subsequent shifts between different regimes of value, between the market, cultural funding institutions and user communities.

Shifting values in the open-source production of animated films

In this section, we take a closer look at the shifts between different regimes of value involved in the production of the Blender Institute’s fifth and most ambitious animated film Gooseberry, and the Synfig-based equally ambitious 2D anime project, Morevna. Both projects have been aiming to create open-content, feature-length animated films by using only free and open-source software tools. This means the films can be regarded as entities that generally reside in the value regime of commons. However, key moments from their production biographies have involved attempts to establish, and the actual establishment of, a spectrum of economic relationships with the market and public funding institutions.

For example, since its inception, Gooseberry has been perceived and presented by the Blender Institute as a low-budget film production. Its budget has been estimated at; ideally three to five million euros’ (see Price, 2014). While this may seem low in comparison to an industry where the productions of Disney, Dreamworks and Blue Sky are measured in millions per minute of animation, the Gooseberry budget sets a precedent in the larger context of commons-based and open cultural production. Attempts to value crowdfunded animated films have suggested that, as of 2012, their costs per minute have been up to $15,000 (Amidi, 2012). For Gooseberry, this figure is higher, and the discourse surrounding the production has constantly attempted to compare it to the industry and not to existing open-source communities. As the director suggested when confronted with differences between the work of professional studios and the Gooseberry project:

—

¹ The source of this and similar quotes used in text later on is fieldwork and interviews conducted in the course of research.
Mathieu: Pixar projects take four to five years internally and thousands of people. Blender Institute [sic] did Sintel\(^5\) in six months with like eight people. So it is very difficult to compare those two because it’s not the same means at all. And expense, and budget. A Pixar movie is $200 million. Per movie.

Julia: But is the ambition to be comparable? Mathieu: Yeah! To me it is. And we can. (fieldwork, August 2014)

Therefore, we can observe that while from one perspective the values associated with the production of Gooseberry reside in the domain of the commons, at the same time the project strives to adapt and associate itself with the market and the industry. This has also been visible in the division of roles and hierarchies within the production of the film. While on a day-to-day, interpersonal basis, the participants in Gooseberry have maintained informal relationships and rather flat hierarchies (Velkova, 2014a), within the frame of concrete work on the production, these have been highly vertical, as reflected in the role division, which is borrowed from the industry, with a producer, director, technical directors, art directors, character animators, riggers, modellers, etc. And their own perception has been that there is not much difference between them and the industry except for the focus on sharing and open-content production:

Do you watch Game of Thrones? … So, it’s high production value, it looks good, and it’s extremely efficiently produced. … What we do is not that different. The only thing we really do differently and we are going to do radically is sharing … (Interview, fieldwork, August 2014)

An obvious difference has, however, been the scale of resources, which has led to creative solutions and a variety of approaches to raising funding from the market, public funding bodies or its own community. With regard to public cultural funding, the Blender Institute and Gooseberry have managed to raise about €200,000 through a grant from the European Union (EU) Media programme\(^6\) in order to enable the full-time temporary employment of software developers from the Blender community and people to document the film production. The project has also received financial support from the Dutch governmental Enterprise Agency. This shows the belief of

\(^5\) Sintel is an earlier short film by the Blender Institute.

\(^6\) Since 2014, the EU Media Programme has been known as the Creative Europe Programme.
the Blender community’s leader, its benevolent dictator, that the creation of cultural commons should not be totally volunteer-driven and free from monetary exchanges, something that inevitably leads to a negotiation of values between the regimes of, in this case, the institutions of public funding and commons.

With regard to the market, the project has established numerous ties to the creative industries in the Netherlands, from recruiting individuals to do dialogue and voice recording for the film to attempts to pitch for money from private investors. As part of the latter, it produced a limited-edition pitch book that has been handed in to different investors. The book framed the project as ‘filmmaking from the future’, emphasising its unique business model, which combines a studio, a free-software community and a potential market established around open-source technology development and open-content sharing. The exact return on investment for investors was not clearly formulated, yet it implied benefits from potentially substantial exposure in the eventual success of this large-scale, though high-risk experimental project. While some participants in Gooseberry have been positive about not having an investor, as it provides substantial creative autonomy to the project, the stated goal of producing films of industry quality has led the project to attempt to enter into such relations. Lastly, Gooseberry attempted also to raise funds from within the Blender software user community. As stated by one of the Gooseberry participants:

We are actually seeking from the community about €1.8 million in the end and it is very hard to raise such an amount of money in 40 days or a month. That’s why we decided to set up a Blender Cloud subscription. That’s how we decided to make the crowdfunding as a subscription-based system, because in this way people can donate small amounts of money during the production as it happens. (Interview with F. Siddi, Price, 2014)

The Blender Cloud has aimed to replace pre-sales of DVDs and other forms of prefunding that have been tested by the Blender Institute in earlier productions. Members of the community can demonstrate their support for Gooseberry by donating directly through long-term subscription to the Cloud. The Cloud also demonstrates the possibility for those who produce digital commons to develop their own independent infrastructures (Löwgren and Reimer, 2013: 18) and seek opportunities to generate money from their own community. An initial campaign for €500,000 of crowd-funding through subscriptions failed, however, and the production temporarily scaled down. From the perspective of value shifts and their nego-
tiation, the introduction of the Cloud infrastructure is an important element, as it represents the introduction of a wall between free and paid access to content, including all previous open animated films by the Blender Institute and a substantial volume of open-content training materials. Content available in the Cloud represents, in this sense, a hybrid between being a commodity and belonging to the commons. This presents an example of how those who produce digital commons try to commodify their own open content while trying to remain faithful to the principle of commons and knowledge sharing. While the Cloud does not restrict access to technology, it puts up a barrier to accessing the content and the knowledge bank that has been developed, such as tutorials for animators, music, graphics, archived blog content, etc. This has caused reactions:

many people accuse openly these projects to be like bad projects, people are saying, “Ton wants to make a feature film. So, he is asking us for money. Right?” I mean, in a way it’s almost like that, because it’s true that we want to make a film. But, we give back so much, that you can actually forget about the fact of producing a movie. We do it to make the software better. (Interview, March 2014)

The last part of this quote suggests that the development of technology through the production of a film is valued more highly by the community than the aesthetic expression and actual film itself. What is interesting here, from the perspective of value creation and the biography of things, is that while the technology remains in the commons, the film content produced shifts its status from commons to commodity. What was presented to potential investors was the open-source aspect as a unique quality that should be supported. But what was being sold to the community was content through subscription to the new Cloud service.

Morevna has also been actively trying to find funding schemes to enable artists and developers to be employed. For nine months, it kept running a successful crowdfunding campaign aiming at gathering $1,000 a month to provide a salary for one programmer in Siberia, who would develop new features and fix bugs in Synfig. The rewards, or as the Morevna project has called them ‘prizes’, for funders have been temporary influence over the direction of the development of Synfig.

you can pay to set [a] higher priority on one thing per month and develop it faster. The second prize will go to select an operating system for the development. (field notes, 2014)
The reward offered was that whoever pledges to donate a set amount would get the power to decide what feature the programmer should focus on and implement during the course of one month. This option was used on several occasions and resembles what has become known as an equity model of crowdfunding, where the contributors become shareholders in the project they fund. In this case, instead of actual shares, they are granted temporary influence and decision-making power. This again reflects the fluctuation and negotiation of different values between commodities and commons and between the community as volunteers and as shareholders.

Morevna also developed an online video training course on Synfig that it now distributes through three platforms: as a commodity through the online educational platform Udemy.com, as commons through the Synfig community website and as a hybrid of both through a pay-what-you-want model. This is yet another example of an object that shifts and moves between the state of commodity and commons and, not least, resides in a hybrid state through the pay-what-you-want’ scheme. All this suggests that producers of commons and their ethics and morality do not deny the possibilities for monetising and creating commodities from their work. The point of tension for the participants is therefore not so much how to merge capital/economy with commons, but how to remain ethical and faithful to the core values of freedom and open knowledge of the community.

The movement of people between different regimes of value: from fanboy to a freelance professional

We will now switch our focus to the move of people between regimes of value, taking Morevna and the Gooseberry animated film productions as the focal points that trigger this move.

The Blender community is populated by both graphic artists and software developers. The success of establishing the Blender software project as a viable tool for professional animation and 3D creation has led to the creation of a substantial base of Blender Institute ‘fans’ who are willing to devote their free time and skills to contribute to the films and software projects developed within the Blender Institute. The social histories of the participants who have been employed within the production of Gooseberry can be summed up and generalised in order to speak of ‘Blender careers’ or ‘open-source graphics careers’ that are closely tied to the work for the Institute. The general pattern for both artists and developers tends to be a start in their early 20s or even teenage years when they discover Blender,
then start exploring it and gradually contribute to the software project or to the ‘objects’ produced around it, such as code, concept art, graphics or documentation. The individual biographies of these individuals provide us with illuminating accounts on how motivations, goals and values are negotiated.

I was a fanboy. I remember I came to the Blender Institute the first time with all my DVD covers to get them signed by anyone here. … Ton, even during the time of Elephant’s Dream, was a legend to me. … His ideas are always 5 or 10 years ahead; and I could feel this around the start of 2000; the first massive crowdfunding to make Blender open-source; then an open-movie project. The idea to open a movie production was shiny new at [that] time. Also mixing software development with a model of artistic creation or demoing is something really innovative. Putting all of this in the context of the time they were done – it’s amazing. (Interview with David Revoy, artist, August 2014)

From being fans, many gradually get involved and start participating as volunteers in various activities run by the Blender Institute. This helps them establish a reputation and portfolio as specialists in the Blender software – be it as artists or developers. This reputation can often later be rewarded by temporary employment on projects like Gooseberry or by starting their own independent open-source animation projects and studios. This process also involves a renegotiation of the relationship with, and valuations of, other community members. From ‘volunteers’ and ‘hobbyists’ they gradually become ‘employees’ and ‘freelancers’, and may change their authoritative power in the Blender community structure – moving higher up or exiting the community. In this process, the autonomy of being an independent contributor in the community can be traded for temporary employment within the Blender Institute. One of the Gooseberry participants discusses the shift from volunteer to an employee in the following way:

It is a bit harder of course when you dip into it. … We have to schedule, we have to, you know, conform to deadlines of course … so it is totally different than you know, doing it like a volunteer. … There is the pressure and the interaction is … bigger. (Interview with developer, August 2014)

The fandom and respect towards the Blender Institute creates a large user base and potential labour force that could be employed in actual film productions. The Gooseberry project has been aiming to select a handful of the best talents of the community and ‘insourcing’ them into the produc-
tion. This has been generally perceived as very positive by the project participants, as the shift in the way they are valued has also created visibility and greater chances for creating economic value out of other commons-based artistic projects.

As an independent artist, the visibility offered by this project is really cool; especially because it brings also eyes on my other personal project, such as Pepper & Carrot, or paintings. (Interview with David Revoy, artist, August 2014)

At the same time, it is not only the community members who become ‘marked’ in different ways and move between different states and regimes of value in the community: – this process also alters the regimes of the community’s benevolent dictator, whose role shifts from being a legitimate authority among many to an employer of some. This is most visible in the intention to crowdsourceroles of the ‘benevolent dictator’ – being both producer of Gooseberry and head of the Blender Institute – makes it possible to combine and reconcile the Blender community and the animation studio in spite of the different structures and organisational models. This creates an efficient and low-cost model of industry-like animated film production. Instead of hiring thousands of people, the community could contribute when needed with labour force and creativity and be rewarded in various ways ranging from employment to getting a credit in the film.

While such a campaign in the end did not happen within I, the initial intentions of having it shows that the simultaneous roles of the ‘benevolent dictator’ – being both producer of Gooseberry and head of the Blender Institute – makes it possible to combine and reconcile the Blender community and the animation studio in spite of the different structures and organisational models. This creates an efficient and low-cost model of industry-like animated film production. Instead of hiring thousands of people, the community could contribute when needed with labour force and creativity and be rewarded in various ways ranging from employment to getting a credit in the film.

Similar, though less structured processes happened in the Morevna project and the Synfig community. For example, in the summer of 2012, the Morevna project’s producer and Synfig’s main contributor crowdsourced the production of 3D models of two of the main film characters. After a month in which various artists were working on a volunteer basis and submitting suggestions, what was favoured was a contribution by two freelance animators from India who got credit in the film as a reward. Follow-up interviews with them suggested that they contributed partly for
fun and partly to get experience that would boost their portfolio. Their involvement also resulted in new contacts and participation in other projects of open-source animated films, and has been helpful for running their own commercial Blender-based animation studio in India. The possibility of converting free and voluntary labour into market value means that the free labour is not experienced as exploitation. In their own experience, the synergy between market and commons also means that they can generate monetary flows while at the same time aligning to the ethics and practices of the commons.

The many and various relationships between regimes of value in these examples demonstrate the problems with theoretical approaches that try to apply dichotomous definitions of markets and commons on open-source-based cultural production. Both producers and the things produced reside in different regimes of value simultaneously and the lines between different regimes are constantly crossed in order to further both market goals and community-related goals. This is not to suggest that the cases analysed constitute hybrids between markets and commons, even though there are signs of such hybridity, but rather that the question of which regime stands to gain from aligning itself with other regimes can vary on a case-to-case basis. However, it is also to suggest that the opportunity to move between different regimes of value is unevenly distributed in the production communities analysed. Whereas the central members of the community can and do reside and move between the institutions of public funding, market and commons, participants in the periphery are usually relegated to a single regime of value. The question of power is thus central to the processes analysed here, but power comes not only from possession of economic capital but also from the position occupied in relation to the other regimes of value and in the communities’ structure.

Conclusion

In this article, we have demonstrated the breadth of relations and flows of interaction between the practices of open-source cultural production and the capitalist market through the cases of two large-scale open-source film projects around two open-source graphics software communities. By mapping and investigating the biographical trajectories of both objects and people involved in the film projects, we have concluded the following.

First, the different regimes of value involved in the analysed projects are experienced by the participants as (sometimes incommensurable) dif-
ferences in goals, beliefs, ethics and thus as constituting barriers between different regimes. At the same time, however, there are participants who work to create commensurability between the different regimes of value, trying to align the goals of the community with the capitalist logics of other related actors, primarily the cultural industries and/or public funding bodies. This involves translation processes that align the different regimes of value by finding ways of converting one value into another. The project participants deliberately and unconsciously shift between different regimes of values in the interactions with market actors and with community members, as seen in our interviews when the participants try to explain their work. The participants often do not notice these shifts in their appeal to different systems of valuation or that there could potentially be conflicts between different goals. The move from one regime of value to another can happen several times in a single sentence without the speaker noticing it.

Second, it should be noted that the two cases analysed here showcase different dynamics in the relationship between markets and commons. There is thus nothing predetermined or automatic in this relationship, and commons-based production communities can stand both to gain and lose from interacting with the market. The development of the two communities in two different directions is contingent on a number of factors that are too complex to sort out in the space of a single article. This complexity could be further explored in future research with a particular focus on the nature and dynamics of business models in open cultural production. While, for Appadurai (1986b: 57), the politics of value ultimately leads to an expansion of the pool of commodities, our empirical material suggests that it can also expand the domain of commons, thus contesting our traditional understanding of what a business model is. The projects analysed here are run as businesses with inspiration from regular market production, but the ‘business’ in itself is not ultimately about making money, but rather about producing a community centred on the re-enactment of liberalist values of individual benefit through cooperation and work based on sharing.

Lastly, it should be acknowledged that these moves are still ultimately tied to questions of power. In both markets and commons, there are hierarchies of power that enable some actors to move between different spheres and to reconcile the different regimes of value, whereas others remain for longer periods of time in a single regime. To be unable to move between different regimes can mean that you are not able to convert the skills learned in commons-based production into gainful employment or to remain in precarious labour conditions (e.g. as crowdsourced labour)
without experiencing the psychological fulfilment of being part of the community. For us, it is important to point out that the power relationships underlying these working conditions not only hinge on access to economic capital but are also related to the position of the actor in relation to different regimes of value. This insight should lead researchers to investigate not only how capital impinges on the commons but also on the multifaceted relationships between the different regimes of value. Open-source-based cultural production, like any cultural production, does not conform to, nor can it be made sense of from, the perspective of a single economic system. By following the cultural biographies of cultural producers and objects – in this case software, developers, and filmmakers – our ethnographic research has revealed the complexities and the cultural embeddedness of the open-source economy.
Open Cultural Production and the Online Gift Economy: The Case of Blender

Article published in First Monday, 21 (3), 2016

Author: Julia Velkova

Abstract
The economies of the Internet are largely driven by sharing. Much of it is often veiled in a celebratory discourse that emphasizes how sharing artefacts online through gift exchanges removes hierarchies and creates broader access to public knowledge, such as in projects of free culture and open source software development. The article critically interrogates these assumptions and the gift economy of open cultural production more generally. Using a practice called open source animation film making, developed by Blender, an organisation at the core of the largest open source 3D computer graphics community, this paper shows that the discourse surrounding free culture online has largely misunderstood the complexity and ambiguities of the economy below the cultural politics of openness. With the help of classical theories of gift and value I discuss issues of debt, obligation, status, discipline, and social hierarchies created by exchanging online a variety of digital artefacts of different value, such as software, culture, and labour. This article shows that the wealth of open cultural production relies on combining multiple dimensions of gifting with fiscal and hidden forms of capital, producing a culture of secrecy in parallel to that of openness.
Introduction

The economies of the Internet are largely driven by sharing. Practices that underpin the so called ‘sharing economy’ today range from distributing pirate content online, to self-marketing through social media, to exchanging private accommodation such as through couch-surfing (John, 2016). For decades, though, some of the greatest changes in the circulation of digital wealth online have been introduced by the diverse practices of hackers, artists, and digital entrepreneurs who have been calling for more openness, solidarity, and sharing on the Internet. Starting with the free and open source software movement that took momentum in the 1990s, and followed later by the proponents of free culture in the early 2000s, the idea of creating wealth online through making public code, knowledge or culture has been a persistent ideal and cause of social action for many. Practices of alternative journalism, such as the case of Indymedia or hacktivism (Coleman, 2015; Dunbar-Hester, 2009; Lievrouw, 2011), open data initiatives (Baack, 2015), and digital artistic practices (Morgan, 2013) have embraced sharing and legal tools such as the GNU/GPL and Creative Commons licenses to make a claim for openness in their respective domains.

Open culture, open source, open content, open science, open farming: in its multiple variations, openness online has tended to mean the proliferation of practices that are more participatory, transparent, accessible, useful and usable, in turn enabling more openness (Pomerantz and Peek, 2016). Many of these practices have been celebrated as creating new forms of collaboration and economic activity that promote egalitarianism by rejecting hierarchies in favor of relations based on reciprocity (Benkler, 2006). They have further revived a gift economy online based on the exchange of objects and services through non-remunerated, free labour (Terranova, 2000).

The effects of these gift economies of openness have been repeatedly noted to be in democratising knowledge, creating online spaces of access for independent experiments with creativity, remixing, and remixability (Berry and Moss, 2006; Björgvinsson, 2014; Hess and Ostrom, 2011; Lessig, 2004; Rennie, 2005).

A problem of this, to a large extent, celebratory discourse has been that it has suppressed a critical debate about the ways in which this open gift economy functions; who benefits from it and how; and what remains out of sight, hidden deeply under the paradigm of openness. Some attempts to do
such analysis have been undertaken in research on the communities of free and open source software development which has stressed the role of gifting for acquiring reputation online as a form of personal capital (Barron, 2013; Berdou, 2011; Bergquist and Ljungberg, 2001). It remains unclear, though, how this economy of open gifts and power gets mobilised in practices beyond software development, such as those of open cultural production. What kind of gifts are exchanged in the online cultural economies of gifting; how do they trigger the creation and distribution of wealth and power among their participants; and how dependent are they on mobilising diverse forms of capital? Considering that the cultural production of symbols and meaning represents today one of the largest and most powerful industries (Hesmondhalgh, 2013), it is essential to interrogate critically the ways in which their alternative modes of production function, in particular those that embrace openness and sharing online as key ideals.

This paper addresses these questions through an analysis of the workings of the Blender Institute, a well established Amsterdam-based for profit organisation. Since its official registration in 2008, it has been committed to making ‘open 3D projects’, predominantly animation shorts that have been enjoying large popularity online.

Figure 1: Cosmos Laundromat by the Blender Institute (2015). (CC) Blender Foundation | gooseberry.blender.org

Using a modified version of multi-sited ethnography, I spent about a year in diverse locations online and off-line doing participant observation of the latest open 3D project that the organisation created, Cosmos Laundromat (Blender Institute, 2015), an ambitious 3D animation film of professional quality released online in August 2015. In addition to this fieldwork, I also did approximately 35 qualitative interviews between 2013 and 2015 and had multiple informal conversations with team members of present and former
Blender Institute projects, their fans, as well as other digital creators who have been trying to make open animation films after being inspired by the work of the Blender Institute.

In the analysis that follows I show how the emancipatory discourse that surrounds free culture online has neglected the complexity of the gift economy beneath the cultural politics of openness. With the help of classical theories of gift and value, I outline three aspects of gifting on which the economy and wealth of open cultural production relies, namely the utilitarian value of digital gifts; the ability of the gift to produce status; as well as its capacity to discipline. These three aspects, present in each gift exchanged online, illuminate a spectrum of values that the gift embeds, namely use value, bonding value, entertainment and sign value, and exchange value. Some of these values, as I will demonstrate, become more evident than others in the circulation of particular objects online. In their totality, they embed the participants in this gift economy in a struggle for power, status, and recognition online that is based on the creation of debt and is oriented not only towards a ‘common enemy’, such as the cultural industries, but also towards each other.

Not least, this paper shows that gift exchanges are not enough to make a successful open cultural project. Fiscal and other forms of capital get subtly mobilised in order to override the gift economy or gain a dominant position in it. The complexity of these exchanges ultimately makes evident that it is not anybody that can become a producer of digital culture today, contrary to the common belief of the proponents of open culture that this is possible through more openness and sharing online.

The Blender Institute: Who they are and what do they do?
The Blender Institute has become widely known among cyberculture fans, digital artists, and hackers for its original open source animation films. In 2007, the organisation made Elephant’s Dream (see Figure 2) and proclaimed it to be ‘the world’s first open movie’.
With a budget of 120,000 euros, this 11-minute 3D animation short was:

a story about communication and fiction, made purposefully open-ended as the world’s first 3D ‘open movie’. The film itself is released under a Creative Commons license, along with the entirety of the production files used to make it (roughly seven gigabytes of data) … The software used to make the film is the free/open source animation suite Blender along with other open source software, thus allowing the movie to be remade, remixed and re-purposed with only a computer and the data on the DVD or download. (Vimeo, 2008)

Since then, the Blender Institute premiered online a new open source animation short each second year, with Big Buck Bunny (2009), Sintel (2011), Tears of Steel (2013), and Cosmos Laundromat (2015) following Elephant’s Dream. The organisation also hosted the creation of Caminandes, an open animation series made as a ‘project for fun’ by a few animators in the studio in the time between these productions. Enjoying a large popularity online, the films have been watched more than 15 million times on YouTube alone1.

The Blender Institute has been creating these open films with the explicit purpose to develop and improve independent, open source technical infrastructure for professional computer graphics production, in particular the 3D animation suite Blender: ‘If you want Blender to become a real software to be used in a film studio, what else are you going to make? We do it [a movie] to make the software better’ (interview with production assistant, March 2014), a Blender Institute employee stated.

---

1 https://www.youtube.com/user/BlenderFoundation, accessed 14 July 2016
For each film, an original script gets written by a professional script-writer. The script develops the plot in such a way as to include the creation of scenes that are either technically very difficult or impossible to make with the existing version of the Blender software. In this way, each new open film requires the software to be rebuilt and extended further.

For each open film of the Institute, a team of animators, programmers, technical artists or visual effects creators experienced in the Blender software get invited to participate. The selected team does not work for free, and neither does it collaborate online from different parts of the world, contrary to the popular claims that free digital culture is made predominantly by volunteers who work remotely through a so-called peer-production model (Benkler, 2006). Rather, individuals are employed on temporary contracts and gathered in Amsterdam for the duration of the production in order to guarantee the professional quality of the films:

You cannot get a good quality with crowdsourcing. We try to do something of the quality of Pixar and Dreamworks, and you cannot get this with crowdsourcing. How do you do it? And we want this quality. We know we don’t have the resources, we are not Dreamworks, but if we work efficiently, find smart solutions, work in this team, functional, then … (Interview with producer, August 2014)

One of these smart solutions has been to trigger an online gift economy through sharing multiple digital artefacts online, an aspect that I elaborate upon in detail further down.

The organisation is a rather unusual actor in the field of open cultural production. Its films are pre-financed with the help of crowdfunding which is collected from its own audiences and users of the Blender software. Public cultural funding and corporate sponsorship by Valve Corporation, Google, Intel, and Dell, among others, complement the crowdfunding. Despite being registered as for profit, the Blender Institute shares under a Creative Commons license its open films, the software through which they are made, their individual media components, and relevant video training demonstrating how to recreate technically innovative or difficult parts of its films.

In a certain sense, this approach is contradictory to both the logic of the creative industries and to the frameworks of open cultural production. The creative industries employ artists and technicians and capitalise on their work through expropriating and commodifying the symbolic content that they create in order to generate surplus value (Bolin, 2011; Hesmondhalgh,
The industry, as a rule, does not share its technology, training courses or digital assets for free on the Internet because selling such content and keeping it proprietary is crucial for their business model to work. On the other hand, open culture projects, such as Wikipedia, have generally relied on the unpaid labour of many volunteers to produce its open, publicly available free content. The Blender Institute combines elements of both models, mobilising resources and institutions from both spheres in order to produce each of its open films (Velkova and Jakobsson, 2017). A notable peculiarity is that the Blender Institute hires selected qualified digital artists and programmers and obliges them to create and share their work online. In this way, the organisation seems to act as a benevolent, philanthropic institution that raises funds in order to make public culture out of idealist, altruistic goals. As I show later, such an investment is, in fact, very strategic. In the course of a decade, the cycle of raising funds, making an open film, sharing the technology, training, and the placing of media content online has created a notable wealth for the organisation. Today, it has a large pool of skilled digital artists, programmers and other contributors who work professionally with Blender in diverse industries. The Blender software has also created a user base comparable to other similar commercial equivalents, such as Autodesk Maya and 3D Studio Max (Velkova, 2016d).

The open films of the Blender Institute have inspired many other creators around the world to try to make their own open animation films. After Elephant’s Dream, numerous other ‘open movie’ projects were launched around the world, such as Morevna and Lampibata in Russia; Arshia project in Iran; Chamba Swathanthra in India; Tube in the U.S.\(^2\), with new initiatives being frequently launched. Yet, it is striking that the majority of these projects have never reached completion. They have either taken another form over time or redefined their goals and ambitions. Even more striking is that despite the open films of the Blender Institute being widely watched online and being open for remixing or further development, there are barely any such remixes made, neither by its own community of fans, audience, and users, nor others. The few remakes that can be found online are mainly replacements of the soundtrack to some of the open films.

---

\(^2\) See Morevna, at https://morevnaproject.org/, accessed 14 July 2016; Lampibata on YouTube, at https://www.youtube.com/watch?v=TIYmXz1TPGw, accessed 14 July 2016; Tube project, at https://urchn.org/work, accessed 14 July 2016. Information about Arshia project and Chamba Swathanthra is available in my personal archive, as their respective Web sites are down.
How can this happen if the idea of sharing media online under alternative to copyright licenses seems to be aiming at precisely the reverse effect? What is the purpose of sharing so much and such diverse digital artefacts if nobody wants to or cannot take the most significant of these gifts, the open animation films, and remake them?

**Gifts of value**

Gift economies function to a large extent in public. They are much more visible than the market-driven ones: ‘Gifts are given in a context of public drama, with nothing secret about them’ (Mauss, 1925/2002: xviii). The public aspect of gifting makes it possible to subject the gift and its donor to public scrutiny, affect his or her reputation, and produce hierarchies of power. In this respect, when creators of digital culture mobilise openness and copyleft institutions in order to create ‘free culture’ online, they do not do something radically new if seen narrowly in the context of how gift economies operate. On the contrary, openness and a high degree of publicity are necessary in order to make gift exchanges function at all.

In his classical work on the gift, Mauss (1925/2002) argues that creating and distributing wealth in the form of gifts represents a total system of exchanges that includes objects, people, emotions and beliefs. Gift exchange may appear as a benevolent act of ‘generosity, freedom and autonomy’ (Mauss, 1925/2002: 29), but it is always strategic – it helps maintain social order, solidarity, social hierarchies and power. At the same time it also represents a mechanism for challenging established systems of social order, by confronting them with gifts. Jean Baudrillard (1981) observes that this particular duality of the gift makes it simultaneously a form of positive communication and agonistic confrontation, one that obscures a struggle for power, prestige, transformation, and humiliation under the veil of benevolent gift giving (Merrin, 2005).

The gift economy is based on symbolic exchanges through which social relations and hierarchies are established and maintained (see Baudrillard, 1981; Baudrillard, 1976/2002; Bolin, 2011; Mauss, 1925/2002). Any gift therefore has bonding value (Godbout and Caillé, 1998; Skågeby, 2008) that is expressed precisely in the ability of the gift to create and establish relations. Symbolic exchange embeds the donor and the recipient in a relation that obliges the recipient to reciprocate the gift at a further occasion, or otherwise become a subject indebted to the donor.
From this perspective, the gift can never lead to egalitarianism. Such assumptions, commonly expressed in relation to the online gift economies, are misleading. Sharing online, or making things public, always implies an asymmetry between two parties; it presupposes a subject for whom things are made open and shared (Tsoukas, 1997) and one who is made indebted. Gift economies are, hence, inherently based on the generation of debt, the repayment of which produces social relations (Graeber, 2011). A question that needs to be addressed, then, is about the nature of obligations and debt in the gift economies of online open culture.

Jean Baudrillard (1981) introduces four types of values that can be part of an object — use value (when an object is used instrumentally); exchange value (when an object is a commodity); symbolic value, which could also be called bonding value (in the case of gifts); and sign value that designates status. In the particular case when an object is made into a gift, all of these value categories are implicitly embedded in it and make possible symbolic exchange. As Baudrillard (1981: 65) notes, any random object can become a gift, but once it does, it establishes a relationship through its bonding value. At the same time, it also carries with it use value, sign value, and can even become a commodity. These properties of the gift are crucial for producing relationships and social hierarchies, but they can manifest themselves to a different degree in different contexts. Acts of reciprocity are then usually about acting on one or several of these value forms.

For gift exchanges in online contexts there are some specifics that need to be noted. Bergquist and Ljungberg (2001) suggest that a distinct feature of the gifts made in the online digital economy is their lack of a designated recipient:

Gifts are often not given to anyone in particular. They are made public (on Web pages) and thereby made available to anyone who cares to make use of them. An application or some information does not really become a gift until someone finds it and makes use of it. If a giver manages to get attention, people will turn the things offered into gifts, which means that a relationship is created between the giver and the user (Bergquist and Ljungberg, 2001: 313)

Skågeby (2008) refers to such gifts as ‘pure gifting’ that represent a one-way mode of transfer which makes the obligation to reciprocate more ambiguous and difficult to trace directly. Gifts of this kind usually aim primarily at

---

3 See Velkova and Jakobsson (2017), Berdou (2011), Jarrett (2016) for detailed discussions of the gift as a commodity which there is no space to discuss here.
demonstrating the power of the donor expressed through the ability to give. The return that is potentially expected for such acts of generosity is status, or sign value, that may not necessarily come from any potential gift recipient, but primarily from acknowledgement by peers or broader social groups.

Gaining reputation through non-designated gifts online can nevertheless help the donor attract attention to other objects that he or she distributes online, either as gifts or as commodities through which stronger bonds could be established and debt created: ‘As gifts do not imply a monetary compensation, virtual community gift giving is managed through acknowledgement: the giver is ‘paid’ by the community by receiving a certain amount of fame and respect’ (ibid).

Hence, in online contexts there exists a certain degree of uncertainty with regards to what kind of and how strong social bonds and obligations a gift may produce, although it always affirms or increases the prestige of its donor simply through the act of giving. Baym (2011) has noted this effect among musician communities for whom gifting online helps to expand their range of audiences and endow their cultural products with credibility.

Gifting online can also discipline the participants in the exchange by obliging them to conform to community norms of behaviour or standards of productivity. These obligations are enforced through reward mechanisms that are implemented either by the donor or by a ‘gifting technology’, as (Skågeby, 2008) calls it, a technical platform that produces rewards that give sensorily or affectively intense experiences to donors and recipients alike (Jarrett, 2015). I will call the latter aspect of the gift ‘disciplining’, a quality that obliges the donor to keep giving. Such gifts may appear oriented to an external audience, but they serve the primary purpose of governing the social and cultural practices of those that employ them, as I demonstrate further on.

To sum up, the gift produces social relations and status through obligations to give back more than one has received, creating a loop of exchanges based on debt. To the extent that the gift is defined by the situations and relationships through which it is exchanged (Skågeby, 2008), certain transfers could happen in ways so that just some of the abovementioned aspects of the gift economy get foregrounded, while others can remain functioning in a more subtle way. In the analysis that follows, I will use the Blender Institute’s production of open films as an example through which to discuss in detail the forms of debt, obligations, and relationships that are established in the online gift economy of open cultural production.
Software: A useful gift

For each of the open films that the Blender Institute has created, the organisation has gifted online five types of artefacts using a GNU/GPL or a CreativeCommons license. These are the software through which each film has been made; the documentation of each open film’s production process; video tutorials; the audio and graphic digital assets that comprise the films; and the open films themselves.

The transfer of software and video tutorials as gifts may create the impression that these artefacts are non-designated because potentially anybody could use them. In practice, though, they are so specialised that they are narrowly targeting individual digital artists, aspiring 3D animators, and small studios who search for powerful, cheap or gratis digital tools for making professional computer graphics media. These gifts seek, therefore, to establish bonds with a narrow group of media creators. They tend to do so by foregrounding mainly the use value of software and tutorials. In computer graphics, media production software is a tool for work, a digital instrument through which media is created. As I have discussed elsewhere (Velkova, 2016c), the software that the Blender Institute shares, Blender, is valued by digital artists for it is free of charge yet a powerful instrument that can be tuned to the specifics of individual creative practice. These considerations reflect a narrowly pragmatic reasoning that makes evident the self-interest and possibilities for individual gains that a creator can make by taking and using instrumentally these particular gifts. They are not significant for expressing altruism as commonly believed to be the case for practices of sharing software (Baytiyeh and Pfaffman, 2010; Raymond, 2000). Rather, gift exchanges of this kind represent a more humanistic way of pursuing self-interest than through market exchanges (Bollier, 2001).

To appreciate software as an instrument leads to the extension of its user and developer community and creates skilled labour with a narrow specialisation that can create digital media with Blender. In return for using this software, creators reciprocate through so called ‘contributions’ that consist in making functional extensions or repairing the software (Velkova, 2016c). An interesting form of repaying debt to the Blender community is when artists hire developers to develop and gift back software features. In this case, gift recipients mobilise financial capital in order to free themselves from the gift relationship, and turn themselves into donors who gain decision-making power influencing the development of software (Velkova, 2016c).
An important category of artists in this context are those who use the software, but do not have neither the skills nor the financial means to develop it further. To accept by just consuming, without giving anything back, is equivalent to becoming a client and servant. It is ‘to become small’ (Mauss, 1925/2002: 95). The ways in which such artists reciprocate is symbolic — they also contribute with their labour by reporting bugs or requesting new software features in online forums such as the widely popular Blender Artists. Such contributions are of less worth than actually fixing bugs or making new features, but they nevertheless help the Blender Institute to set priorities for the future development of the software. In this process, the type of contribution made determines the place one achieves in the hierarchy in the community, giving some individuals more power and status over the software and over part of the community, while some remain at the bottom.

When the requests for features become too many or too controversial, the Blender Institute intervenes by making its next open film and settles some of the disputes by incorporating those requests that it considers most important:

<developer> the bottleneck is not *ideas for features*. We really have lists of features to take years of dev …

<julia> so making a film is really a way to choose

<developer> yes, you only listen to 5 people … that works :). (Excerpt from an IRC interview with a Blender developer, November 2014)

The variety and nature of contributions given back by digital creators in exchange for using Blender reconfigures dynamically the power hierarchies in the community. In order to re-declare its supreme power over the whole community, the Blender Institute decides unilaterally which features will be prioritised for further development and materialises this decision by making a new open film and gifting it away. Producing an open film represents a ritual that needs to occur with certain frequency within the community in order to resolve the internal conflicts and disagreements within it, but is also important in order to generate a new round of digital gifts to be circulated in order to affirm and legitimate the decision-making power of the Blender Institute.

—

4 See BlenderArtists.org (2013).
Culture: A gift for consumption and status

Two other types of objects that the Blender Institute shares online are the digital media assets and the open films that it creates. Their aim is to make an artistic statement, demonstrate the skill of its creators, and the uniqueness of the technology, the development of which they push forward. They also express a hope that other digital creators could use the assets of the film and make a derivative work from them, embedding them in the reciprocal obligations of the gift exchange. To the extent that these digital artefacts produce culture, their main function is to create and circulate symbols, images, and meaning (cf Hesmondhalgh, 2013). Similarly to software, an open film and its aesthetic components have use value which appears in acts of consumption, such as when media is enjoyed as entertainment, appreciated, debated, remade, or spread further (cf Bolin, 2013).

Some authors have expressed hopes that such gifts in the context of the Internet economies can drive forward a new wave of creativity through remixing (Lessig, 2004; Manovich, 2005). Such hopes are, however, misleading, or at most of interest for merely a marginal group of artists. A range of Blender fans and users I interviewed admitted that they would be reluctant to reuse or remix any of the characters, images or films of the Blender Institute because, even if they are shared freely, they remain signed, carrying the creative energy of their authors:

I could use that, but I would feel more comfortable if I design my own project, my own characters. If you design a character, you will design it for your product … For example, you can have a picture of Batman here. You can use Batman inside some animated series. You can use Batman in every chapter of the series, but it won’t be the original Batman, it will be an adaptation. To make such adaptation is very complicated. (Marco Adamante, animator from Spain, interview, October 2014)

Another animator admitted that he did not like gifting the artistic creations of the Blender Institute because their characters lose their identity when somebody else uses them for other purpose. The problem he sees is that the original author will always need to be credited, no matter if the adapted character is used ‘on a slot machine or in a porn movie — they will still credit you, despite that the character will have nothing to do with the original except in visual appearance’ (Interview, May 2015).

To remix a gift of online culture means to remove the social energy and the personal investment made in this particular gift, but to keep giving back,
reciprocating to its author. Taking an artistic creation made by someone else produces a forced social relation which the receiver must pay back by acknowledging the original author. In a market economy, such an obligation could potentially be erased through the mechanisms of fiscal exchange and intellectual property rights regulation. Yet, in a gift economy, sharing objects of culture online enforces the creation of bonds even when they may not be desired by the donors. This is one of the reasons why some artists reject the possibility of reusing gifted digital art and insist on making their own, as the quote above shows.

Another aspect of the gift exchange is the implicit status that it gives to its donor. When a creator uses Blender software to make an original film, he or she contributes to strengthening the reputation of the software. When an audience consumes the Blender Institute films, or remakes them, it again contributes to affirming the status and prestige of its creators. Exploiting the use (and potentially exchange) value of the gift contributes to increasing its sign value, or the status, of its donor.

Therefore, the greater variety of digital gifts that are circulated by one donor online, such as the Blender Institute, the greater power it accrues. In some cases, gifts can obtain excessive proportions and then the act of sharing becomes an act of public humiliation as it makes it impossible for others to reciprocate and to return something valuable back, so that they remain always in debt. Reciprocating with writing code, making digital art with Blender, or even reusing some of the digital assets that the organisation shares can never match the total sum and value of the gifts that have been shared by the Blender Institute, and can therefore never represent a challenge to its established prestige, solidifying a relation based on unpaid debt.

One way to challenge the power of such a powerful actor would be to try to make open animation films, software, and tutorials and gift them online, reproducing the model of the Blender Institute but creating a different community and a separate gift economy. Such attempts have so far largely failed, an issue which I discuss later.

Another way is by overriding the gift, bond, and debt politics by bringing in fiscal wealth, for example, by claiming sponsorship of the Blender Institute’s open films. Sponsorship is always accepted by the Blender Institute and rewarded with a mention in the film credits. The position which one’s name will take in the list of credits in the end depends on the amount of money donated to the film, establishing yet another hierarchy in the community, that of financial patrons. Such a reward is, of course, sym-
bolic and insufficient to match the value of the financial donations. In this way, financial capital puts the Blender Institute in debt, while its donors remain outside of the circle of gift exchanges that the organisation nurtures.

Public labor: The disciplining gift

The last type of digital artefacts that the Blender Institute shares is a public record of the production process of making a film, namely the labour it incorporates. In the course of making its last film, Cosmos Laundromat, a record of the production process was made through regular livecasts on YouTube called internally ‘The Friday Weekly’ (see Figure 3). In the course of one year, each Friday, at 6 p.m. all team members and present guests gathered in front of a Web camera in the Blender Institute office in Amsterdam and reported to an ‘imagined’ (cf Marwick and boyd, 2011) and often absent online audience what each one of them had accomplished during that particular week.
Programmers presented the code that they have been working on; artists demonstrated concept art, animation in progress, sketches of models; and I was also obliged to share what I had been doing in the office for the week of my fieldwork (e.g. Velkova, 2015). Despite all the seriousness with which these meetings were treated internally, there was much to wonder about their function, in particular in relation to the subjects towards whom these gifts were meant.

On a normal day, the viewers of the live stream ranged between none and a dozen. There were no attempts to secure a good quality for the livecast, in contrast to the otherwise high production values that were set for the films. The video was streamed with a cheap Web camera and a microphone borrowed from one of the team members. Video editing was absent. The material that ended up on YouTube was hours of low quality recording in which 10 to 12 people were mundanely reporting in great detail about their work, a format that was not aimed at capturing a potential audience. The team occasionally reflected internally about the purpose of the Friday Weeklies. Some suggested that they were possibly aimed at attracting potential investors to the production. Others were critical, suggesting that it was only the ‘hardcore’ fans who were interested: ‘you are not attracting investors with showing a 1.30hrs of unedited, low-quality, bad video’ (Interview with Cosmos Laundromat team member, February
2015), one team member commented. In the course of the production year, the Blender Institute made 45 such live streams.\(^5\)

The subject of these gifts was arguably not an external audience, but the team members themselves. Its purpose was to increase their work efficiency and discipline them. The artists in the production were generally positive about these livecasts and they were a source of an experience of good, just work (cf. Hesmondhalgh and Baker, 2010). The business models of the media industries presuppose that the work of artists is expropriated and commodified. Much creative work that is made in this process gets rejected, and is never shown in public. A 3D modeller who worked on *Cosmos Laundromat* admitted that the livecasts each Friday were very important for him because they offered the chance to show what he works on, something that he could not do at his previous work at a large computer graphics corporation:

> In big companies sometimes you make huge projects that might not even go published – and you can not show anything, no part and put in your demo reel. So you basically can spend two years on stuff which will never be shown. At [the company] we have not released what we have made. I worked half a year, but it didn’t fit the brand, it was too aggressive – not family friendly – reasons can be anything. Also, they can be testing what we can do – but not necessarily release it. (Interview, December 2014)

To keep creative labour secret means to humiliate the artist, and make her powerless. The gift which an artist makes by giving his creative ideas to a company cannot be compensated merely through a salary or material rewards, especially because artists maintain very strong sense of ownership of their work even after it has been expropriated (Huws, 2014). Some Hollywood corporations have created consolation gifts to compensate their artists for this humiliation. A team member of *Cosmos Laundromat* told me that Disney used to have an internal award for the person who spent most time on things which did not make it into the final film.\(^6\) In *Cosmos Laundromat*, a similar system for rewards was triggered with the help of the YouTube livecasts that generated constant individual labour exposure.

Despite being perceived as rewarding, as (Jarrett, 2015) notes, such rewards can mobilise affect and emotions in order to discipline and to

---

\(^6\) Field notes from an informal conversation with a Cosmos Laundromat team member, December 2015.
conduct politics of exclusion through norms. The gift, and practices of public disclosure generally, is ‘not only about clarity and insight but, also and simultaneously about boundaries, regulation, and control … [transparency] is wrought with power’ (Flyverbom et al., 2015: 387).

The Friday Weekly established a rhythm, structure, and pace for the film production, which from the outside seemed rather spontaneous and unstructured. The Friday livecast created intensities of pressure and obligations among the participants to actually have something to share, to present, to report, and to admit progress in a very accessible form, on a weekly basis. Each individual was put under peer-pressure to create and share as much as any other team member or else have a public explanation on the YouTube livecast suggesting why little was reported and shared.

Stress and pressure were common and the production team had almost no life outside the studio. After a week of conflicts about the artistic vision in the film, a team member shared the relief that his Friday presentation would be together with another artist ‘so it eases a bit the stress, and there’s a nicer vibe now with the arrival of X too, new blood always helps’ (Field notes from an informal conversation with a Cosmos Laundromat team member, December 2015). At another occasion, a team member was self-critical when admitting to me that he had not managed to do that much during the working week. The sense of guilt and concern were apparent and triggered his thinking about how to compensate for the lower productivity with intensified work in the next days to come. Building on Foucault, Flyverbom et al. (2015) have called this form of self-control regularising, meaning that processes of self-examination and confession can penetrate the whole social and work practice of subjects, leading to internalising and normalising self-regulation as a form of self-imposed control.

Despite the official hours of presence at the Blender Institute being set to between 11 a.m. and 4 p.m., there was rarely anyone going home before midnight or being absent on weekends on the occasions when I was there. There was no direct demand to work so much, but most artists and programmers used the late night hours either to work more on the film or to improve their skills and develop hobby projects, such as designing models for 3D printing, board games, or coding for fun. These long hours of work and dedication to productive activity epitomise how a disciplining gift ritual boosts productivity while retaining senses of freedom and emancipation among creative workers, a practice arguably normalised in the cultural industries today (Ross, 2004).
The gifts of public labour shared online further obliged the *Cosmos Laundromat* team to engage in self-reciprocity. Every Friday livecast meant that the next Friday had to bring more and better work, as well as gifts online. This closed loop of auto-gifting makes it worth recalling Claire Birchall’s (2011) observation that openness can become a moral project, one which creates positive effects but also carries a totalitarian outlook: ‘Transparency cannot easily accommodate those who want to be exempt from its project, those who want to remain not merely private, but singular’ (Birchall, 2011: 24).

This remark summarises rather precisely my own experience of forceful embeddedness in the gift economy of open cultural production triggered by the Blender Institute. I was granted access to do participant observation of the production of *Cosmos Laundromat* in Amsterdam under the condition that I document and make public my observations in the studio, as well as my research process and results. I was advised by the *Cosmos* producers to start a blog on which some of the material used for this paper, as well as reports from my fieldwork, reflections, and papers in progress were made available.\(^7\) The demand to share my work online as a gift defined my debt and enforced an obligation on me to ‘pay back’ for the gift I received, namely access to the production. In this way, I also was embedded in the cycle of giving, receiving, and returning. The demand to share my work also made me into a donor within the online gift economy. The problem of such obligation is that it is not voluntary, but enforced, and that it is impossible to say when a debt is repaid. No matter how many texts I have put online on my blog, it was hard to say when that would be sufficient. I have been asked further to present my findings orally to the community during a yearly conference, or become a subscriber to a new ‘cloud’ service that the Blender Institute developed. Once bonds are established through symbolic exchanges such as gifts, it is very difficult to break them. Instead, the bond merely triggers more gift exchanges, strengthening the power and prestige of the main donors and expanding the online gift economy.

**Secrets of the open gift economy**

The online gift exchanges that I have so far discussed form a complex system for creating and managing capital in the Internet economy of open cultural productions. The obligation for sharing work online is not voluntary, but enforced. No matter how many texts I have put online, it is hard to say when that would be sufficient. I have been asked further to present my findings orally to the community during a yearly conference, or become a subscriber to a new ‘cloud’ service that the Blender Institute developed. Once bonds are established through symbolic exchanges such as gifts, it is very difficult to break them. Instead, the bond merely triggers more gift exchanges, strengthening the power and prestige of the main donors and expanding the online gift economy.
culture. Gifts that emerge as having predominantly use value need to be produced and circulated online in order to create independent software infrastructures under the control of its users, as well as to expand the range of qualified techno-artistic labour force that can work with it and participate in making open films. Mobilising this cultivated labour and infrastructure, digital artists create media content that they also share as a gift, as a statement of the wealth and prestige of its authors. Finally, the successful creation of this so important media content is dependent on the third aspect of the gift, its ability to discipline and self-reciprocate, motivating and managing the efficiency of the carefully selected labour force in open cultural projects.

One aspect that can easily be forgotten in this context is the question about what remains hidden behind so much openness and gifting in public. Since 2008, an animation community in southern Siberia, Russia has been trying to replicate the gifting model of the Blender Institute and establish a 2D animation community using a similar approach. The initiator of the project, Konstantin Dmitriev remembers: ‘Ton [the founder of the Blender Institute] inspired me in 2006. Through Elephant’s Dream I saw how things can be’ (Interview, January 2015). However, after nearly 10 years of experiments, Dmitriev admits:

The potential of Creative Commons is not revealed because there are only very few strong players in relation to resources … You need to be able to be comparable to the Blender Institute – you need to have an infrastructure, rendering in order to be able to do it, and your creative potential needs to be able to introduce something new in order to do a remix. (Interview, January 2015)

Dmitriev’s remark is useful for illuminating four hidden forms of capital which were not circulated in the gift economy but upon which the success of the Blender Institute open film projects has been contingent.

First, specific infrastructure, particularly the hardware power that the Blender Institute has managed to obtain and increase in the course of making its open films has never been gifted away, nor commented much upon. While the organisation gifted its software infrastructure, it has never tried to distribute its hardware power nor its alliances with large manufacturers of computer graphics equipment such as Dell, Intel or emerging renderpower actors such as Qarnot computing. At the start of Cosmos Laundromat, the Blender Institute had at its premises an autonomous rendering cluster consisting of 30 mid-end computer graphics workstations
and several high-end machines (dual Xeons with 65GB RAM) donated primarily by Dell which, even though not considered internally as being of great value, were essential for computing the animation made for most of the duration of the production. In the final stages of *Cosmos Laundromat*, when higher requirements for the output quality of the graphics were needed, its demands for computing power were satisfied by making a barter deal with the French startup Qarnot Computing. The company donated access to 200 mid-end rendering computers located in Paris, offering computation services for free, in return for testing a new service of heating homes with data. The deal helped the Blender Institute make a drastic saving from the costs of hiring computation power which is otherwise one of the greatest expenses in making computer graphics media. In this case, the industry initiated gift politics by donating the hardware and establishing ties with the Blender Institute.

Access to such computing power for free is not normally available to the average media producer who would start experimenting with making open media. Instead they would need to buy it from commercial services, such as those offered by Google or Amazon, or find alternative ways, such as through open source services as those provided by renderfarm.fi. Possessing such power is a great advantage that has been undercommunicated.

A second moment that remained hidden was a ritual that followed the Friday Weekly livecast. It was called the Monday kick-off meeting. One of the team members explained the difference through a change in the attitude of the producer: ‘If Ton is soothingly happy on Friday, he is not that on Monday’ (Field work notes, December 2014). The Monday meetings scrutinized the productivity of the team, set goals, and questioned individual members’ approaches to solving problems. The tone of the meetings was often authoritative and steered the team strongly towards ever increasing productivity and performance. Ideas were rejected, roles reassigned, conditions of work renegotiated. These closed-door meetings were obviously an internal managerial technique through which the producer of the film affirmed his power and hierarchical status, making it very clear that all of the team members were employees who had to adhere to production plans, budgets, and be ever more efficient. This employment relationship represented, therefore, a second type of capital that was mobilised to guarantee the efficiency of the open gift economy.

Thirdly, the internal conflicts in the production, and the ways in which the team managed to overcome them, were never disclosed. Conflicts between artistic and technical visions, changes in the production team,
layoffs, as well as ways to manage discontent from decisions of the director or the management were issues that were never made public online. Keeping conflicts hidden represented an important way to keep a positive image of the production and maintain trust among the community supporting it in its success. It did little, however, to help an external public learn how such conflicts could be productively dealt with, and to gain from others’ errors. Hence, valuable know-how and internal dynamics were hidden as a way to maintain a positive image, and represents the third form of capital being used.

Lastly, a concern with the financial economy of the project has been present ever since its beginning. The budget of _Cosmos Laundromat_ exceeded a million euros. To the extent that it relied on unconventional means of funding such as crowdfunding and subscriptions to a cloud service that has been developed in the course of making the film, money had to keep being raised in the course of the production. Much energy was spent internally solving problems related to the development of technical infrastructure for managing the monetary flows of the project and as much on attempts to raise more funds. Yet these efforts were seldom commented upon or disclosed. Administering and increasing financial capital remains crucial for the success of these projects and demonstrates how its use is necessary to complement gift exchanges. All these dimensions made evident that the transparency of one reality of the project knowingly eclipsed another dimension of it. The gifts being shared online were both too great to enable others to reciprocate them in their totality and at the same time obscured how hidden forms of capital were mobilised and strengthened the power positions of the Blender Institute. There was generally a lack of self-reflection within the production of these issues, neither was there debate about the potential need to disclose them. The lack of such reflexivity raises the question to what extent a concern with helping more actors to enter the scene of open and free cultural production was actually present, and to what extent the politics of gifting and secrecy were used to stabilise Blender Institute’s own position in the field, keeping other actors in open cultural production in a subjected position.

**Conclusion**

This paper mapped three central aspects of the gift exchanges that take place online, namely their use value, sign value and disciplining power. These aspects are enacted to a different degree in symbolic exchanges of
gifts online and produce sub-hierarchies within online communities, always maintaining asymmetries of power. The social bonds that get established in the process can vary in intensity, yet they always lead to an increase in the sign value of the gift and the status of its donor among a community.

This article showed further how fiscal and other forms of hidden capital can be subtly mobilised in order to override the bonds created by gift exchanges and reconfigure established hierarchies. Hence, fiscal capital functions as a complement to the gift economies online and can both strengthen them, leading to a greater production and circulation of digital gifts, but also weaken them by rearranging the hierarchies and putting powerful actors in debt.

I also demonstrated that these gift economies are crucially reliant on keeping certain forms of capital out of circulation as a gift. A conclusion that can be drawn from the case discussed here is that open cultural production is based on a dialectic attitude towards gifting. It rejects opaque, non-public culture, but it represents a strategic opaque culture itself, in a constant and ambivalent process of negotiating what is to be shared online and what not. Organisations such as the Blender Institute confront the cultural industries with their own gift economy, yet confront other creators of open culture who remain always in debt and have limited possibility to match their wealth. The result is, as is the case for the Blender Institute, a nearly monopolistic position in the open 3D graphics field, maintained by eliminating competition from within. Lastly, the rhetoric of openness and practices of gifting can create, outwardly, the false impression that access to software, Internet connections, and media content of high production values are enough to make a successful open film and gain recognition online. This paper showed the fallacy of this assumption and suggests instead that the project of the open gift economies is neither about egalitarianism, nor about democracy, but ultimately about power created through moral politics of debt that mixes gift exchange with other forms of capital.
Abstract
This article discusses how alternative software infrastructures can emerge out of frictions, failure, and repair in the attempts of media creators to evade piracy. Using a case from the geographical fringes of Russia called Morevna project, and theories of infrastructures and repair, the article suggests how repair can lead to the slow, mundane and fragile formation of what I refer to as ‘situated’ digital infrastructures for cultural production. While pirate-based media production can push creators to search for and develop alternative infrastructures, the latter emerge as fragile frameworks that are constantly threatened from collapse and suspension. The continuous work of integrating diverse interests across local and online media-related contexts and practices becomes an essential stabilising force needed to perpetuate these infrastructures and prevents them from falling back into oblivion.

Keywords: repair, free software, Russia, Synfig, piracy, infrastructures of breakdown, 2D animation, open culture, Morevna project
Introduction

Gorno-Altaysk is a remote city in Southern Siberia located close to the border with Mongolia. It is the capital of the region of Altay in Russia, a mountain area populated by tourists in the summer, and with about 60,000 inhabitants during the rest of the year. The closest large city is Novosibirsk, located 500 km away and accessible by overnight train. Besides being geographically isolated, Gorno-Altaysk is also at the fringes of any Russian or global media production. Nevertheless, over the past decade it has become a small but important node for the proliferation of open digital culture. A vibrant micro-community of anime fans crafts there independent computer animation shorts and explores, repairs and distributes free software for making it.

About 10 years ago, one of these fans, self-taught digital animator Konstantin Dmitriev, launched an ambitious personal project with the aim of finding ways to create digital animation using non-pirate technological frameworks. In a context in which piracy is considered part of national culture (Kiriya, 2012), his decision embodied a desire to overcome some of the frameworks of control embedded in pirate technologies that limited him to adapt his creative practice to local circumstances. Realising that the tolerance to piracy could end at any moment, and in search for collaborators beyond Russia to join his project, Konstantin considered the available technological alternatives at hand.

In the mid-2000s, costly proprietary software for computer graphics production was rapidly proliferating, but non-proprietary, broadly accessible alternatives were largely underdeveloped. Konstantin found an abandoned, free software\(^1\) program for vector animation called Synfig. Synfig had many bugs, limited functionality and was very unstable. Lack of technical documentation had resulted in few individuals knowing how to work with this program. Rather than giving up, Konstantin engaged in a 10-year-long endeavour that he named ‘Morevna project’ to study, repair and ultimately develop the software so that it could be used in actual digital animation production.

---

\(^1\) Throughout this article I use the term ‘free software’ because it reflects more precisely Synfig’s ideological outlook as aligned with that of the free software movement and engrained in its distribution license, GNU GPL. Nevertheless, the informants in this study used a mix of terms such as free software, open source, free and open source with a rather open attitude to the ideological distinctions between ‘free’ and ‘open source’.
This article analyses the efforts and mode of repair of Morevna project with the aim of discussing how alternative software infrastructures can emerge out of frictions, failure and repair in a process of continuous negotiation of interests of practitioners across diverse contexts and media-related practices. The article aims further to draw attention to the important role of local contexts and cultural infrastructures in the process, and how their integration with online resources and actors can give vitality and traction to attempts to establish non-pirate frameworks for media production, also shaping the form which these attempts take.

Drawing on theories of infrastructures (Larkin, 2013; Star, 1999) and repair (Jackson, 2014), this article conceptualises such integrations as a specific mode of repair that leads to the slow, mundane and fragile formation of what I refer to as ‘situated’ digital infrastructures for cultural production. The article further suggests that while pirate-based media production can push creators to search for and develop alternative infrastructures, the latter emerge as fragile frameworks that are constantly threatened by collapse and suspension. The continuous work of integration of diverse interests across local and online media-related practices becomes an essential stabilising force needed to perpetuate these infrastructures and prevent them from falling back into oblivion.

Infrastructures of breakdown

Around the world, software piracy continues to inform practices of cultural production. It represents a central infrastructure for acquiring media production skills and for media circulation and plays an important role in digital media preservation practices. A notable part of the literature on piracy has focused on practices of illegal content consumption and questions of copyright infringement (Cammaerts, 2011; Cohen, 2006; Gillespie, 2007; Lessig, 2004; Newman, 2013). Yet, as De Zeeuw et al. (2015) note, piracy is much more complex than the issues of illegality through which it is commonly discussed. The production of piracy can be seen as a political exploration of sovereignty and de-identification in surveilled and regulated online environments. Understood as ‘parametric politics’, such explorations take infrastructural design as their starting point and aim at transforming ‘the machinic arrangements of logistical media apparatuses’ (De Zeeuw et al., 2015). In effect, the infrastructural design of piracy comes to represent individuated responses to problematic aspects of dominant technological configurations.
Infrastructures of piracy are also deeply related to the production of individuated experiences of modernity and globalisation in geographical areas where access to global media content is either too costly or materially and technically restricted (Athique, 2008; Larkin, 2004; Liang, 2009). In such contexts, infrastructures of piracy emerge through innovative practices that cater to local needs and tastes, creating new genres of media – such as film-making based on recycled materials (Liang, 2009) – or new networks of video and audio media distribution (Larkin, 2004; Sezneva, 2012) as well as low-cost new media production (Sundaram, 2014) which blur the boundaries of the legal and the illegal.

Liang (2009) uses the term ‘infrastructures of creativity’ to denote the connection between piracy and the emergence of alternative media production infrastructures, often based on low-cost materials, home-assembled video cameras and computers, low Internet bandwidth and other material aspects. In their ground, these ‘infrastructures of creativity’ are based on practices of distortion and breakdown. Larkin (2004) uses the term ‘semiotics of distortion’ to depict the constant condition of media corruption that surrounds the infrastructures of media piracy. Taking as an example the gradually degrading products of the Nigerian pirate media industry, Larkin shows vividly how starting from a low quality film copy, videotapes and CDs are distorted ever more in the endless process of further reproduction, consumption and circulation of copies. Semiotic distortion is in this context rather literal, but it can also be interpreted metaphorically, as a form of cultural resistance when integrated in parallel infrastructures of media production based on the recoding, remixing and redefining of popular cultural content to address very local audiences, as Liang (2009) suggests.

The distortions which the infrastructures of piracy produce are contradictory to general conceptualisations of infrastructure. Common understandings of infrastructures define them in terms of being generally invisible until breakdown (Star and Bowker, 2004). Their invisibility is often strategic for their secure operation (Starosielski, 2015) and stems from the ontology of infrastructures as complex network architectures that connect people, places and flows of exchanges (Graham and Marvin, 2001: 11). Piracy as an infrastructure complicates this understanding, as the material aspects of pirate infrastructures are often invisible per se, operating in a regime of illegality, or a parallel public sphere (Kiriya, 2012), one that functions with breakdown as a starting point, existing at the borderline between the visible and the invisible. For piracy to function, technologies need to be cracked, disrupted, degraded and potentially recoded. In many countries,
MEDIA TECHNOLOGIES IN THE MAKING

the promise of technologies comes with a common experience of permanent technological collapse and a temporal detachment from the global through an artificially imposed mode of ‘waiting’ – for films to arrive, for a faster internet infrastructure to be built – that prompts the emergence of infrastructures of piracy (Liang, 2009). In such moments, from an infrastructure of breakdown, piracy becomes an infrastructure of repair, one that has the capacity to fix gaps in the temporality of potential experiences of media.

This article does not aim to delve deeper into the nature of piracy as such but rather sees it as a material context which can also give birth to specific practices of repair that aim at creating non-pirate infrastructures for media production in the global media fringes. The permanent state of distortion and breakdown that surrounds these practices represents a force of friction (Tsing, 2005) that can ignite the search for alternatives to itself.

As an infrastructure based on breakdown, overcoming piracy in its material dimensions implies triggering repair as a mode of action. Rather than mobilising repair mainly in moments of infrastructural failure, repair can thereby emerge as a subtle productive force that simultaneously holds together existing pirate infrastructures and also evokes the emergence of their alternatives. How does the latter happen?

Infrastructuring through repair

The search for non-pirate alternatives can emerge in cases when media producers attempt to enter the professional labour market of the media industries (Velkova, 2016d) or more frequently through forms of activism that negate copyright and control frameworks embedded in proprietary technologies. In the latter case, the work of hackers² and the free software movement have been particularly strong examples. However, as Liang (2009) sharply notes, the possibility to resort to building alternative infrastructures through inventing new legal frameworks and forms of organising, as those employed by the free software movement have come from a position of privilege to disavow the global, one that is not easily available to many located in the world’s peripheries. Nevertheless, once in place, the diverse legal and technological artefacts developed by the free software

² Following Coleman (2016), hackers are understood here as skilled technologists in whose practices craft and craftiness converge, and who often have a liberalist political outlook.
movement can become an inspiration for other actors to embrace and recode them in other practices of cultural and technological production (Coleman, 2013; Kelty, 2008). Thereby, the privilege of rejecting piracy through the material infrastructures of cultural production has, as Powell (2016) notes, made free software into a resource for a broader range of actors who use it as means to reach other ends rather than an end in itself.

There are today numerous free and open-source programs available online. Yet, many of them are in constant decay, some falling into a state of obsolescence faster than others, as not every such software project produces a community – in many cases, programs emerge as personal projects to solve specific tasks. At the same time, as Mackenzie (2006: 12) notes, software needs to be carefully maintained as it is under constant pressure by changing hardware and by other software. The needs and ambitions of cultural producers whose work is dependent on software are also not static and can lead to the rediscovery of software and its repurposing in ways as to serve the circumstances and needs of users other than those originally intended for. Such revival can represent the base to form new infrastructures.³

Practices of repurposing and repair emerge often as a result of diverse types of structural failures. Parks (2015b) notes how the failure to provide lower electricity prices to homes in rural Zambia has led to individual, yet widespread practices of repurposing car batteries to power television sets and stereo systems maintained by self-taught geeks. In Turkey, self-taught engineers and entrepreneurs who have acquired their skills through apprenticeships, technological repair and online forums perform a crucial societal function by maintaining cybercafés that mediate knowledge and access to digital resources between the governmental policy of censorship and the broader population (Harris, 2015). In the high-tech Bay Area in California, middle-class women build hackerspaces as a way to try to combine creative work, hacking and motherhood in a desire to ‘have it all’ and use failure as a productive way to establish alternative notions of hacking, challenging masculine-dominated technological culture (Rosner and Fox, 2016).

Steven Jackson (2014) observes how taking breakdown rather than growth and progress as a starting point for thinking about new media technologies can open up a new horizon of enquiry into the contemporary politics of media. Repair, as he defines it, constitutes ‘an aftermath’ that grows

³ Here I refer to Star and Ruhleder’s (1996) observation that infrastructures rarely emerge from scratch but tend to be built on an installed base.
‘at the margins, breakpoints, and interstices of complex sociotechnical systems as they creak, flex, and bend their way through time’ (Jackson, 2014: 223). In this sense, repair becomes a force of hope, of craftiness, of reconfiguration and of adjustment to changing or unexpected circumstances in media technologies. Jackson (2014: 227) further observes that repair is based on simplicity and distributed expertise that emerges not in smooth, linear progress but through breakdowns, reaching the limits of practices and searching for ways to overcome them. From this point of view, repair emerges through the forces of friction. Tsing (2005: 5) defines friction as ‘the awkward, unequal, unstable, and creative qualities of interconnection across difference’ through which cultures are produced, one that provides an opportunity for reconfiguring structures of power and cultures from within. Repair is one such way, as it is capable of producing technological difference, by fitting technologies to national contexts, individual circumstances and personal stories (Jackson, 2014: 227). The work of fitting, Jackson (2014: 223) notes, is a work of articulation, one that adjusts and calibrates sociotechnical systems to function smoothly while interacting between their different parts. This work of calibration is based on improvisation (Graham and Thrift, 2007) which is in turn constitutive for infrastructural development, defined as ‘the historical process of development of many tools, arranged for a wide variety of users, and made to work in concert’ (Star and Bowker, 2004: 34). Repair, in this sense, can both act on thing broken and become an act of development that illuminates the fallacy of the linear outlook of technological progress and invention. Thereby, the synchronization work done through repair defines the ontology of infrastructures as ‘things, and also the relation between things’ (Larkin, 2013: 329). Rosner and Ames (2014) call the effects of such work ‘negotiated endurance’, one that aggregates the expectations of durability, functionality and local circumstances of operation of material objects of diverse actors.

Such work of synchronization and adjustment has not been a common focus in studies of media. However, its centrality in the formation of infrastructures through repair makes it a necessary object of empirical attention, not least because it also hides an ethical dimension. Adjustments represent a way to take responsibility for technology, one that its designers tend to evade (Suchman, 2000). Repair assumes such responsibility at its very bottom, as it rests upon ‘an ethics of mutual care and responsibility’ (Jackson, 2014: 231). The latter, in Jackson’s terms, is both a form of routine maintenance work and a practice of resistance through tailoring the ways in which technologies are appropriated.
In the field of technological design, the work of adjusting and assuming responsibility has been called ‘artful integrations’ (Suchman and Bishop, 2000), understood as a mode of connecting diverse actors, interests, practices and ways of work, and reorganizing them to negotiate a common interest mediated through technology. It is a process of situating technology in an attempt to negotiate ‘one’s own technology’ across practices in which it is used or planned to be used (Suchman and Bishop, 2000: 9). Integrations are ‘artful’ because they do not emerge following a smooth, linear and friction-free logic, but rather stem from laborious reconfigurations – always partial, provisional, and precarious – to familiar arrangements and modes of action (Suchman, 2000). In this light, repair emerges as a provisional, always tentative mode of action that reconfigures the ways in which technologies mediate relations, interests and individual ambitions across practices. It materialises at the nexus between individual and collective anticipations of a future aligned to specific technologies, and the actual work of integration of concerns across practices into them.

The next sections illustrate one way in which this work can happen with an obsolete piece of free software as a starting point, using the case study of the Morevna project. My ambition is to demonstrate how the work of integration of concerns, together with anticipations for a future related to specific technologies leads over time to the formation of new, non-pirate software infrastructures and a gradual situation of infrastructure.

Methods

Entwined with one another, technological development and repair are timely and rhythmic phenomena (Jackson, 2014). Repair can either stretch over long (and often indefinite) periods of time or come at an intermittent and rather unpredictable pace. This poses methodological challenges in terms of how to capture it as a mode of action beyond singular moments of breakdown and how to gain a broader perspective on the ways in which it drives the gradual development of infrastructures.

The case through which I address repair is Morevna project. It started in 2007 as a personal endeavour of one individual, Konstantin Dmitriev, in the Siberian city of Gorno-Altaysk to find ways to create digital anime films with free software. The online presentation of the project describes it as an independent initiative aimed at testing and improving open-source tools by adopting them in the real animation production. As part of those activities we [are] documenting the developed workflows and approaches to
help others learn from our practices and publishing results of production as free content. (Morevna project, n.d.)

Morevna project started with a double anchoring in breakdown. It wanted to free itself from the prevailing culture of piracy in Russia that informed much of the production of digital media in the country at the time. Its mode of doing so was to start with the repair of a free software program for 2D animation, Synfig. The program was proprietary until 2005 when it was abandoned and relicensed by its original author as free software. Since 2007, Morevna project became the catalyst behind its repair and the creation of a user community around it.

It has not been possible for me to study the project in its full duration, since 2007 to date. The data collection took place from 2012 to 2016. My approach was based on qualitative methods through which to understand the evolution of the project, its history, its modes of work, the participants involved and their roles and personal ambitions. I studied the extensive online documentation which Morevna’s initiator had published on the project’s production blog, morevnaproject.org. This material gave contextual information which was complemented with tens of formal and informal Skype interviews with the project leader, Konstantin Dmitriev. On some occasions, these interviews took the form of oral history of the project and its changing intentions and problems from the beginning to the present day. It was through these interviews that the centrality of repair emerged as a key topic of concern of the project. On other occasions, the interviews focused on ongoing project developments, but the conversation often became future-oriented, with Konstantin envisioning new refinements of his creative ambitions as an animation director through particular fixes or extensions of Synfig. These interviews were revealing for the anticipatory work that underpinned technological adjustment in the project. Following Suchman (1987), I interpreted the conversations as a form of articulation that situates technologies in the middle ground between plans and actual actions, conditioned by specific material and social circumstances.

The interviews with Konstantin were extended by a 2-week-long participant observation in November 2014 in Gorno-Altaysk during which I met six more individuals affiliated to the project at that time. One of them was the main Synfig software developer and the remaining five were Synfig users, four of whom were female.4 In addition to the participant observa-

4 In difference from many free software projects in which women are a minority, in this one they had a dominant presence. Nevertheless, common gender divisions got en-
tion, I interviewed two more project participants via Skype, one from India and one from Italy who had minor, one-time contributions with visual artwork to the project. Finally, two animators close to Konstantin who worked for large animation studios in Moscow and St. Petersburg provided more contextual information about the relationship between software piracy and media production in Russia.

All interview material was transcribed. The analysis involved identifying patterns and common themes that could narrate and nuance the story and meaning of Morevna project over time. The interview material has been anonymised with the exception of that of a few respondents who are referred to by their original names, as the nature of their involvement in the project made it difficult to keep them anonymous.

Based on this temporally and spatially fragmented methodology, I was able to reconstruct and sketch out some important moments of repair and actors involved in it which are presented in the next sections.

Identifying the need for repair

As noted earlier, repair emerges from the entanglement of local circumstances, breakdown and the individual aspirations and negotiations of technology across practices.

In terms of local circumstances, in the Russian media context, software and content piracy are considered part of the national culture. Often allowed to proliferate, piracy has frequently been used instrumentally by the Russian state for practising censorship and negotiating its terms of access to international institutions (Kiriya and Sherstoboeva, 2015; Sezneva, 2012). In 2004, the state purposefully refused to enforce anti-piracy legislation in order to negotiate its terms of access to the World Trade Organization. But in 2006, it shifted position and organised a major crackdown on producers and distributors of pirate CDs containing illegal software and entertainment media. Rather than reducing piracy, the move strengthened the positions of several formerly state-run factories for optical disc production (Karaganis and Sezneva, 2011: 156). Occasionally, these crackdowns also targeted users of pirate software. Karaganis and Sezneva (2011) discuss the particularly controversial case of a school principal called Ponosov from the city of Perm who was arrested after pirated versions of Microsoft Windows were

grained through the division of labour in the project as women were responsible for the aesthetic work of animation while the few men coordinated or performed actual software development and directed the animé shorts.
discovered on computers in his school. After a trial lasting several years, he was released and started campaigning for free and open-source software.

The infrastructures and culture of piracy in Russia are arguably even stronger the further one gets from the cities of Moscow and St. Petersburg. An animator from Moscow explained the difference through her interaction with visual culture teachers from rural Russia:

If in Moscow and St. Petersburg we got the culture that it is easier to buy software, it will pay off, it is not the case in the countryside. There, it will never pay off the investment, or they [the teachers] feel unsure that Adobe will actually get to receive their money. So they flood the chat with questions about how to crack it. Then I decided to give a webinar on Krita. But then, people started asking – what is this infamous program? We want to work in famous, real software. Why should we study this? (interview, September 2016)

The above quote reflects vividly the ambivalences created between the infrastructures of breakdown and the striving of individuals to be part of the global. The use of industry developed proprietary software becomes embedded in the politics of cultural identification that creates links of belonging to the contemporary global media production industries. But this very same rationale embeds its users in the culture of piracy, practices of breakdown and software disruption, propelling and stabilising the infrastructures of piracy, making cultural producers their legitimising agents and propagators.

Morevna project emerged as an attempt to reject the connection between piracy and the global as the only viable option for local media creators, in an effort to assert the capacity of local agency and global belonging in remote locales. Morevna’s founder, Konstantin, explained,

I wanted to do a miracle. I want to show that if someone wants to do something, you can do it even if it is very hard. It is not like, someone can come and tell you, go to Moscow. . . I would like to become a precedent.... This feeling of power over your own life, and this feeling of drive – to be able with your own hands to make change – to make impossible, incredible things gives you very high adrenalin. (interview, May 2014)

The main tool for accomplishing his goal became Synfig. He discovered it by chance in early 2006. It lacked features, stability and a community of users at the time, but it carried a promise for becoming a viable alternative to pirate software: ‘Ugly website. Ugly program which crashes all the time. I had to compile it! … But Synfig gave me a total control over each element of
an animation film. At first this was rather scary, but it was completely awesome’, Konstantin remembers (interview, November 2014).

The promise of gaining such control reflects a belonging to a culture of making and desire for technological self-sufficiency, but they do not come without frictions. The choice of Synfig prompted the need for finding creative ways to match Konstantin’s own ambitions with the limitations of his choice of software:

There are many ways to do animation. But the problem gets to the functionality of free software. If you know how to do it on proprietary software, you switch to free software and you realize that there is simply no such functionality, this workflow...you are in a way trying to do the same thing, but through a compromise between the functionality, the possibility to improve all this, and your own capabilities. (interview, November 2012)

Since Konstantin had no past experience in repairing software, his project became about finding ways to make repair and software development happen. As Sennett (2008: 10) argues, imperfect and incomplete tools stimulate imagination and develop ‘the skills to repair and to improvise … resistance and ambiguity can be instructive experiences’.

Between 2007 and 2012, Konstantin tried to organise Synfig’s repair as an online project as part of making a short animation film with it. He tried to find online collaborators but failed as the project did not manage to attract enough interest. A couple of aspiring riggers and animators from India and Italy joined occasionally and contributed with conceptual art or minor one-time tasks but their commitment to the project was shortlived. One of them remembers,

The project was really stimulating, and the idea of being able to contribute to the creation of an animated film has really excited me that’s why I really wanted to join them… My collaboration lasted only few months… That period was very hard for me…so I had to quit drawing for a little and rearrange my ideas. (interview with Yuumi Hikari, September 2014)

As much as free software can offer a possibility for growing an online community (Benkler, 2006), this growth may not emerge naturally by sharing software and projects for making media with it online. Konstantin experimented by trying to attract contributors through other free software graphics communities, but with little success. During this time, he studied Synfig on his own, by trial and error, and documented his knowledge in an online manual.
Failing to progress was nevertheless a productive moment for turning to explore existing cultural infrastructure in Konstantin’s local environment and trying to integrate it with resources from the online sphere. As Rosner and Fox (2016) write, and as noted by other studies (Medina, 2011; Peters, 2016), failure can play a central role in achievement by way of offering moments of reflection through which to transform techno-cultural practices in their ground. In the case of Morevna, transformation was not so much in terms of practice, but in terms of creating and restoring missing links between local structures and online resources that helped push Synfig’s repair further.

**Repairing software through fitting together local structures with online actors**

Konstantin organised repair in two directions. One was to introduce the software to young aspiring media producers still not part of the culture of piracy, connect them to online developers and collectively repair Synfig in ways that match their individual creative ambitions. The other was to speed up and stabilise the process of repair by finding local and online financial resources.

In terms of the first of these orientations, a local folk arts and crafts school for extracurricular activities for school children, ‘Adamant’, in the city of Gorno-Altaysk, became a crucial cultural infrastructure. Established in 1996 by the local government, the school is one of the few in post-Soviet Russia to offer free classes to school children in performance arts, painting, animation and crafts such as ceramics and pottery. Over time, these classes have become informal hubs for experimenting with creating independent projects using a variety of techniques and materials, ranging from sand and plasticine to computer-generated two-dimensional (2D) and three-dimensional (3D) animation. A Moscow-based animator noted that ‘all Siberia is a very powerful frontline of enthusiasts who use their own money and enthusiasm to make serious animation studios for children. They study technologies, they buy equipment, they explore software’ (interview, September 2016).

Konstantin has been teaching animation at the Adamant school since 2013. When I visited the studio in 2014, the classes lasted for 2 hours and were attended by about six students aged 11–16 years old. Most students had little knowledge or interest in software; they were driven there by a strong
passion for fan fiction and digital storytelling, wanting to make their own animations, having been enthusiastic media consumers for years.

Digital storytelling has been generally portrayed as easy to produce, as it relies on what many have referred to as ‘standard industry-made digital equipment’ (Hartley and McWilliam, 2009; Lambert, 2012; Lundby, 2008). For many media producers outside of the global West, this implicitly translates into resorting to pirate digital equipment. Yet, as Morevna project’s ambition was precisely a rejection of the latter, Konstantin embedded Synfig in the work of the students in the animation classes. If the students’ parents provided for the hardware – usually locally assembled laptops and digital drawing tablets – Konstantin has been helping them with software. In doing so, Konstantin integrated his own interest in Synfig development. The students’ individual visual projects became a testing and learning ground to make Synfig useful in real production, simultaneously nurturing a small local user community in the absence of an international one. The animation projects helped Konstantin and the students to identify bugs, possibilities and limitations of the software through practice.

These activities established and activated links between the students’ projects, Konstantin’s own ambitions to make an anime film with free software, and a volunteer developer from Spain interested in helping to improve Synfig. When the program was failing to meet the expectations of its users, Konstantin was collecting information about the problem and trying to resolve it either on his own or in cooperation with the online developer. Occasionally, some of the students would discover that a functionality was missing and ask Konstantin to help with implementing it. One former student, currently freelancing animator remembers:

I tried to work as an animator [with Synfig], but then I wanted to have a special feature, ok? So, I say, make me one…. Then they [developers] would make it and give it to me, asking – can you work with this? I would then try it and I tell them – no, there is a bug… So, I am an artist who tests a program, I am one of the first to test it. (interview, November 2014)

As Suchman (2000) writes, for technologies to be made useful, practitioners having different roles in technological use and development must effectively take up the work of design through activities that incorporate technology ‘into an existing material environment and set of practices’. Such activities establish ‘working relations’ that cross the boundaries of established enclosed spheres of technological production and use, allowing to situate them in actual needs and practices. This work ultimately converts repair into an
act of infrastructural development that connects and organises people and practices across contexts. Synfig’s evolution from an ‘ugly, crashing program’ to a software that could be used in digital animation production was therefore crucially contingent on the mediation between the different individual ambitions, levels of knowledge and personal interests surrounding Synfig.

Even though Konstantin’s own creative projects were much more technologically ambitious than those of his students, the work of the latter was crucial for defining certain directions of Synfig’s development by working with it even in moments when it was functionally at a very immature stage. The use of partially repaired objects and their tight integration with software development is a fundamental component of the work of repair.

**Speeding up development through integrating local with online financial resources**

The process of improving Synfig was slow and mundane. For long periods of time, Morevna stalled completely, while on other occasions, it rapidly progressed. All work was done on voluntary basis, which brought the project to a complete halt several times and set an uneven rhythm to the work of repair. Konstantin explored ways to speed up and stabilise Synfig’s development by integrating local and online sources of funding.

In Russia, state and oligarch-run oil and gas companies exercise great influence on the media and provide funding for it (Smirnov, 2014; Vartanova, 2013). A series of short freelancing projects for entertainment media commissioned by some of these companies and by Novosibirsk-based start-ups represented a sudden source of income for Morevna project on several occasions between 2013 and 2015. Konstantin was commissioned to make short animations to be screened at private events. For one of the first such projects, a small team consisting of Konstantin, some of his local students, an animator from Costa Rica and one from Novosibirsk collaborated to make a 4-minute-long animation short through which they developed a technology for rapid production of multiple character animation, lip synchronisation and dubbing in Synfig. As Konstantin recalled, ‘There was a technological gap for making very quick animation at the time. It normally takes two years [to animate that number of characters], but with this technology we will help fill in this gap’ (interview, March 2015).
Part of the income from these projects funded a 2-month salary to one Synfig developer to repair bugs and include the new technology for rapid character animation. This moment of Synfig’s development established indirect links between the larger financial and media ownership structures in Russia, the animation community in Gorno-Altaysk and an online developer, all of them mediated by Konstantin through his Morevna project.

Although fragile, and rather fragmented, a technical and financial infrastructure was emerging through this mundane, disparate and improvisational form of repair based on interconnections. This work was contingent on the presence of an actively involved software developer who could perform the actual work of repair as the predominant part of the small user community around Synfig, who were hobbyist artists in need of technical features to realise their creative projects. But at the moment when Synfig seemingly started increasing its community of users due to the new technological features, the main developer left the project for personal reasons. A local developer from Gorno-Altaysk emerged as a replacement, driven by a desire for visibility and credibility for his work, long suppressed in his previous job at a local accounting software company:

I got good conditions for developing Synfig. The salary was not important, we collected funding through donations so that I could work permanently without looking for other projects. But the advantages were that I can make public my code, and I can get fame…. plus I have always liked to work with programming graphics. (interview, November 2014)

The work of this developer was funded through a specific online crowdfunding campaign. For a year between 2013 and 2014, Konstantin set to collect 1,000 USD monthly through the crowdfunding platform IndieGoGo with the motivation to provide a way to control the direction of development and support the vitality of Synfig development at the same time. Users can choose the [development] priorities and all collected funds will go to support further sustainable development of Synfig. (IndieGoGo, 2014)

The campaign was a success, as each month animators from Sweden, Russia and other countries used the opportunity to order features or prioritise bug fixes in an attempt to advance their work as freelancers in the media industries in Europe (Velkova, 2016c).
In this way, the user interface of the program was improved, and the general performance of the software speeded up, while catering simultaneously for the individual wishes and needs of a diverse group of users. These requests and modes of work altered the orientation of the project from a local effort of resistance to piracy to an infrastructure of value for computer graphics artists generally. By August 2016, Synfig had about 3000 users and about 500 downloads a month, starting from none 9 years earlier. By integrating local cultural and financial infrastructures with the individual ambitions of media creators across contexts and practices, Morevna project created a fragile infrastructure in which the local community in Gorno-Altaysk had become an important resource for other digital creators for getting help with training, bug-fixing and Synfig functionality development.

This turn represented a challenge in its own right, as the project outgrew the initial ambition of rejecting the local dependency on pirate infrastructures. As Konstantin admitted,

I became autonomous, I can do everything I want with my program...But at the same time I am less autonomous from all this infrastructure that I have created – I need to maintain it. I am not autonomous in relation to my community – I can not ignore some things. I understand that I can not disappear from the network for a day. I can not not check my email because I need to solve issues that emerge every day. (interview, March 2015)

As infrastructures grow through the practice of repair, the people involved are given greater responsibilities for performing maintenance, becoming important stabilising nodes that drive forward, mediate, and ensure an acceptable level of operation.

Conclusions: Situating software infrastructures

The case analysed in this article provides opportunities for rethinking the relationship between practices of free software development, piracy and repair. For specific creative practices of digital media production, free software can emerge as an alternative not out of the privilege to reject the global, as Liang (2009) suggests, but to reject the prevalent (outside of Western contexts) entanglement of software piracy and participation in global cultural production. Such disentanglement, based on repairing and developing alternative software infrastructure for media production, does not need to be initiated by hackers. Aspiring digital artists and cultural
producers can now bend software infrastructures to fit their needs and push for their development through the politics of negotiation embedded in repair. This specificity leads to the redefinition of the role of hackers and technologically savvy individuals in such infrastructural development, from having a leading role to gaining a more symmetrical position in relation to the needs and desires of other actors who have an interest in software.

This is an important difference from how many communities around free software development function. Repair, as mobilised in Morevna project, changes the way in which we can understand the value of participation in free software (and thereby infrastructural) development. In many free software communities, contribution to software is connected to an implicit system of meritocracy that defines one’s authority in the community (O’Neil, 2014). For the one or two software developers involved in Morevna, the project has undeniably been about such merit and recognition. But, considering that the majority of other individuals involved, including the project leader, were not developers, software development was of different value. For cultural producers, reputation comes from the recognition of the symbolic products they produce which can be shown and appreciated. Their work gains higher value when developed, first, by non-pirate technologies and, second, by self-made ones adjusted to their individual creative demands and practices, as it brings them closer to an artisan, craft-like way of work. Therefore, specific configurations of repair, such as connecting local with online actors, institutions and resources in one common practice of infrastructuring, are related to the need to reconcile a spectrum of different values connected to and dependent on software development.

In effect, the mundane repair performed in such a mode leads to a process of, somewhat paradoxical, situating of the infrastructures being developed or the production of what may be termed ‘situated infrastructures’. The paradox in the concept stems from the general understanding of infrastructures as systems that create the grounds on which other objects can operate. As such, they aspire to universality, tend to outcompete other systems, and as a consequence, rather frequently get monopolised. Understanding infrastructures as situated rejects the possibility for universality and redefines them as constant objects of contestation and redefinition that happens through repair. The question of whose priorities and problems are

---

5 The concept is derived from Suchman’s (1996) discussion of ‘situated technologies’ which is in turn a development of Haraway’s understanding of situated knowledges.
catered to first in the practice of repair becomes a moment of alignment of mutual interests that requires a fragile balance between the collective effort and dependency of many people on the functioning of infrastructures and individual ambitions and needs. Repair, as a process of situating infrastructures, can therefore emerge as fragile and tentative as the infrastructures of breakdown that it may try to evade, such as those of piracy.

Finally, what form the process of situating infrastructures will take is largely dependent on local circumstances and socio-political contexts. The Synfig software, as a form of digital infrastructure for media production, has been repaired as a result of the complex entanglement of shifting attitudes to piracy by the Russian state, individual local desires to connect to creative communities beyond national borders and the search for the technological means to do so. This particular context configured in very concrete ways the spectrum of possibilities for financial, cultural and technological resources that could be used in the project that emerged out of a form of digital scarcity and infrastructural breakdown rather than from a critique of abundance, as other forms of repair infrastructures can take in Western contexts (Kannengießer, 2016). Therefore, place, locality and local circumstances still play a crucial role in technological projects and contribute to the situatedness of infrastructure even when it is distributed, online, and entangled in multiple lifeworlds and ambitions.
Paper 4
Negotiating Creative Autonomy: Experiences of Technology in Computer-Based Visual Media Production


Author: Julia Velkova

Abstract
Media production is today heavily computerised, and as a consequence of this, profoundly reliant on software. At the same time software does not represent a neutral artefact – it imposes certain affordances, logics, structures and hierarchies of knowledge onto the media making processes. This chapter explores the ways in which visual media creators negotiate the choices between multiple technological alternatives, and the ways in which these negotiations relate to the degree of creative autonomy experienced by cultural producers in their media practice. Combining perspectives from media studies of work in the cultural industries, and science and technology studies (STS), the paper suggests that choices of technology lead media producers to experience creative autonomy differently, by making them labour either within post-industrial technological frameworks that they do not have ownership or control over, or conversely, allow them greater ownership on technology and possibilities to mould their tools, bringing their practice closer to forms of pre-industrial craft production. Creative autonomy, I suggest, can therefore be negotiated by artists and media creators not only in relation to institutions of employment, or nation state politics, but also through deliberate choices of tools, the digital technical toolset that they select and embed in their practice; an approach largely inspired and practiced by some forms of hacker culture.

Keywords: creative autonomy, visual media production, free software, open source, experiences
Introduction

The past decades have witnessed the gradual rise of a social movement of global outreach, one that has left lasting traces on the way that the Internet and much of the software infrastructure that underpins today’s communication networks function; namely the Free and Open Source software (F/OSS) movement (Coleman, 2013; Kelty, 2008; Söderberg, 2012). Representing a specific form of hacker culture that is narrowly centred on the politics of technology, of ‘making things public’ (Kelty, 2008: x), in which participants value and practice ‘craft autonomy’ (Coleman, 2016) through writing and sharing computer code, this movement has become an icon, and a source of inspiration for a broad range of other actors from the fields of law, education, media and journalism, all of them eager to make the case for open access (Coleman, 2013: 197).

In this paper I discuss one major area of media production, that of digital visual media production, in which ideas and practices inspired by the F/OSS movement have more recently started to be brought in, but have remained overlooked by scholarly enquiry. For about a decade computer graphics artists, technologists and creators working in the domains of digital painting and illustration, 3D sculpting and animation film have started to adopt and collectively develop digital F/OSS tools for the professional production of visual culture. Among the software programmes that they employ are Krita for digital painting, Blender\(^1\) for 3D animation and sculpting, and Synfig for 2D vector animation. These programs represent the non-proprietary but licensed software alternatives for computer graphics and animation manipulation such as 3D Studio Max, Photoshop Element, Adobe After Effects, Anime Studio and Maya. These F/OSS programs are also used today to a greater or lesser extent in a broad range of industries and media practices. The usage ranges from the more experimental type such as conceptual art, or designs for 3D printing, to ones where the programmes are used for the production of comic books, illustrations, special effects, games, animation, and simulations.\(^2\)

---

\(^1\) Of these, Blender is by day the most well-known and broadly used free software programme for 3D manipulation and animation, with more than 3.7 million unique downloads per year, or about 300,000 a month, see http://www.blender.org/wp-content/uploads/2015/04/Screen-Shot-2015-04-03-at-10.24.48.png (accessed 20 September 2015)

\(^2\) The range of uses can be seen, for example, through the diversity of projects presented at the annual Blender Conference: https://www.blender.org/conference/ or at Libre Graphics Meeting: http://libregraphicsmeeting.org
My focus in this paper is on sketching out some of the trajectories that are leading media creators to adopt F/OSS tools for digital visual production. In particular, I am interested in the ways in which visual media creators negotiate the choices between multiple technological alternatives, and the ways in which these negotiations relate to the degree of creative autonomy experienced by cultural producers in their media practice.

Creative autonomy and the media industries

Creative autonomy in media work, and, in particular, within the creative industries, has for more than a decade, been an object of intense debate among scholars of media production. Studies of the computer games industry (Deuze et al., 2007), television production, music recording and magazine publishing (Banks, 2010b; Hesmondhalgh and Baker, 2010), radio production (Stiernstedt, 2013), as well as the Hollywood animation film industry (Stahl, 2010) have pointed to an inherent tension between autonomy and the control of creative labour embedded in capitalist, neoliberal systems of production. On the one hand, artistic and technical work within the media industries carries with it the allure of work that has both a high degree of creative autonomy and flexibility and which is sometimes manifested in an anti-corporate work culture, enabling creators on occasion to develop the reputation of being an ‘auteur’ (Deuze et al., 2007). At the same time, the organisational frameworks of production are dependent on constant rationalisation and effectivisation of labour in order to accelerate production, thus constraining the autonomy of creators in order to adjust creative works to market demands. This tension may arguably result in a somewhat alienating experience for artists and media creators that stems from creative work being embedded in institutions of employment and regulatory systems of intellectual property. The latter allow artistic and other creative work to be treated as any other kind of work, thereby converting creators and their creations into an object of value extraction (Stahl, 2010). At the same time, they can also develop strategies to accommodate these tensions, such as through what Banks (2010a: 262) and Ward (2015: 215) refer to as forms of ‘negotiated autonomy’. The latter refers to processes of creating subjective meanings in creative practice in what Banks (2010a: 262) denotes as a ‘quotidien struggle to try to mediate, manage or

---

3 In the context of this paper, I understand creative autonomy in the sense of the degree of freedom a creator has to define the aesthetic dimension of an artwork.
reconcile the varied opportunities and constraints of the art–commerce relation’. The primary concern in this struggle, he argues, is to find meaningful self-expression within, rather than by directly confronting capitalism.

What I am proposing is that going beyond the scope of subjective meanings, creative autonomy can be negotiated by artists and media creators through their choice of tools, the digital technical toolset (including both software and hardware) that they select and embed in their practice.

The politics of technology in digital media production

Contemporary media production is today heavily computerized, and as a consequence softwarized. The computer, together with the accompanying software, has become ‘the new engine[s] of culture’ (Manovich, 2013: 21) through which media production, distribution and reception are channelled, integrating the logics of software into the core of most types of production, including that of media and culture. As Berry (2014) suggests, this has also arguably led to a reconfiguration of the role of the author, or creator of media – from one who has once been presumed to be the originating transmitter of a discourse to one standing in a mediating position ‘as just one among all those other managers looking upstream to previous originating transmitters – database or XML schema designers, software designers, and even clerical information workers’ (Hayles, 2012: 201). In this sense, creators of media are not only integrated in structures of employment, or nation state politics, but also in the specific logics of technology with which they daily interact and in which they are embedded at multiple levels. As art critique Boris Groys (2013) argues, one of the consequences is that the post-industrial creative industries presuppose ‘the innovative, project-oriented and autonomous working process. But on the other hand, the artists, designers, or writers use the means of production that they do not own or control’.

Choices about technology, including ones relating to media production software, impose certain logics, structures and hierarchies of knowledge onto the media making processes and affordances (Berry, 2014; Fuller, 2003). In the process of so doing, these logics act as a form of power diffused through computer coded objects and computational devices (Allen-Robertson, 2017; Berry, 2014). This power is not determining, but neither is it a neutral force (cf Williams, 1974/2003). It contains, rather, the politics of technical decisions, and questions about who can make these decisions,
which makes software and hardware, just like any other technical infrastructure, a highly political issue (Frabetti, 2015; Star and Bowker, 2004).

At the same time, tools and technologies are relational in their usefulness, and can make their political nature more evident for some and more seamless for others. For some, digital infrastructures such as software (or hardware) may represent an easy-to-use black box while for others, including visual media creators, they are an object of work, a daily struggle and a problem (Star and Ruhleder, 1996).

Below I will illustrate some of the considerations of visual media producers that lead to particular negotiations relating to the technical apparatuses they use. As will become evident below, these negotiations are conceptualized by most creators as oscillating between two poles, that of proprietary software and that of F/OSS. The material is based on the critical self-reflections of 35 digital artists, animators and programmers collected in the course of interviews and informal conversations, as well as drawing on public online material and participant observation of producers’ creative practices that took place in the period 2013 – 2015. All of the individuals have been using or been involved in developing the three non-proprietary tools mentioned above: Blender, Krita and Synfig.

Early-career negotiations
Already from their formative years, visual media creators are confronted with the need to choose from a range of tools and technologies in relation to which they develop their professional skills and specializations, a process that is typical of art and media production (Becker, 1982/2008).

In the early stages of their practice, many of them adopt popular, ‘out-of-the-box’ proprietary media production software manufactured by a small set of large corporations such as Adobe, Autodesk, Corel. Those who do not have the resources to buy their own software, resort to pirating it in the same way as has historically been practiced in many other types of artistic activity. As Becker (1982/2008: 71) has observed: ‘Artists get materials and equipment through the mechanisms that society has for distributing goods […] where the market economy does this allocation, artists buy, rent or barter […] and those without money can steal’.

The use of illegal versions of programmes usually works for a certain period of time, but at the point when creators of digital media start employing them in their professional work, they begin to recognize piracy as unethical:
When … there was something I needed to do, I needed a tool for it – Photoshop, After Effects and all those, but they were very expensive… you had to either pay a lot for it, or just go and grab a pirated version somewhere around. That just didn’t feel right. After a while I tried Linux and I switched to that. (free-lancing 2D animator from Sweden)

The above considerations are related to the process of creating a professional identity. With this comes also the need to negotiate the economic aspect of software. This negotiation can manifest itself in the need to choose between continuing to use proprietary software and deciding whether to legally purchase all necessary programmes, or to move to F/OSS tools. For some, this moment comes rather early in their lives. A 3D modeller from Finland who has been using Blender in his work at Rovio, the company behind the Angry Birds franchise observes: ‘If you are 15 years old and want to start playing with 3D, you need to pay 5,000 dollars to buy software. You can’t afford it when you are 15, and Blender is free’.

In some cases, especially for creators who start their careers in non-Western countries the choices could also be related to technical accessibility:

I started using Blender because I wanted to do 3D. And I didn’t have a CD-Rom, so I couldn’t run the big packages like Max, Maya… A friend of mine had internet and he found this software called Blender for Linux. And he said, there seems to be a Windows version too. We put it on a floppy disk, it was only 1 MB or half a megabyte….and we were like, oh wow, you can do 3D! Awesome! So we started learning it. (3D light designer and animator from Argentina)

Whereas the choices between proprietary and F/OSS tools tend to be initially anchored in pragmatic, economic and technical considerations in relation to their envisaged long-term use, the reasoning changes over time and becomes more concerned with the degree of agency possible to exercise on technology.

On the surface, what differentiates proprietary from F/OSS is the legal licence under which programmes are distributed. Yet, they configure creative autonomy differently. Proprietary software applies copyright law in a way which limits users’ agency to act upon the software by legally preventing interference with the programme’s source code – both through the licence agreement and through the distribution of programmes in binary, ‘pre-packaged’ form. Proprietary software configures creative autonomy in a specific way – it allows creators to work within the scope of a technical
framework created, owned and controlled by someone else other than the user – in the case of visual media production software, by corporations such as Adobe, Autodesk and Corel. Conversely, F/OSS uses ‘copyleft’ licences that ‘reformat copyright law to prioritize access, distribution, and circulation’ (Coleman, 2013: 1), configuring user agency in a way that allows producers to a greater degree ‘to labor within a framework of their own making’ (ibid), or what Coleman (2016) refers to elsewhere as allowing them to exercise ‘craft autonomy’.

The difference between the two is experienced tangibly by visual media creators at later stages in their careers.

**Negotiations in later stages of a career**

French illustrator and digital comic artist, David Revoy, recalls how the upgrade to a newer computer and a newer version of a proprietary operating system caused all his legally purchased tools such as Corel Painter, Manga Studio, Photoshop Elements, CS2 and more to stop working on the new computer, and on the new version of the operating system that came with it: ‘I had to do a lot of horrible hack to make all my software run[ning] on it, but it wasn’t stable as it was on Xp anymore. I had to reboot almost twice a day’ (Revoy, 2013). From a tool that automates and mediates creative expression, media production software can become an artifact with ‘agential’ (Paasonen, 2015) rather than instrumental properties that may, for some time, leave the user powerless. Faced with the choice of either repurchasing all programmes to match the new operating system and hardware, of reverting to the older computer and operating system, or of doing something completely different, Revoy (2013) chose to move to F/OSS:

I thought all of this circus couldn’t work in the long term, and wasn’t happy…. I switched my machine to a full open-source system around 2009 … thinking, open-source could work on (in) the long term.

The result of this negotiation was not explained in terms of economic gain, but in the qualitative difference related to a new degree of creative, or craft autonomy gained:

I really like the independence I get from it: I can install it on laptops, every machine, upgrade, downgrade, fine tuning it. This independence is gold. The con is that I’m now dependent on hardware ‘linux’ compatible. Which is not easy to find, and not well documented. (Revoy, 2013)
Another moment of negotiation emerges in situations of anxiety over the inability to drive forward the development of software so as to adjust it to one’s individual way of working. A former artist, now developer of Blender code, recalls a moment from his early professional life working for an industry that was a heavy user of proprietary software for computer simulation:

As a user, I was like – okay, you pay a lot of money, they give you a good product, this is fair, this is okay. There is no problem with that … it works actually, I wouldn’t be too dismissive of that… But software that your business relies on – it’s complex and … it has bugs. It’s got problems. It is imperfect (Blender developer, interview, 2014).

This imperfection is inherent in any kind of software, but the way imperfections are overcome differs substantially between F/OSS and proprietary software.

I tried to report bugs with those closed source guys and they were … sort of … in the position of pretending as if there was nothing wrong. Because they had sold you something. And if you told them that something was wrong, then they just tell you that this feature was never meant to work or something like that….and that’s okay, fair enough. But with open source, the people who I dealt with were like…, oh, fella, really you found it [a bug], can you give us a file, and….yeah, that’s fixed. And the number of problems I had fixed the same day that I reported them would be in the 50s probably (Blender developer, interview, 2014).

Creators who use specialized software are dependent on its responsiveness. The degree to which they can intervene in the process of development, and in the re-inscription of software, its improvements and failures directly affects their work processes. The greater the possibility to mould the production software to their needs, the greater their sense of creative autonomy becomes. A US-based animator and director had the following observation to make about this: ‘Free software matches very well with the artistic idea because no artist wants to be locked into what they can do – a lot of the process of making art is about making the tools’ (Bassam, animation director, archived blog post, 2014).

The actual making of tools may not necessarily be performed by the creators themselves, who may not have the skills to do the programming, but is enacted through the mechanisms of F/OSS development based on ‘making things public’ (Kelty, 2008: x) and the autonomy to act upon them:
I experienced the ‘ask for a feature—have it the next day’ thing, which was really new to me. I was actually being part of the making of the tool… The Blender way really seduced me. (an animator and digital painter from Costa Rica)

These experiences suggest that the distinction visual media creators make when negotiating between proprietary and F/OSS are in relation to the way technological power configures their creative autonomy. The ‘failures’ of proprietary software are perceived in a way that resonates with philosopher of technology, Feenberg’s (2005: 49) proposition that power in industrial capitalism is configured ‘through designs which narrow the range of interests and concerns that can be represented by the normal functioning of the technology and the institutions which depend on it’. The way technological power is exercised through F/OSS could instead be seen as allowing one to expand one’s range of interests, and the possible applications of software independent of a single controlling body, thus adapting tools to individual creators’ work processes and momentary demands, and illustrating the possibility of exercising craft autonomy. As a French digital painter Timothée Giet shared with me: ‘It is more like the old painters who made their paint themselves. Mixing the ingredients and building their paint themselves’.

This sense of autonomy, also experienced in other practices of F/OSS development such as hacking (Coleman, 2014), often does not emerge immediately upon the first encounter with F/OSS. The first attempts of creators to produce something with a F/OSS tool such as Blender, Krita or Synfig are often disappointing. They often describe these early attempts as painful, full of a sense of powerlessness that stems from not having developed the skills to use these tools, and the failure to understand the social mechanisms in which they are embedded. Sometimes this drives creators to the point of emotional desperation. However, once these frustrations are overcome, visual media creators often experience a sense of freedom, independence, and autonomy. For many this comes as a revelatory moment of illumination in their creative practice. As Manu, a 3D modeler from Finland puts it: ‘The transition to Blender has been one of these things that are a spot in your lifeline, when it starts moving your life in a different direction’.

This direction is related to the creation of a specific feeling of ownership developed in relation to the tools of media production that gives pleasure, and an experience of a high degree of creative autonomy (see Velkova,
2:4 NEGOTIATING CREATIVE AUTONOMY

2016c). It can lead to further engagements such as becoming part of the core development of the tools, or of becoming employed in the production of visual media for organisations that have incorporated them into the core of their business operations and their creative practices (Velkova and Jakobsson, 2017).

Conclusion

User encounters with technology are caught up in a constant tension between control and powerlessness, between freedom and dependency, with networks, devices and software embodying different potentialities for action (Paasonen, 2015). The experiences described above, although not representative of the whole spectrum of possible encounters of visual media creators with technologies, illustrate some of the key trajectories of negotiations with respect to software tools used in creative practice. They also suggest a somewhat dichotomous distinction between proprietary and F/OSS as technological choices, one that excludes the wide range of other programmes existing in the ‘grey zone’ between these two, such as freeware, or small low-cost applications that could be integrated into work processes. This could be due to the specifics of the production frameworks of some digital visual media, such as animation, games and illustration, and is an area on which further research could be profitably dedicated. The trajectories and considerations outlined above have been expressed in relation to what creators consider their ‘main’ production tools and systems used in their practices. The way in which visual media producers reflect on the use of these tools suggests a craft-like attitude to technology, even in work related to producing ‘purely’ visual media artefacts. This attitude could be summarized through the idea that: ‘you get the best out of the computer and its software if you are able to drive the tool rather than being driven by it’ (Dormer, 1997b: 146). In creative practices in which creators are dependent on increasingly complex specialized software tools, the degree to which one is allowed to mould, re-inscribe and extend their predefined functions can provide the experience of ‘good work’ (Hesmondhalgh and Baker, 2010), and of creative autonomy. The latter is perhaps best described in the comment with which Krita’s founder, Boudewijn Rempt, concluded our interview: ‘If you want to be free, you need to have all your tools free’.
Paper 5
Free Software Beyond Radical Politics: Negotiations of Creative and Craft Autonomy in Digital Visual Media Production


Author: Julia Velkova

Abstract
Free software development and the technological practices of hackers have been broadly recognised as fundamental for the formation of political cultures that foster democracy in the digital mediascape. This article explores the role of free software in the practices of digital artists, animators and technicians who work in various roles for the contemporary digital visual media industries. Rather than discussing it as a model of organising work, the study conceives free software as a production tool and shows how it becomes a locus of politics about finding material security in flexible capitalism. This politics is ultimately contradictory in that it extends creative and craft autonomy of digital artists but does not mobilise a critical project. Instead, it nurtures further precarious labour. Empirically, the article draws on ethnographically collected material from the media practices of digital artists and programmers who engage with two popular free software production tools, Blender and Synfig.

Keywords: Blender; craft autonomy; F/OSS; media tools; material politics; media industries; open source software; post-Fordism; Synfig
Introduction

Media practices, such as free and open source software development, and the technological experiments of hackers have been broadly recognised as fundamental for the formation of political cultures that foster democracy in the digital mediascape. Their relevance for political agency today is expressed through the ability of actors who take part in these practices to ‘reconfigure the material politics of cultural action’ (Coleman, 2013: 185), primarily through introducing new ‘entities’ into the world (Söderberg, 2011: 23), and by making them public (Kelty, 2008). These entities can range from material objects that take the form of open hardware, such as self-made 3D printers (Söderberg, 2014), through writing an independent operating system (Coleman, 2013; Kelty, 2008), creating alternative institutions for intellectual property rights management, to experimenting with digital aesthetics and critical art projects (Morgan, 2013). In all these cases, politics is practised primarily through creatively engaging with building, modifying and maintaining technological equipment, an activity that resembles both public demonstrations of technical expertise and a way of arguing about technology with and through it (Kelty, 2008; Kubitschko, 2015).

Occasionally, the public entities and institutions that are brought to the world can inspire broader social groups to repurpose them for other goals and embed them in other practices, imbuing them with other meaning. Such cultural ‘modulations’ (Kelty, 2008: 242ff) of free software often represent forms of criticism, such as in the case of Indymedia, to make a case for alternative journalism (Atton, 2007; Lievrouw, 2011), its use by the open data movement (Baack, 2015), its use for creating alternative social media networks (Gehl, 2015) and the emergence of the Creative Commons licences for open cultural production (Coleman, 2013: 197ff). Free software also plays an important role among artistic minorities as a way to develop criticism of dominant regimes of ownership over digital ‘materials’, i.e. software used to make visual media (Morgan, 2013).

Despite the richness and importance of these studies, one of their limitations has been their focus on the uses of free software predominantly for political activism by social movements and creative minorities. However, free and open source software has also come to be increasingly integrated in the practices of corporate technological manufacturers like IBM, Google and Hollywood computer graphics giants Disney and Pixar. With regards to these developments, Kelty (2013) suggests that corporate use of free software threatens to make its critical potential ‘sterile’ by being equally
easily put to use to mobilise counter-critical power that strengthens monopolies rather than to criticise them. At individual level, free software could also be used instrumentally for technical career advancement: ‘for a great many software developers, toiling as they do in the richer veins of freelance precarity, it meant not having to rebuild the same damn thing over and over again with every upward career move’ (Kelty, 2013). Kelty concludes that ‘As open source becomes an instrumentalised kind of politics, the possibility of new beginnings fades’. Thus, the critical potential offered by free software seems to simultaneously flourish among activists, and get neutralised by its use in the media industries, converting it into a motor for new models of value creation (Barron, 2013).

This article seeks to broaden the scope of knowledge about the role of free software in the politics of digital media production by discussing its relevance for other actors, beyond activists, hackers or large media corporations. In particular it explores its value, use and development among computer graphics artists, designers and animators who work in a wide range of roles at small advertising agencies, visual effects and computer game and film production companies for the contemporary digital media industries, while occasionally engaging in projects on free culture and independent film making.

The material for this study comes from a large research project on the media practices of two free software computer graphics communities: those formed around the programs Blender for 3D animation and Synfig for 2D animation. The data has been collected through multi-sited ethnography and qualitative interviews with 35 visual media artists and developers. They were held between 2013 and 2015 and documented the use of these two programs for, predominantly, open and free cultural production (see Velkova, 2016b). As the large research project progressed, however, it became clear that the same producers who engage, for payment, in open cultural production and free software development also work in different roles for the media industries where they put the same media production tools to use. Some have worked on large projects such as the LEGO movie or Pixar’s short films or for Rovio, who own the Angry Birds franchise. Others work for advertising agencies across Europe, develop animation for educational projects, or create independent and free culture films. Oscillating between two supposedly antagonistic fields of media production, by having a relation to the industries and to free culture projects, the empirical material that underpins this article represents a fruitful starting
point to explore the broader value of free software as a media production tool beyond its uses for radical politics.

The approach I take here is to first briefly outline the work context in flexible capitalism using the overarching framework of Boltanski and Chiapello (2007) on the moral justifications that motivate society to engage in the ideology of capitalism. I then apply a narrow focus on digital media production and draw on Howard Becker’s work on ‘Art Worlds’ (1982/2008) in order to discuss the role of materiality in creative practice, which I connect to the conditions of producing media in flexible capitalism.

The argument developed here is that free software for visual media production is conceived by media creators as a form of material capital that represents a source of creative emancipation and security in relation to their creative practice in the highly competitive media production environment. These forms of empowerment, however, are not mobilised to serve a broader critical political project, but represent individual pragmatic strategies to extend digital artists’ creative autonomy in the media industries or establish links of equivalence with them while nurturing further precarity.

**Media Production and Free Software in the New Spirit of Capitalism**

Digital visual media production takes place today to a large extent in the context of post-Fordist work frameworks that promote ‘creativity, reactivity and flexibility’ (Boltanski and Chiapello, 2007: 90) as core cultural values. In their seminal work on the transformations of capitalism between 1960 and 1990, Luc Boltanski and Eve Chiapello advance the thesis that these values are not universal but rather manifestations of a new ‘spirit’ of capitalism. By ‘spirit’ they refer to a set of normative and moral rules that justify society’s engagement in capitalism. These rules need to offer a promise of some form of autonomy and security for individuals while serving the common good. In terms of autonomy, Boltanski and Chiapello argue that there should exist an incentive for people to engage in the process of accumulation even if they will not necessarily enjoy the main benefits of it. Individuals also need to feel some form of security for themselves and their children, while participation in accumulation needs to be justified as serving ‘the common good which contributes to producing for everyone’ (8) and being just.

The transition to post-Fordism in the 1980s and 1990s is regarded by Boltanski and Chiapello as a specific point in capitalism when its justification apparatus is radically redefined. In terms of autonomy, the core values
become ‘the development of oneself and one’s employability’ (111). The former emerges through the paradigm of constant improvement of skills, reputation, being adaptable, self-organised, and participate in novel and exciting projects. To become employable, workers need to know how to engage in a project and to remain ‘adaptable, physically and intellectually mobile’ (112). Enhanced by networked communications, qualities such as flexibility and adaptability are argued to emerge from activity and autonomy, rather than from obedience and belonging to hierarchical structures. In this way, personal development as an option for ‘everybody’ serves the ideal of the common good, while contributing to broader processes of value production and its accumulation.

This spirit is particularly identifiable in the contemporary media industries and in the debates about autonomy and control of media work. These industries carry a strong allure for young people and creators promising work of greater social status, autonomy, personal expression, flexibility and self-actualisation (Mayer, 2014). To stimulate their employees’ creativity, many media companies adopt an anti-corporate work culture and on occasions enable creators to develop a reputation of being an ‘auteur’ (Deuze et al., 2007), a celebrity (Hesmondhalgh, 2013), or a person with broader public recognition (Mayer, 2014). At the same time, the organisational frameworks of production are dependent on constant rationalisation of labour in order to accelerate production and reduce costs, thus constraining the autonomy of creators and adjusting it to market demands. They do so by, first, transferring ever greater responsibility for personal artistic and technical skill development to individual creators and, second, by embedding creators in institutions of employment and regulatory systems of intellectual property that detach creators from their creations, converting their labour into an object of value extraction (Deuze, 2007; Huws, 2014; Stahl, 2010). In the latter context, free software development has been acknowledged to have a potential to bring change in terms of offering more efficient and less alienating ways of organising and managing media production (Benkler, 2006). These alternatives have nonetheless been questioned in terms of their financial viability (Hesmondhalgh and Baker, 2010) and placed free software in the context of the free labour debates (Terranova, 2004), two issues that I have engaged with and nuanced extensively elsewhere (Velkova and Jakobsson, 2017).

In the context of digital media production, free labour has been discussed largely in terms of the unpaid work that media users perform by producing content in various online contexts, work that is valorised by the
media industries (see for example Bolin, 2012b; Hesmondhalgh, 2010; van Dijck, 2009). However, unpaid work has always been integral to certain spheres such as those of social reproduction (Jarrett, 2016) or cultural production (Hesmondhalgh, 2010: 277). In these spheres, free labour can be regarded not only in terms of paid or unpaid, but also as good and bad, just and unjust (Hesmondhalgh and Baker, 2010). For example, the internship systems in the media industries today are largely unjust, but unpaid labour as such has always been part of the process of developing skills, ranging from learning to play music instruments to programming, computer graphics and game development (Hesmondhalgh, 2010). Rather than being unjust, the latter forms of free labour stem from the dependency of cultural production on materiality and are addressed in part by Howard Becker (1982/2008) in his work on the sociology of art production. I will discuss this dependency later.

Free software producers are also able to engage in the valorisation of their products (Velkova and Jakobsso n, 2017), something which, as Barron (2013) shows, has transformed it from a critical practice to a distilled form of the ‘spirit’ of contemporary capitalism. Converting technology into global software commons, free software enables autonomy and project mobility for everyone, serving the common good. What it falls short of, Barron concludes, is to guarantee security to those who engage in its development, thus paving the way for new forms of criticism.

Indeed, security is what Boltanski and Chiapello dismiss as the new ‘spirit’ of capitalism not offering enough solutions to. The main security that projects or companies can offer to individuals today is development of personal capital that could help employability in future projects and initiatives.

However, as I will argue, free software could represent a specific form of security, that of material security, that enables media creators who engage in using and developing it to also gain a form of creative autonomy, namely craft autonomy. In order to understand how this happens, we need to take a different perspective on free software and approach it as a media production tool rather than a model of organising work. This article therefore continues by exploring more deeply the relationship between technology and digital media creators rather than that between individuals and the broader organisational structures of media production.
Materials for Media Production

Employability and participation in media projects is largely predicated on the creativity and technical skills of creators, whose practice in turn develops in relation to the materials, or tools, available to them. In the current ‘spirit’ of flexible capitalism, media creators need to be adaptable and flexible not only in relation to the organisations or projects that they work on; their possibility to sell their work or develop criticism also depends on the flexibility and creative autonomy that the technologies they work with can offer them.

From this perspective, creators of media are not only integrated in structures of employment, nation state politics, or networks of peers, but also in the specific logics of technology with which they interact daily and in which they are embedded at multiple levels. The sociology of art proposed by Howard Becker (1982/2008) offers some insights into how to understand these entanglements in relation to creative autonomy. In his discussion of art as collective action, Becker emphasises that creators’ choice of materials affects the work they do (71). Materiality forms a crucial part of the production of artistic works:

Musical instruments, paints and canvas, dancers’ shoes and costumes, cameras and film—all these have to be made and made available to the people who use them to produce art works (Becker, 1982/2008: 3).

In the case of producing specialised media, e.g. digital visual media, creators need materials that are designed and manufactured specifically for them. Becker argues that since the manufacturing of specialised items is so technical a specialty, the artists who use them cannot in most cases produce the items themselves. Despite the fact that manufacturers try to be sensitive to the needs of the creators of a particular medium, they may fail to satisfy those who try to innovate in the medium: ‘How much conventional materials constrain an artist depends on how monopolistic the market is’, he argues (1982/2008: 73). Through this argument Becker establishes a link between technical innovation, creative autonomy and the frameworks of creation and distribution of materials. The fewer manufacturers that dominate the market, he argues, the more insensitive they become to what artistic minorities want or need. Occasionally, artistic minorities can revert to the craft of making their own materials, or of customising existing ones if faced with the threat of discontinuing the material against which creators have developed their skill, if they want more than the available materials can
provide or if materials to satisfy a creative impulse are not available (Becker, 1982/2008: 71ff)

It is in this context, and rather pragmatic considerations about individual strategies to develop creative practice, that free software emerges as a tool of high value among media professionals, digital artists and aspiring media workers. The next section substantiates this point through a discussion of the emergence of two popular free software tools for computer graphics production, Blender and Synfig.

Crafting Technical Autonomy: The Blender and Synfig Free Software Projects

The free software discussed here, Blender for 3D animation and sculpting and Synfig for 2D vector animation, were conceived as digital tools that would enable their creators to exercise a greater degree of craftsmanship, innovation and autonomy in the medium. They also represent the free software alternatives for professional animation production to programs such as 3D Studio Max, Adobe After Effects, Anime Studio and Maya.

The 3D animation software Blender and the 2D Synfig were initiated by two industrial designers, one living in Europe and the other in the US, who had ambitions to make large-scale independent animation projects of Hollywood class. Despite having notable differences in their focus of specialisation, and being incepted at different points of time, with Blender having its roots in the late 1980s and Synfig in the mid-1990s, both were conceived as in-house programs developed within two small commercial animation studios. After facing bankruptcy in the early 2000s, both projects emerged as free software through very particular processes of decommodification (Velkova and Jakobsson, 2017).

In the case of Blender, the need to start developing an independent program emerged from the ambition of its creator, Ton Roosendaal, to align with the industrial practices of 3D technological development:

3D is specialist... it is so specialist...any big studio who does animation—or visual effects—they depend for the most of it on their own, in-house software development. They are not going to buy all their applications—and even when they buy some stuff, they want to have the code. Because they can’t depend on a software, submit a bug, then wait for two weeks for a bug fix to come in while a thousand people are waiting, right? That’s kind of...at that level your IT, your information systems have to be under control.

(Ton Roosendaal, interview, 2014)
Blender emerged from its author’s desire to have complete control over the development, changes to and possible extensions of a computer program, ‘a digital tool’ that would enable its creator to adapt it and mould it to his own creative ambitions.

Until the mid-1990s, software for computer graphics development was distributed as an add-on to very expensive hardware that media creators anyway needed to invest in. The computer industry restructured in the late 1990s. With computing power becoming cheaper and more ubiquitous, companies began developing business models around selling, and more recently renting specialised software for computer graphics production. The changes in the politics of distribution of software for computer graphics production have been experienced as constraining creativity, experimentation and large-scale projects by small studios and individual digital artists:

[In the 1990s] the hardware cost money, but once you had it, you could do anything – we were getting CDs with Silicon Graphics code! It was proprietary stuff, but it didn’t prevent us from making things with it. Computer graphics is about openness, because you can build on everyone else’s developments. Once you get a patent or close it—people find a way around it. (notes from informal conversation with Ton Roosendaal, May 2015)

Hence, the experiences of material constraints to continue experimenting with computer graphics led Blender’s creator to find a way round them by re-licensing his program as free software as a strategy to retain technological and creative independence and let the program grow by allowing other digital artists to contribute to it:

open source is about developing your own software. So the best model [to develop computer graphics]. OK, not the best, the Blender open source model is the in-house software model. (Ton Roosendaal, interview, August 2014)

Similar concerns drove the development of Synfig. Its founder Robert Quattlebaum wanted to rationalise one of the most laborious tasks in 2D animation creation, tweening, and adapt the software to his own creative ambitions:

Our goal was to write a tool that could be used for the production of feature-film quality 2D animation. In traditional animation, the senior animators use the storyboards to create the keyframes for each shot. The junior animators then use these keyframes as guides for making all of the frames in between—which is called tweening. Tweening is a time-consuming and
labour-intensive (and thus expensive) process. However, it is also rather mechanical. So that was the original idea from day one—the elimination of the tweening process… While Synfig has been used in production, the animators using it had the benefit of having the primary developer sitting behind them. That counts for a lot. (OS News, 2006)

After its decommodification in the mid-2000s, and conversion into a free software project, Synfig’s development was driven forward primarily by one self-taught animator, Konstantin Dmitriev, from the city of Gorno-Altaysk in Southern Siberia, Russia. For him, Synfig, represented a technology that with some further development could fulfil his creative idea of making a large-scale independent feature-length animation film.

In search of style, his work had begun with proprietary programs such as 3D Studio Max but after some time he experienced a limitation in scale: ‘the more I complicated a scene, the less controllable it became’, he explained. Facing in this way a constraint to innovate in the medium, instead of trying to adapt his practice to the technical limitations of the tool, he switched to experimenting with free software as a way to adjust technology to the scale of his creative ideas. Initially he tested Blender, an experience which he describes as largely affective:

What shocked me in Blender the first time I used it was that it had layers… layers existed in many other types of programs at that time, but not in 3D… this was so daring, to do layers in a 3D program, I had never seen such a thing before. (Konstantin, interview, January 2015)

While improving his skills in Blender, Konstantin also specialised in 2D animation in parallel with using proprietary programs until their development frameworks collided with his own work process. The manufacturer of the 2D animation program Moho discontinued its development under Linux, which had gradually become Konstantin’s main platform. The impossibility to use this software as a production tool caused him great anxiety:

I liked the fact that everything (in Moho) was under my control. But nobody was supporting it… then I realised what dependencies proprietary software was creating. It is not about the cost, it is about the dependency. (Konstantin, interview, November 2014)

Since then he has focused his efforts on studying and developing the free software Synfig, which he integrated at the core of his creative practice, and
multiple projects ranging from free-lancing work to education and independent free culture production (Velkova, 2014b).

Both Konstantin’s and Ton’s choices to invest their time in developing Synfig and Blender respectively emerged out of explicitly pragmatic concerns related to the possibilities to create within frameworks of their own making and under their own control. This form of engagement with technology has been referred to, in the contexts of free software development and hacker cultures, as forms of establishing ‘craft autonomy’ (Coleman, 2016), one that fosters skill and expertise, but also sensibilities similar to pre-industrial, craft-like engagement with technology. The emergence of these two programs for visual media production is also an indication that constraints to creativity imposed by the politics of creation and distribution of media production tools continue to be a topic of high concern even in digital media contexts, and lead to reactions similar to those that have always been historically present in artistic practice (see Becker 1982/2008: 71–77).

Despite the freedom of creative expression which developing autonomous media production tools granted to their creators, it also constrained their autonomy in new ways. In order to fulfil their ideas they needed to motivate more people to adopt these technologies and contribute to the free software projects in order to let them grow in functionality. Both Blender and Synfig faced the problem that, instead of developing art projects, they needed to develop frameworks to train or convince other people to use these technologies. As Becker (1982/2008: 74) points out, when creators go about developing their own materials, they need to spend time in developing their material precursors and knowledge frameworks instead of working on making art. There is no space in this article to discuss in detail the strategies employed in these cases, but for the present argument it is enough to say that Blender succeeded in creating a large user base on a greater scale than Synfig and is today embraced to a greater extent by animators, digital artists and technical artists who use it for a broad range of purposes. Uses range from experimental concept art projects through developing 3D printing models to experiments with novel forms of artistic collaboration; from open culture projects to the production of special effects, games, animation, and simulations for the media industries.

The variety of uses which it finds implies that the public nature of free software represents a source of value and craft autonomy for a broad range of actors and purposes. The next section discusses three main ways in which digital media artists find meaning in these tools and illustrates how they
reconcile craft and creative autonomy with efficiency, independence, ultimately securing materially their creativity.

**Sensibilities of Craft**

Every media creator has a unique work process. The more creators develop their skill, the stronger the connection established to the tools they use, as this skill is shaped through practice which is anchored in the materialities of technologies, even in the case of digital ones.

French free-lancing illustrator and digital comic artist David Revoy recalls how he used to work with proprietary digital production tools such as Corel Painter, Manga Studio, Photoshop Elements and CS2. After upgrading to a newer computer and a newer version of a proprietary operating system, all these tools stopped working: ‘I had to do a lot of horrible hack to make all my software run on it, but it wasn’t [as] stable as it was on Xp anymore. I had to reboot almost twice a day’ (Revoy, 2013). From a tool that automates and mediates creative expression, media production software can become an artefact with ‘agential’ (Paasonen, 2015) properties that may, for a time, leave the user powerless. Faced with the choice of either re-purchasing all his programs to match the new operating system and hardware, reverting to the older computer and operating system, or doing something completely different, Revoy (2013) chose to move to free software: ‘I thought all of this circus couldn’t work in the long term and wasn’t happy…. I switched my machine to a full open-source system around 2009… thinking open-source could work on the long term’.

The result of this move was not explained in terms of economic gains, but in the qualitative difference related to a new degree of creative autonomy and security gained in relation to technology:

> I really like the independence I get from it: I can install it on laptops, every machine, upgrade, downgrade, fine-tune it. This independence is gold. The con is that I’m now dependent on ‘Linux’ compatible [hardware]. Which is not easy to find and not well documented. (Revoy, 2013)

If, for David, free software was initially a way to reduce his material and creative dependency from technological frameworks out of his control, for other media producers switching to free software has been a way to increase their work efficiency.

Hjalti, an animator from Iceland who has worked for many years in the advertising industry, encountered Blender by chance after many years of
using the popular package 3D Studio Max. He adopted Blender in his
practice out of a desire to collaborate on a commercial campaign with a col-
league of his who had it as a tool of his choice. He discusses his initial
experience of learning Blender as an agony that has been worth it:

I was throwing my keyboard at the screen for the first couple of weeks or
whatever, but once you get over it you start to realise why it makes sense.
Why pressing G is already moving an object. . . instead of like having a
widget that you press on. . . it’s because it’s faster. It just cuts a lot of steps
out of the way. Which adds up. So you start doing things a little faster. And
smoother. And then of course you can customise everything you want now
after Blender 2.5. Which I do, a lot (Hjalti, animator, interview, August
2014).

Later versions of Blender and Hjalti becoming more experienced with it
allowed him to adapt it to his own work process in a way that increased his
working speed. In practice, this meant adjusting small details, such as the
position of his hands which he wanted to keep static while working. Until
moving to Blender, whenever he needed to change perspectives on the
screen while animating, the program interface would require him to move
his hand to the keypad on the right side of his keyboard. He experienced
this as a constraint to be efficient:

I am doing it every 10 seconds. And take one second to let go of my mouse, I
am losing valuable time, you know, after 15 hours or whatever… and it also
breaks your concentration. Because your eye, your thought process has to go
into that motion instead of just keeping going, doing what you are supposed
to be doing (Hjalti, animator, interview, August 2014).

After version 2.5 of Blender it was easier for its users to customise their
work processes to a great degree. Hjalti used this possibility to assign his
own commands in such a way that he would no longer need to move his
hands away from the keyboard while working. Such a seemingly minor
detail was very important for him as regards experiencing a sense of craft:

That’s when it becomes really beautiful. When the tool itself doesn’t become
a hurdle, you are just doing something and it’s an extension of you…. So
you can do something, you can adjust something, it’s intuitive. It is muscle
memory. Which is really awesome. (Hjalti, animator, interview, August
2014)
This example shows how free software as a production tool is conductive to frameworks of rationalising production, and personal skill development while maintaining a strong sense of autonomy among its users. This combination ultimately gives a competitive advantage in the media industries’ labour market. Of course, possibilities for customisation exist in other software too yet, in line with Becker’s argument about the constraints of materials, the limits to which free software allows creators to adapt technology to their everyday practice depends more on individual technical skill and creative ideas than on the production frameworks and affordances set by software manufacturers.

Besides reducing dependencies and increasing efficiency, many digital artists value free software for its infinite adaptability and extensibility. In the spring of 2014, a freelancing animator and a technical artist from Costa Rica worked on a 4-second shot for the teaser for a larger free culture animation film project. The shot was supposed to show a green caterpillar blinking. The animator wanted the caterpillar’s pupils to resemble the facial features of the main character in the animation film. They were using Blender for this production task and found that it did not have the technical capacity to animate the desired effect. The technical artist came up with a concept for how the problem could be solved and delved into the program code: ‘I started hacking a python script to automate this :)’. At about 3:00am it actually worked!’ He shared the script and the technical details online with the following comment:

Beware it’s a production script and as such it doesn’t have a nice UI or anything and you might need to change a couple of names in the first few lines :). (Salazar, 2014)

In this case, the animation process was very similar to hacking. Hackers, artists and free software developers have come to be described as ‘craftspeople’ who have resisted the general decline of craft in the Western that came with the dominance of Fordist styles of production (Coleman, 2016). A common metaphor frequently used among the digital artists who were interviewed was to compare working with free software to the work of painters from pre-industrial craft production: ‘It is more like the old painters who made their paint themselves. Mixing the ingredients and building their paint themselves’, Timothée Giet, a comic illustrator explained. In these cases, the possibilities to craft and mould their own tools blur the separation between art and craft, techne and poiesis:
Free software matches very good with the artistic idea because no artist wants to be locked into what they can do—a lot of the process of making art is about making the tools (Bassam, animation director, archived blog post, 2014).

The above examples illustrate how free software strengthens feelings of creative autonomy in their users by being flexible and adaptable to individual needs for creativity, efficiency and material independence. In their totality, these experiences construct free software as a source of individual material security and capital that allows digital artists to gain competitive creative advantage in the post-Fordist media industry frameworks. With the increased transfer of responsibility over skills development to individual media creators, the choice of technology becomes an investment that can increase media producers’ mobility and employability in different projects. At the same time, while free software stimulates a craft-like engagement with technology, it illuminates how the values of personal self-development, flexibility and security of the new ‘spirit’ of capitalism become embedded in digital artists’ technological choices. The problem to which the latter leads is that the security and autonomy that controlling and extending free software digital tools gives may decrease criticism of some problematic aspects of the post-Fordist production frameworks, e.g. precarity of labour. As the next section will show, while digital artists strengthen their creativity and material security through free software, they further nurture precarity of work.

Tools Development as a Source of Precarity

Once digital artists identify free software as tools of value to them, they employ different strategies to attempt to further shape and adapt the programs to their individual needs. Those artists who are unable to code (and they constitute a majority), or do not want to dedicate time to code, resort to financial and rhetorical means to convince programmers to do the work for them. Below I discuss three dominant ways in which this can happen.

Hiring a Developer

The technical possibility to extend Blender for other purposes than those intended by its original creator emerged from a technical artist’s need to rationalise his process of work at a wealthy media production company. He
attempted to find a less costly and more flexible alternative to a professional 3D program that could satisfy the production needs of the company: ‘I got Blender and I started extending it’, he remembers. He admits that his programming skills were not good, so he hired a programmer from Canada to come to Australia to do the extension for him:

Well, no, I didn’t know how to program, like—I was, I was artist, so—I was OK, making stuff with the mouse. But I knew some programmers so I got them to program... I hired them to program. I had one of the Blender developers come over to my house, doing internship with me, so I got him to program so it was like—the artist and developer thing happening. (technical artist, interview, 2014)

The functional extensions made at that time entered the core of Blender and made it possible for other artists to further develop the program. While representing a contribution to the common good, the possibility that free software opens for an artist to hire a developer changes the artist’s status. From being a wage-earner who sells his or her work to the industry, the artist can become an employer who creates small, temporary jobs for programmers. By offering programmers temporary projects, digital artists mirror the frameworks of the media industries by outsourcing jobs with the promise of personal development, employability and a wage, for the common good. Hence, while free software represents a source of material security for artists, it becomes a source of work insecurity for developers, further nurturing precarity.

Becoming a Financial Patron of a Project

Another common strategy used by artists to influence the general direction of free software tools development is to become a financial patron of the project. This can happen by making small donations to the free software projects in order to buy developer time to develop the project in the direction they want.

A free-lancing animator from Sweden who specialises in cut-out animation which he sells to the Nordic advertising and film industries explained how he could make small financial donations to Synfig to push its development in the direction he needed. His principle has been to donate 3–4 per cent of his income from commercial projects to the free software projects he uses, with occasional higher donations in order to set a priority for the development of a specific feature. He remembered during a conversation we had how he once paid a few hundred euros to the project to speed up the
development of a specific function in Synfig that he needed in his work for
the industry.

This form of exercising influence over the broader technical develop-
ment of the project turns digital artists into patrons who become con-
necting links between a media project (be it for the industry or not), the
creative visions of an artist and the technical community that can be con-
vvinced to prioritise the development of a feature.

Motivating Developers

When artists do not have financial means to invest in a project, they resort
to rhetorical means to motivate a developer to do the job for them for free,
an approach that is the driver of major disputes in the communities formed
around free software tools.

Digital artists can request features and extensions directly from the
programs’ main developers. Mobilising rhetoric and prototypes of un-
finished media projects in order to illustrate the need to improve software
in a particular direction, these interactions become the locus of many
tensions and conflicts. In some cases, feature requests are welcomed and
fulfilled, but in most cases they are ignored:

We get far, far more requests than we even have time to read. Also, these
requests vary in quality. People may explain features in detail, which we
already have. …People ask for very specific stuff… ‘I’m using Blender for an
interactive blah blah and it’s draw modes don’t work for me because …
etc’…. People who use Blender for ten minutes and don’t like colour also
post…. (Blender developer, interview, December 2014)

This example illustrates the fact that despite gaining a greater technical
autonomy, free software makes digital artists deeply embedded in the social
dynamics surrounding the maintenance and development of their tools of
choice. Those artists who manage to convince the developers of the import-
ance of their request are usually those who are most active in the media
industries and have concrete, urgent needs:

I was already doing graphics that were watched by millions, and I started
falling in love with [Blender] because it is so versatile. And plus I really liked
the idea that you could change the program. That’s what sold me on
Blender. Wasn’t the interface, wasn’t the toolset, it was just the fact that you
could change it. That made the case that even if you are not happy with it, if
you argue for your case well, you can actually get changes to it. (Beorn,
 animator, interview by BlenderGuru.com, 2014)
Hence, a rhetorical approach anchored in a concrete project for the media industries can become the equivalent of a financial donation as its fulfilment may bring value for a broader range of digital artists while satisfying individual creative demands.

Conclusions

The empirical examples discussed in this article show that free software’s role in the politics of digital media production should be understood as individual strategies to find material security and extend personal creative and craft autonomy through technological choices. Approaching free software as a tool, rather than as a form of organising work, allowed the degree to which digital media creators’ creative autonomy is configured to be illuminated in relation to the affordances, mouldability and degree of control over the programs that they use in their everyday creative practice. The main issues which artists used to struggle with in the past, as described by Becker (1982/2008), such as dependency on materials and the frameworks of their production, changes in the politics of their distributions, and not least, their affordances, remain highly relevant in the contemporary digital mediascape.

Drawing on Becker, the article conceived free software as a strategy to develop one’s own materials and independent frameworks of production in response to changes in the political economy of software distribution. In Becker’s framework, such an approach has been commonly used by artistic minorities. This article has shown that free software can resemble this approach by becoming relevant for a broader range of users, beyond creative minorities, in particular those working in different roles for the contemporary media industries. Free software as a source of value for digital artists is thus about meaningful, and not ideological, self-realisation (cf. Hesmondhalgh and Baker, 2010: 180ff). In the new ‘spirit’ of capitalism that promotes self-development and outsources the responsibility for skill development to media producers, the ability to shape technology according to distinct creative ideas becomes an individual strategy to remain flexible and competitive.

The specific ways in which artists find meaning from using free software as a production tool are in bringing their work to a form of pre-industrial craft, and saturating their work with an attitude described by Peter Dormer as: ‘you get the best out of the computer and its software if you are able to drive the tool rather than being driven by it’ (Dormer, 1997b: 146). The
senses of craft autonomy developed through free software are, importantly, not mobilised for a broader critical or political project for social change, but are rather pragmatic, rooted in strategies to influence technological development in ways that benefit one’s individual work practice. As a consequence, digital artists inscribe further the values of the new ‘spirit’ of capitalism, embedding them in the free software tools that they use and develop.

Finally, in crafting security and autonomy for themselves, digital artists do not offset some of the negative effects of flexible capitalism, such as the shift of responsibility for skill, personal development and finding work onto individual creators. Rather, their practices further nurture precarity of labour by them becoming employers or patrons of other groups of creative workers, such as hackers and software developers. Further research could fruitfully explore the practice of media workers hiring developers to code functionality for them and study whether such engagements create new hierarchies or forms of exclusion, or whether they are a positive source of pleasure from digital work that enhances autonomy and creativity in the digital media industries.


Duke University Press.


Markham AN (2013) Fieldwork in Social Media: What Would Malinowski Do?
Qualitative Communication Research 2(4): 434–446.
Morgan T (2013) Sharing, hacking, helping: Towards an understanding of


Parks L and Starosielski N (eds) (2015) *Signal traffic: critical studies of media infrastructures*. The geopolitics of information, Urbana: University of
Illinois Press.


Vásquez C, Brummans BHJM and Groleau C (2012) Notes from the field on organizational shadowing as framing. Qualitative Research in Organizations


Velkova J (2016e) Open cultural production and the online gift economy: The case of Blender. First Monday 21(10).


York: Routledge.
Sammanfattning
(Summary in Swedish)


Denna avhandling undersöker hur dessa ökade möjligheter för skapandet av teknologier och infrastrukturer för digital medieproduktion, i synnerhet programvara, har tagits tillvara av mediekreatörer som arbetar, eller strävar efter att arbeta, med datargrafik. Avhandlingen fokuserar på kulturella, teknologiska och ekonomiska praktiker genom vilka frilansare, oetablerade mediekreatörer och mindre produktionsbolag skapar användardrivna programvaror. Med användardriven avser jag programvara som utvecklas av dess användare: digitalkonstnärer, amatörer och professionella skapare av digitalt visuell media, snarare än de industriella producenter som traditionellt satt de tekniska ramarna för medieproduktion.

Avhandlingen baseras på två empiriska fallstudier som rör skapandet av fri programvara för datoranimation. Med fri programvara avses program där användarna har frihet att använda, kopiera, distribuera, studera, ändra och förbättra programvaran (GNÜProject, 2017). De huvudsakliga forskningsfrågorna är: a) hur skapare av datarografi utvecklar, formar och guidar de fria programvaror som utgör ett alternativ till industriella programvaror för digital animation, och b) vilken mening dessa alternativ tillskrivs när de används i medieproduktion.

Den första fallstudien fokuserar på arbetet av Blender Institute, en oberoende animationsstudio i Amsterdam, Nederländerna. Sedan 2006 har studion arbetat med att utveckla och förbättra en populär programvara för 3D-animation, Blender. Detta har skett genom skapandet av så kallade ‘open-source animation films’, korta animerade filmer med höga produk-
tionsvärden genom vilka programvara, filmelement och utbildning i programvaran har delats online. Genom den här fallstudien har jag diskuterat programvaruutveckling i en kontext av delningsekonomi. Jag har visat hur strategiskt delande kan vara ett sätt att erövra en maktposition inom digital medieproduktion. Jag har också belyst de olika spänningar som uppstår när kulturproducenter söker förena olika perspektiv på programvaror, individuella ambitioner och existerande marknadsstrukturer.

Den andra fallstudien fokuserar på praktikerna av Morevna project, ett kollektiv av animé-fans, geografiskt situerade i staden Gorno-Altaysk, i ryska Sibirien. Kollektivet har skapat korta datoranimerade filmer genom vilka man utforskat, lagat och distribuerat den fria programvara de använt i sina produktioner: Synfig för 2D animering. I denna fallstudie har jag argumenterat för värdet av att undersöka spänningar, misslyckanden och lagning snarare än innovationer för att förstå hur alternativa infrastrukturer för digital medieproduktion kan uppstå i kontexter starkt präglade av piratverksamhet.


Teoretiskt utgår avhandlingen från ett perspektiv på medier som praktik (Couldry, 2004, 2012). Specifika praktiker som analyseras och teoretiseras i artiklarna är dekommodification av programvara; förankrandet av lagning av programvara i medieproduktion; samt delning online av programvara, filmer och filmmaterial; produktionsarbete; samt utbildningsmaterial.


Begreppen beskriver hur olika relationer upprätthålls mellan digitala artefakter, ekonomi och personer. Jag förenar dem i ett gemensamt teoretiskt ramverk genom begreppet infrastructuring (Karasti och Syrjänen,
SAMMANFATTNING


Genom att anlägga ett perspektiv på medier som praktik och utveckla det perspektivet med begreppet *infrastructuring* till det jag kallar för ‘media-related infrastructuring practices’ har jag visat hur användardriven programvara och infrastrukturer för datografik skapas och stabiliseras genom att skapa nya och integrera existerande resurser i det digitala medieland-
detector. Detta perspektiv öppnar upp möjligheter för att etablera kopplingar mellan olika delsfält inom medievetenskapen som fokuserar på medieproduktion, såsom studier av industriell medieproduktion; amatördrevet och öppen teknikproduktion; samt studier av medieinfrastruktur. Genom *infra-structuring* kan man se hur medieproducenter skapar nya, förändrar och kritiserar existerande arbetsrelationer, ekonomiska relationer samt kunskapsrelationer. Dessutom kan det växande fältet av infrastrukturstudier utvecklas genom att byta fokus från studier av stora etablerade medieinfrastrukturer till processer av gående infrastrukturformering av mindre och nya aktörer i det digitala medielandskapet.

Sammanfattningsvis bidrar denna avhandling med empiriskt material vilket skapar en större förståelse för förmeringen av delar av de digitala medieproduktionsinfrastrukturer genom en analys av skapandet av användardrivna fri programvara för digital animation. Den bidrar också teoretiskt till en utveckling av perspektivet på medier som praktik (Couldry, 2012). Metodologiskt bidrar den genom att betona värden av platsbaserad deltagande observation och etnografi även i sammanhang av decentraliserad medieproduktionspraktik. Den bidrar även till att skapa en större förståelse för produktionen av tekniken som underbygger och möjliggör de visuella uttrycken som präglar det mesta av vårt digitala medieinnehållsutbud idag.
17. Renata Ingbrant, *From Her Point of View: Woman’s Anti-World in the Poetry of Anna Świrszczyńska*, 2007
34. Tommy Larsson Segerlind, *Team Entrepreneurship: A process analysis of the venture team and the venture team roles in relation to the innovation process*, 2009
37. Karin Ellencrona, *Functional characterization of interactions between the flavivirus NS5 protein and PDZ proteins of the mammalian host*, 2009
43. René León Rosales, *Vid framtidens hitersta gräns: Om pojkar och elevpositioner i en multietnisk skola*, 2010
44. Simon Larsson, *Intelligenstaristokrater och arkivmartyrer: Normerna för vetenskaplig skicklighet i svensk historieforskning 1900–1945*, 2010
47. Michael Wigerius, *Roles of mammalian Scribble in polarity signaling, virus offense and cell-fate determination*, 2010
49. Magnus Linnarsson, Postgång på växlande villkor: Det svenska postväsendets organisation under stormaktstiden, 2010
52. Carl Cederberg, Resaying the Human: Levinas Beyond Humanism and Antihumanism, 2010
53. Johanna Ringarp, Professionens problematik: Lärarkårens kommunalisering och välfärdsstatens förvandling, 2011
57. Christina Douglas, Kärlek per korrespondens: Två förlovade par under andra hälften av 1800-talet, 2011
63. Wessam Melik, Molecular characterization of the Tick-borne encephalitis virus: Environments and replication, 2012
65. Peter Jakobsson, Öppenhetsindustrin, 2012
68. Anna Tessmann, On the Good Faith: A Fourfold Discursive Construction of Zoroastrianism in Contemporary Russia, 2012
70. Maria Wolrath Söderberg, Topos som meningsskapare: retorikens topiska perspektiv på tänkande och lärande genom argumentation, 2012
71. Linus Andersson, Alternativ television: former av kritik i konstnärlig TV-produktion, 2012
76. Tanya Jukkala, *Suicide in Russia: A macro-sociological study*, 2013
77. Maria Nyman, *Resandets gränser: svenska resenärers skildringar av Ryssland under 1700-talet*, 2013
82. Anna Kharkina, *From Kinship to Global Brand: the Discourse on Culture in Nordic Cooperation after World War II*, 2013
84. Oskar Henriksson, *Genetic connectivity of fish in the Western Indian Ocean*, 2013


101. Yuliya Yurchuck, Ukrainian Nationalists and the Ukrainian Insurgent Army in Post-Soviet Ukraine, 2014

102. Hanna Sofia Rehnberg, Organisationer berättar: narrativitet som resurs i strategisk kommunikation, 2014


105. Katharina Wesolowski, Maybe baby? Reproductive behaviour, fertility intentions, and family policies in post-communist countries, with a special focus on Ukraine, 2015


107. Larissa Mickwitz, En reformerad lärare: konstruktionen av en professionell och betygsättande lärare i skolpolitik och skolpraktik, 2015


111. Björn Sjöstrand, Att tänka det tekniska: en studie i Derridas teknikfilosofi, 2015


118. Sari Vuorenpää, Literacitet genom interaction, 2016

119. Francesco Zavatti, Writing History in a Propaganda Institute: Political Power and Network Dynamics in Communist Romania, 2016


124. Ramona Rat, Un-common Sociality: Thinking sociality with Levinas, 2016
131. Ekaterina Tarasova, *Anti-nuclear Movements in Discursive and Political Contexts: Between expert voices and local protests*, 2017
133. Michal Salamonik, *In Their Majesties’ Service The Career of Francesco De Gratta (1613–1676) as a Royal Servant and Trader in Gdask*, 2017
140. Maarja Saar, *The Answers You Seek Will Never Be Found At Home: Reflexivity, biographical narratives and lifestyle migration among highly-skilled Estonians*, 2017
144. Fredrik Bertilsson, *Frihetstida policieskapande: uppostringskommissionen och de akademiska konstitutionerna 1738-1766*, 2017


In our increasingly mediated lives today, we constantly encounter and interact with computer-generated imagery. This dissertation explores the ways in which freelancers and small media production studios engage in making free software and infrastructures for computer animation. Using the workings of a Dutch animation studio called the Blender Institute, and of an informal collective of anime fans in Russia called the Morevna project, the dissertation discusses how two popular programs for 2D and 3D computer graphics – Synfig and Blender – have been decommodified, and developed into useful tools for media production that are based on individual needs of practice rather than industrial interests. By approaching these practices as forms of infrastructuring that mobilise sharing, repair and diverse politics of value, the dissertation sheds light on some of the politics and negotiations of technological unevenness that surround the intangible technologies for media production today.

Julia Velkova is researching and teaching at Södertörn University (Sweden). She is affiliated with the Centre for Baltic and East European Studies (CBEES) and the School of Culture and Education. Her interests include the politics of development of digital technologies, infrastructure studies and open culture.