ARTS UNIVERSITY BOURNEMOUTH
AND
UNIVERSITY OF THE ARTS LONDON

Workarounds in the production of contemporary animation series in the UK: an examination of creative approaches to overcoming production barriers.

Author
BENJAMIN VINCENT OAKLEY

Director of Studies
Dr. Paul WARD
Co-Supervisor
Dr. Paul TABERHAM
Co-Supervisor
Dr. Tom WALSH

A Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy.

January 17, 2025

Declaration of Authorship

I, Benjamin Vincent Oakley, declare that this thesis and the work presented in it are my own. I confirm that:

- This work was done wholly while in candidature for a research degree at Arts University Bournemouth.
- No part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- I have drawn on examples from John Morley's (2023) *Academic Phrasebank* to develop the written expression of the text. Additionally, I utilised various AI tools, such as Hemingway, Grammarly, Quarkle, Sapling and Quillbot, to review the spelling, grammar and expression of the completed thesis. These tools were used in conjunction with each other to refine the written expression, but the ideas, thought process, and decisions reflected in the included content are entirely my own.

Signed:

Date: January 17, 2025

Abstract

Research into workarounds – which are changes to established methods to overcome transient obstacles, mishaps and anomalies – in the making of contemporary animated series is limited. Such research exists in parallel areas, like healthcare and aeronautics. However, the examination of workarounds in media production and animation scholarship is under-researched. Likewise, research into animation production processes is emergent but limited. No previous study has investigated the application of animation workarounds in contemporary animation production methods. Therefore, to date, little is known about the motivations, consequences and impacts of these changes on contemporary production processes. The current study focuses on addressing this knowledge gap by investigating the conditions, impacts, and consequences of these changes in contemporary series-making processes in the United Kingdom. The study explores the relationship of workarounds in contemporary commercial animation-making methods. The research addresses animation workarounds in the storyboard-layout transition, reuse systems, asset and sequence changes and animation labourer and animation management workaround perspectives. The research focuses on the design, application, perspective and integration of animation workarounds in the making of contemporary commercial series in the UK.

The current study utilises a *Production Studies* (Caldwell (2008) and Mayer et al. (2009)) approach. This paradigm focuses on how practitioners make media while navigating the complexities of making commercial creative projects. The study utilises this approach in the investigation of accounts of practitioner processes. This qualitative data is examined through Alter's (2014) *Theory of Workarounds*. This process generates new understandings of the conditions, activities and impacts of planned and unplanned changes to established ways of making animated series in the United

Kingdom. The *Theory of Workarounds* provides a theoretical framework for examining and categorising planned/emergent changes and the *local and broader consequences* for workarounds in business organisations. This is a major advantage of utilising this framework in examining animation production processes. This study builds upon the *Theory of Workarounds* by extending the analysis of changes to established methods and applying this in the analysis of activity in creative organisations – animation studios. A variation of a case study approach allowed a deeper insight into the perspectives, design and impacts of changes to methods of modern series-making. This approach used interview data from relevant practitioners, such as storyboard, layout artists and directors working in contemporary series-making. This data was analysed through a process of *thematic analysis*, identifying themes and trends then drawing conclusions.

This investigation established that commercial animation-making methods evolve through an iterative process. The research found that changes are introduced, learned from in the application, formally improved and eventually transformed into subsequent systemised methods. The study's findings support the idea that changes which facilitate the principles of digital mass-production (digital-standardisation, digital-interchangeability, and digital-assembly) have the highest probability of being integrated into established methods. Such a process enables the production of content for a regular release schedule with controlled manufacturing costs. One of the most significant findings was that practitioners working at any level in the animation studio can implement changes to accepted methods. However, the scope, type and impact of potential changes depend on the hierarchical position of the person suggesting said procedural changes.

The research discovered that animation workarounds can be designed and implemented any time in the production process. However, this study found that these changes can be both met with resistance and integrated into series production on a systematic and regular basis. This is the first study to examine contemporary series-making activities in the UK using the *Theory of Workarounds*. In doing so, the research expands both the study of workarounds into contemporary animation processes and develops new understandings of the role of animation workarounds in commercial animation production. This research has contributed to knowledge. Thus generating new understandings of how temporary changes to accepted ways of making animated series can become integrated into future recognised methods. The research found that this integration is achieved through a process of initiation and routinised systemisation.

Acknowledgements

This collection of mismatched words, meandering thoughts, typographical errors, deeply offensive double-entendres and threatening references to individuals and institutions both living, dead and undead would not be possible without the help of many people. I blame you all for the suffering I have endured writing this and I routinely dance in a frenzy around burning effigies of you all...

Firstly, thanks to my Director of Studies Paul Ward for his patience and ability to understand my unique and deeply disturbing ways of working and his help in channelling these into something that vaguely resembles academic rigour or those delightful and insightful messages one often finds on the walls of public lavatories. Likewise, thanks to my Co-supervisors Tom Walsh and Paul Taberham for having the patience to read the strange and troubling collections of ideas scrawled on the backs of discarded cigarette packets and betting slips that constituted the earlier versions of this thesis, and helping me in transforming these into the excellent birdcage lining you see before you. Now I feel qualified to pursue my dream of becoming a Gong Farmer!

Also at Arts University Bournemouth I would like to thank Research Manager Valerie Lodge for arranging and providing the framework and support for all PGR students – needless to say, I failed to attend or make use of any of these available resources due to scheduling conflicts with my various community service sentences – and for her help and support throughout the utterly bizarre research process focused on finding out more about a subject that nobody cares about. The first draft of this thesis was very painful to write, especially since it was written with my bleeding finger across the nicotine stained and damp-encrusted walls of my dilapidated bedsit in Maidstone. So, a thank you to Julia Kotula at AUB Study Skills for advising and tutoring me over the last two years in the skill, craft and unrelenting torturous suffering of academic writing, and for also introducing me to paper, its spiffing stuff!

Thank you to all of the animation professionals who aided me in this project by revealing inside secrets about the realities of working within commercial production that they wouldn't want published...oh wait...nah, don't worry about it, no one will ever read this, and if they do, then God help us. God help us all!

Finally, an enormous thank you to my Mum for her support in helping me delay getting a real job. Now I can stop being a long-haired layabout and enter the wonderful world of full-time employment, where I get the unrelenting joy of spending the rest of my life performing repetitive tasks like playing with rusty knives, passive-aggressively competing with my co-workers and talking about house prices, what fun!

Contents

List of Figures

List of Tables

Part I

Animation Workarounds in Theory

CHAPTER 1

Subject Area and Research Aims

> So there we were in months of finishing this movie and all of a sudden [after the 1994 Earthquake in Southern California] people can't get to the studio...and we started to figure out...the deadline's not gonna move, so we started shuttling things back and forth and all of a sudden this next big film from Walt Disney Pictures is being done in garages around Southern California.
>
> Don Hahn, *The Making of the Lion King: A Memoir* (1994)

This thesis is about changes made to overcome problems while making animated series. These changes to established production processes are workarounds. This study investigates changes to accepted activities in modern animated series through the *Theory of Workarounds* (Alter, 2014) and *Work System Theory* (Alter, 2013). Steven Alter (2013, p.82) defines workarounds as goal-driven changes to aspects of the *work system* that are designed and implemented to overcome the impact of obstacles, mishaps and established practices perceived as preventing the desired level of efficiency, effectiveness or other organisational/personal goals. These changes alter aspects of the current work system without the separate allocation of significant project resources. This study uses Alter's framework to identify process changes and their motivations and obstacles in modern 2D cut-out animated series-making. Therefore, throughout this thesis, the term animation workaround will refer to changes to established processes that allow animation project completion despite production constraints, obstacles and mishaps.

> **Original Contribution to Knowledge: Animation Workarounds**
> *An animation workaround is a change to accepted production processes designed to complete a project on time and within budget despite the impact of temporary production obstacles, mishaps or anomalies.*

The study seeks to identify animation workarounds in the storyboarding and layout stages of animation assembly, focusing specifically on digital 2D cut-out series software, including CelAction, ToonBoom, Adobe Animate, and Adobe After Effects. A key aspect of the storyboard-layout transition is scene idea reification. A storyboard is a visual representation of an intended scene (illustrated in *Figure 1.1*). The storyboard's primary purpose is to convey a story's narrative flow through defining project problems (Tumminello, 2005, p.1). Storyboards are tools to effectively and critically judge production problems of the intention, allowing the animator to externalise and test current ideas graphically (Blatter, 2007, p.5). Layout artist Mark T. Byrne describes the role of layout:

> The role of the layout artist is to design and draw the 'stage' on which the character and special effects animation takes place, in addition to staging every scene and camera set-up. The layout[s] are drawn from the storyboard panels, which the layout artist develops into detailed backdrops, ready for the background department to paint.
> (Byrne, 1999, p.12)

Figure 1.2 illustrates an animation layout. These examples demonstrate the material differences between the storyboard and layout. This medium change – from the abstract to concrete realisation – presents material and practical factors requiring reconciliation. For example, a storyboard panel may show a character making movements that the model may not be able to replicate without breaking. Here, successful scene reification requires changing the storyboard panel or the character model in light of these unforeseen limitations and conditions. Hence, the transition from storyboard to layout allows the understanding of these changes, their motivating factors, and the consequences of particular modifications, which is impossible to gain by studying another point in the production process. Examining these important factors motivated the research to focus on this point in the animation assembly process.

Figure 1.1: An Animation Storyboard (Jeaks & Tetali, n.d.)

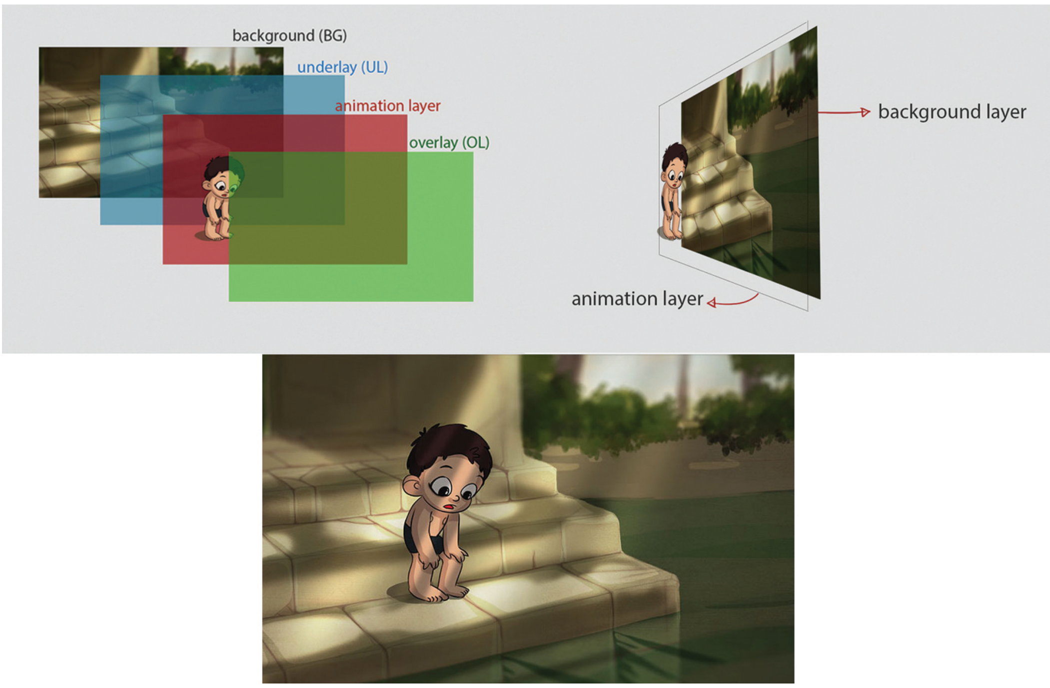

Figure 1.2: An Animation Layout – Consisting of: Background Layers (upper-left), Animation Layers (upper-right) and Final Animation (lower-center) (Jeaks & Tetali, n.d.)

RESEARCH AIM AND RESEARCH QUESTIONS

The study sought an understanding of the function of workarounds in modern series-making, specifically investigating how established processes are changed to overcome obstacles and how these modifications are integrated into future methods.

To accomplish these outcomes, this investigation seeks to answer the following research questions:

1. **How do workarounds function in the transition from storyboard/animatic to layout?**
2. **How do workarounds function in reuse systems?**
3. **How are pre-designed assets and sequences changed when combined in layout?**
   a. **What constraints motivate asset changes?**
   b. **Why do these constraints occur?**
4. **How are workarounds viewed in contemporary series production? (by practitioners, management and studios?)**

RESEARCH RELEVANCE AND RATIONALE

Animation workarounds allow practitioners to overcome obstacles. However, little is known about the nature of workarounds in modern animated series production. A gap in the literature exists in both workarounds research and animation scholarship. Definitive research on workarounds in animation production is scarce. Workarounds research exists in other industries, for example, higher education, healthcare, aeronautics and telecommunications (Roder et al., 2016, pp.9-10). Likewise, the making of animated series is currently under-researched in the field of *Production Studies*, though there is growing scholarly interest in animation production processes (Ward in: Honess Roe, 2020, p.155). Thus the current research contributes to this growing study of production processes.

This research extends the *Theory of Workarounds* and *Work System Theory* into the analysis of industrial animation activity. Thus shifting the focus of these frameworks from investigating factors and influencing forces that affect IT-reliant organisations to understanding changes to established methods in creative organisations, such as animation studios. This current study is the first investigation to use these models in analysing animation production activity. This knowledge is vital for understanding production processes. Without this knowledge, practitioners may change established methods that can negatively impact the production process. Paul Wells (2007, p.14) illustrates that making animation is labour-intensive: material preparation – such as the story, assets, characters and environments – requires time in advance (preproduction) to execute the piece's intentions in the most economic and time-sensitive fashion (ibid.,). However, practitioners may need to use animation workarounds to address unforeseen challenges during project development.

This present study makes it possible to understand the impacts, motivations and consequences of these changes. For example, an individual may implement a change designed to accelerate the progression of their tasks. Said change might generate the broader effect of losing access to other animation work, resulting in the additional expenditure of time and labour to recover or re-complete the lost work to ensure timely project delivery. Therefore, this current study offers new understandings with the potential to prevent such negative consequences. This study is one of the first investigations to examine and assess the motivations, conditions and impacts of workarounds in contemporary animation production processes, contributing this vital knowledge to animation scholarship and industry. Thus, this thesis argues that animation workarounds are required for successful commercial animation production.

THESIS STRUCTURE

The thesis consists of three parts. *Part I: Animation Workarounds in Theory* introduces and defines the subject of animation workarounds and outlines how the thesis investigates these and their theoretical and industrial contexts. *Part II: Animation Workarounds in Practice* examines animation workarounds in the storyboard and layout stages of contemporary series-making. Finally, *Part III: Animation Workarounds in Reflection* presents the research conclusions and recommendations and remodels the *Theory of Workarounds* for commercial animation assembly.

Part I: Animation Workarounds in Theory

Chapter 1: Subject Area and Research Aims has introduced the subject area and has identified the study's contribution to animation scholarship and industry.

Chapter 2: Research Context maps the literature context of the study, examining relevant research within *Production Studies* and animation scholarship, focusing on assembly processes and storyboarding and layout activity to establish gaps in current knowledge addressed by this study.

Chapter 3: Research Methods describes the methodological approach and data collection methods of the research: analysing storyboarding and layout activity through the *Theory of Workarounds*.

Chapter 4: The Theory of Workarounds and Animation Production Activity is a longer chapter which provides an in-depth interrogation of Alter's *Theory of Workarounds*. This chapter introduces key parts of the *Theory of Workarounds* and examines these concepts concerning animation production and other industries.

Part II: Animation Workarounds in Practice

Chapter 5: Mass-production in Animation examines the use and conditions of the principles of digital mass-production, file formats and software, and the creation of digital asset libraries and reuse systems at personal and organisational levels in series production.

Chapter 6: Organising and Coordinating Production Activity interrogates studio organisational relationships and their impacts on individual job roles, responsibilities, processes and the development of animation workarounds.

Chapter 7: Animation Production Resources investigates the allocation of privilege on practitioner processes and the organisation of animation activity at a personal and organisational level. Providing an analysis of the ability of said privilege to influence both the production process and the potential development and implementation of animation workarounds.

Chapter 8: The Storyboard Process examines storyboard and animatic functionality and the motivations of shot and sequence alterations in contemporary processes.

Chapter 9: The Layout Process investigates how the appearance of 3D environments is created with 2D assets, the problem-solving process required during layout and the motivations of asset alterations made in layout.

Part III: Animation Workarounds in Reflection

Chapter 10: Discussions, Conclusions and Contributions discusses answers to the research questions, outlines the study's contribution to knowledge, remodels the *Theory of Workarounds* for commercial animation assembly and provides recommendations for both industry and future scholarship.

Glossary defines key terms used throughout the thesis.

List of Participants provides a brief biography of the professionals interviewed for this research.

Taxonomy of Animation Workarounds outlines the examples of animation workarounds gathered during this research and referenced throughout the thesis.

Interview Questions provides a list of questions asked during the data-gathering process of this investigation to aid in research replicability.

Having outlined the thesis's subject area and specific research aim and questions, the next chapter explores the academic context of the current study and the examination of animation workarounds in contemporary industry practice.

CHAPTER 2

Research Context

This study sought to investigate and understand animation workarounds and their motivations. This thesis examines how established production methods may be changed and how these changes may be incorporated into future conventionalised methods. The study examines workaround functionality in the storyboard-layout transition, reuse systems, and changes to pre-designed assets and sequences, besides seeking a deeper understanding of how animation workarounds are perceived by both animation labourers and animation management in contemporary UK series-making. This literature review seeks to establish the empirical and academic research contexts, establishing an understanding of what is and is not known regarding animation workarounds, and thus establish this study's relationship to existing scholarship. In doing so, this chapter establishes a gap in current knowledge that this study addresses regarding animation workaround functionality in the storyboard-layout transition. Thus, this literature review examines the state of current knowledge in the fields of animation scholarship and *Production Studies*, focusing specifically on the context and application of workarounds in contemporary commercial series-making. Thus substantiating the current study's original contribution to these fields.

This focus means that the literature review centres on examining the existing scholarship on industrial production processes and labour organisation and control within these. This review will not cover animation aesthetics, representation, or the artistic and narrative aspects of animation research in great detail, as they are of limited relevance to the thesis subject and discussion. The overall structure of the chapter is formed of five sections. This chapter begins by establishing the basis of the *Theory of Workarounds* and its context within the field of *Information Systems* (IS) in the *Theoretical Framework*. The second part examines the evolution of *Commercial Production Processes*, while the third – *Commercial Production Labour Organisation* – contextualises the research by examining the state of knowledge concerning the organisation and control of labour in commercial production organisations. The purpose of the fourth section: *Commercial Production Storyboarding*, is to examine current understandings of commercial storyboarding practice and theory. Finally, the *Research Gap* section establishes the gap in current knowledge addressed in this thesis.

SECTION 2.1

Theoretical Framework

This section presents the definitions, concepts and models used to examine process changes and practitioner agency within contemporary animation assembly. The present study uses the *Theory of Workarounds* (Alter, 2014) and *Work System Theory* (Alter, 2013) to examine and conceptualise practitioner activity accounts. These frameworks originate from the field of *Information Systems* (IS), which is a sub-field of *Organisational and Management Science*. The approach utilised in this study takes these frameworks from the IS field – an organisational and business-focused discipline – and extends them into the analysis of creative production activity. Thus, the study can claim a modest contribution to knowledge by using novel frameworks within animation scholarship and *Production Studies*. The section will begin by outlining the context of the *Theory of Workarounds* and then describes the model's key aspects used in examining animation assembly activity to draw research conclusions.

The literature on workarounds was originally focused on analysing *information technology* (IT) workflows. This research field originally focused on IT processes and workflows in the achievement of personal and organisational goals, for example: Kling & Scaachi (1979), Gasser (1986), Koopman & Hoffman (2003) and Azad & King (2008). There has been some research into procedural and management process changes outside IT practices and workflows. For example, both Halbesleben et al. (2010), and Niazkhani et al. (2011) investigate temporary alterations to accepted routines in medical and nursing settings, while Campbel (2012) investigates process alterations in management contexts. Therefore, it can be observed that the study of workarounds has moved from IT to management contexts, without a coherent framework for studying changes. However, what still needs to be clarified is how workarounds function in commercial creative organisations.

Research of workarounds in animation production is underdeveloped. This is the first study to examine changes to established animation production practices through the *Theory of Workarounds* (Alter, 2014) or *Work System Theory* (Alter, 2013). In the field of animation scholarship, Matthew Teevan (2011) has used the term *workarounds* in his article *Animating by numbers: workflow issues in Shane Acker's 9* when describing production process aspects and pipelines designed by Teevan's team while making the feature film *9* (Shane Acker, 2009). Examples from this piece of work will be discussed through the lens of the *Theory of Workarounds* throughout this chapter and the thesis. However, a key limitation of Teevan's article is that it is not an inquiry into integrating activity changes into accepted methods. Furthermore, said article describes processual amendments from the view of a practitioner possessing decision-making authority (animation management) in the studio. However, the current study examines animation workarounds implemented by both animation management (those with decision-making authority) and animation labourers (practitioners who do not have decision-making authority). Thus presenting a more coherent and complete understanding of animation workaround development and integration.

This present research uses Alter's (2014) and (2013) theories in the first extensive examination of animation workarounds. This study examines these changes made by both artists and managers through Alter's frameworks, generating new insights into workarounds in established animation production methods. Alter (2013, p.82) defines workarounds as goal-driven changes to aspects of the work system to overcome the impact of obstacles, mishaps and established practices perceived as preventing the achievement of efficiency, effectiveness, or other organisational/personal goals. Further recognising these alterations change aspects of the current work system without the separate allocation of significant project resources. Applying this definition to modifications examined in this inquiry, an animation workaround can be defined as **a change to accepted animation activities designed to overcome the impacts of obstacles, mishaps or procedures that prevent animated projects from meeting the conditions of commercial production**. Therefore, the use of animation workarounds allows practitioners to meet the conditions of commercial production.

The prominent service-based animation sector in the UK has significant organisational implications. To anticipate and address potential future changes and problems, it's crucial to understand the process of integrating change into contemporary production, and the underlying basis and driving factors behind these changes. Having outlined the context of workaround theory, the discussion will now turn to the specific aspects of the model used in the analysis of practitioner data and the generation of new understandings of activity within modern animation assembly.

THE WORK SYSTEM FRAMEWORK

This study analysed the making of animated series in the United Kingdom through Alter's (2013) *Work System Framework* (WSF). The *Work System Framework* is a conceptual structure which models the form, function and environment of a work system, emphasising business rather than IT concerns. The WSF contains nine elements: *Processes and Activities*, *Participants*, *Information*, *Technologies*, *Products/Services*, *Customers*, *Environment*, *Infrastructure* and *Strategies* (including: *Enterprise Strategy*, *Department Strategy* and *Work System Strategy*) (Alter, 2017, pp.3-4). *Figure 2.1* illustrates these categories.

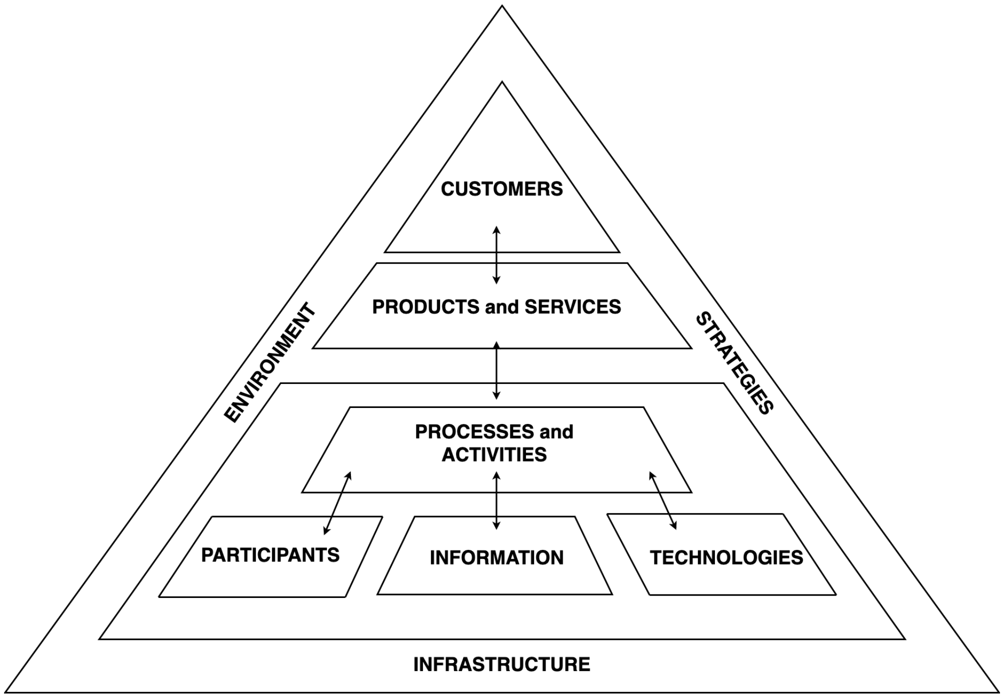

Figure 2.1: Alter's Work System Framework Model (Alter, 2013, p.78)

THE THEORY OF WORKAROUNDS

This present study analyses practitioner activity accounts through the *Theory of Workarounds*, which models changes to established methods, analysing how agents decide to follow established practices and proceed when exceptions, anomalies and mishaps occur (Alter, 2014, p.1043). *Figure 2.2* illustrates the *Theory of Workarounds*, showing the stages and motivating forces involved in the design and implementation of workarounds into established systems. The *Theory of Workarounds* provides an industry-neutral framework for categorising these planned/unplanned changes. In the case of this study, these changes are implemented into established animation production methods to overcome temporary setbacks perceived as preventing project completion. In applying this model to series production: *agents* are animation practitioners, *established practices* refer to traditional processes, and *anomalies and mishaps* are possible production obstacles. To date, research into workarounds in media production has been limited (Roder et al., 2016, p.8), as workarounds research has traditionally been based on changes to *information technology* (IT) processes. Therefore, this present study has shifted the focus of these frameworks from IT-reliant organisations to creative businesses, as animation studios are organisations utilising creative and commercial processes.

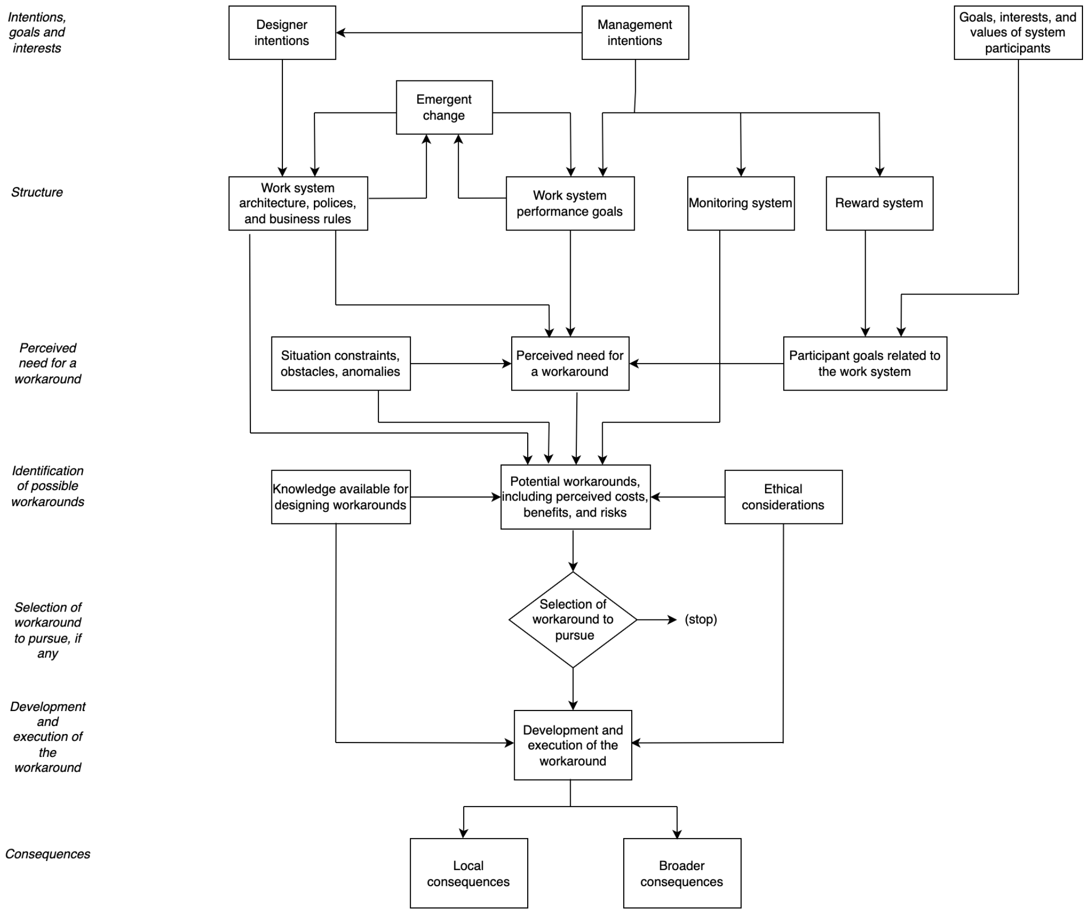

Figure 2.2: Theory of Workarounds (Alter, 2014, p.1056).

Typology of Workarounds

Alter's (2014) *Typology of Workarounds* provides ten categories of changes based on IT-reliant organisations. *Table 2.1* shows these workaround categories. Changes to production activity gathered from practitioner accounts were categorised using this typology. The *Typology of Workarounds* is one of the most comprehensive frameworks for identifying and understanding workaround activity. A major advantage of framing changes to established methods in this way is that the approach allows identification and analysis of the type, scale and motivations of animation workarounds. This research applies Alter's original categories in examining animation production activity. This is the first study in animation scholarship to utilise this framework in analysing practitioner activity, highlighting the present study's contribution to the field.

Alter (2014, pp.1048-1049) proposes that workarounds can be distinguished by their temporality. This temporality encompasses a spectrum from *short-term* changes – that can occur in seconds – to *longer-term* alterations – that might take up to several weeks to design and implement. These temporal categories range from adaptations: referring to short-term changes, bricolage: involving making use of what is available, and workarounds: substantial changes to aspects of a work system to overcome problems (ibid.,). *Figure 2.3* shows the *Temporality of Workarounds*. The *Temporality of Workarounds* framework offers a valuable advantage – it enables the identification and comprehension of the timescale involved in changes to established organisational processes. This study analysed accounts of production activity through this framework, allowing a deeper understanding of the contextual factors influencing the design and implementation of animation workarounds.

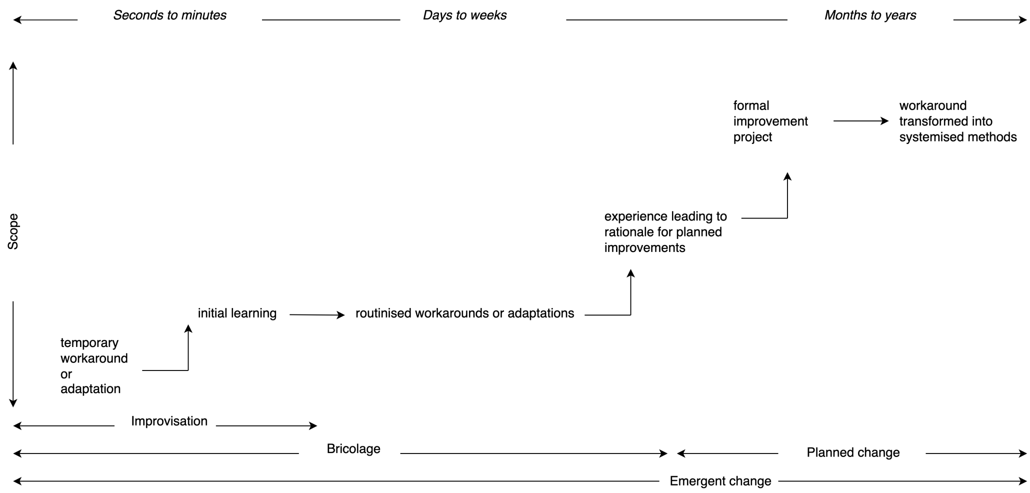

Figure 2.3: The Temporality of Workarounds (Alter, 2014, p.1058)

Alter (2014, p.1050) highlights that the study of time is fundamental to the understanding of workarounds. Alter (2013, p.58) identifies that workarounds can act as a springboard for longer-term changes: observing that the limits which improvisation and bricolage cannot overcome can lead to planned change: the generation of longer-lasting work system improvements. The *Temporality of Workarounds* (Alter, 2014) models change implementation into future established processes. *Figure 2.3* shows the *Temporality of Workarounds*, and *Figure 2.4* shows the *Work System LifeCycle Model* (WSLC). The *Work System LifeCycle Model* represents how a work system

Table 2.1: Typology of Workarounds (Alter, 2014, pp.1050-1051)

Workaround Category	Explanation
Overcoming IT Functionality	Available hardware and software may lack the specific functions and/or capabilities needed to perform the required work steps and record data.
Bypassing Obstacles Built into Existing Routines	Work system participants attempting to bypass constraints, obstacles or anomalies built into organisational routines.
Bypassing or Overcoming Transient Obstacles or Anomalies	Bypassing a control system to achieve the participant and/or management goals.
Responding to mishaps with quick fixes	For example, nurses receiving incompatible drug administration times that would lead to drug interactions in patients may change drug administration times to match the temporal rhythms of nursing work and the patient's conditions, such as, administering medications before or after meals
Augmenting Existing Routines Without Developing New Resources	Occasional computer users who are busy with other tasks may view the need to repeatedly log on to a computer as a waste of time, for instance.
Substituting Unavailable or Inadequate Resources	A lack of staff, for example, sometimes the unavailability of a resource is only a perception.
Designing and Implementing New Resources	Designing and implementing a paper-based record system that contains additional information to augment an electronic system, for instance.
Prevention of Mishaps	Double-checking computer records against data records, for instance.
Pretending to Comply	Creating the appearance of complying with directives, objectives and conducting expectations set by management.
Lying, Cheating, or Stealing for Mutual Benefit	The coding of patient illnesses by physicians paid based on those codes, for instance.
Collusion for Mutual Benefit	'Lying, cheating and stealing for personal benefit' (Alter, 2014, pp.1050-1051) pursued with the acquiescence or encouragement of management.

might evolve through a four-stage process of *operation and maintenance* (identification and minimising of flaws through adaptations, fixes and workarounds), *initiation* (the idea for a new system), *development* (the detailed requirements for this new system) and finally, *implementation* (execution and training for the new system's operation) (Alter, 2017, p.4).

This research uses the *Temporality of Workarounds* to categorise the temporality of changes to animation practices based on change scale. The distinct advantage of using the *Temporality of Workarounds* is the ability to understand the potential for workarounds to create iterative *work systems*. Participant accounts and existing animation research detailing changes to accepted animation processes were analysed through these frameworks to understand how accepted production processes have *evolved* through the integration of animation workarounds. This is the first study to utilise the *Temporality of Workarounds* to understand production activity, allowing this study to claim a modest original knowledge contribution of the temporal implications of animation workarounds to both the fields of *Production Studies* and animation scholarship.

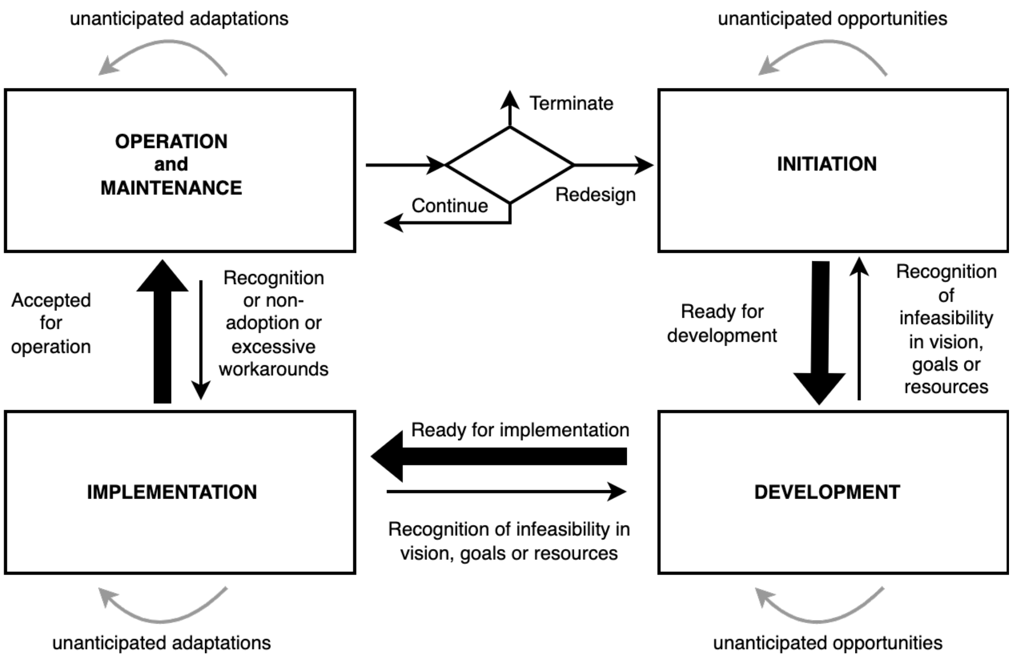

Figure 2.4: The Work System Life Cycle Model (Alter, 2014, p.1078)

This section has discussed the context of the *Theory of Workarounds* (Alter, 2014) and *Work System Theory* (Alter, 2013), in addition to describing the specific models of process evolution. The thesis will use these frameworks to understand animation production activity, thus shifting the application of these models from *Information Systems* and *Organisational Management* disciplines to the study of industrial creative activity. Such a shift strengthens this study's contribution to knowledge through the use of novel frameworks within the animation scholarship and *Production Studies* arenas. The subsequent section examines the literature of both animation research and *Production Studies* to identify under-researched areas and thus establish gaps in current understandings that this study seeks to address.

SECTION 2.2

Commercial Production Processes

EARLY PRODUCTION PROCESSES

Before examining the state of knowledge of production processes, it is important to contextualise the foundations that govern the examination of animation assembly methods. The study of production processes is rooted in film scholarship. Animation historian Mark Langer (1991, p.3) usefully observed that animation research has followed the agenda of film scholarship, thus tending not to focus on studio organisation. However, Ward (in: Honess Roe, 2020, p.155) acknowledges that the study of production processes is limited but growing within *Production Studies*. Therefore, what we know within animation research concerning process development is largely based on interpretive historical analysis of production artefacts and limited practitioner accounts. These sources illustrate that the study of animation focused on aesthetics and narrative rather than production process development.

The existing literature on animation largely overlooks the motivation behind the development, integration and consequences resulting from using workarounds in commercial animation production. The study of animation workarounds requires a literature focus on production processes. This dictates the focus of this literature review. Previous studies have yet to examine how and why producers implemented unsuccessful changes to their established methods through ad hoc practitioner-led initiatives. This lack of documentation has led to the subsequent obscurity of these change efforts. This trend of animation scholarship has resulted in a lack of study into production processes, as observed by Ward (in: ibid.,). The relationship between production process evolution and practitioner-led changes needs to be better understood. As such, this literature review focuses on studying production processes within animation scholarship and *Production Studies*.

The phenomenon of early – pre-1913 production methods – animation assembly processes originating as a single-person artisanal enterprise has been widely addressed in animation scholarship. For example, Callahan (1988), Solomon (1994), Crafton (1993), Furniss (2017) and Ward (2000) observe that original pre-1910s production processes usually involved a single artist, such as Windsor McCay or Emile Cohl, who would complete all the required work to accomplish the piece, usefully highlighting that this method mandated a substantial personal investment in time and labour. This view is corroborated by Gowanlock (2020, p.64), who argues that these methods were forms of animation craftwork. Therefore, what we know concerning original production practices is based upon post hoc interpretation of historical artefacts and accounts. For example, Langer (1991, p.3) pertinently observes that one problem of interpreting any document is that it is a product of its specific historical conditions which can change. Thus, potential future researchers may lose or misinterpret the original context. Nonetheless, these sources illustrate that early animation was originally a fairground attraction, often consisting of lightning sketches, for instance. This era of animation was seen as a craft, driven by a personal, artisanal approach.

This approach failed to achieve production output matching regular cinema release schedules, as recognised by Crafton (1993, p.5), Ward (2000), Furniss (2017) and Langer (1991). An explanation for this is that one person could not produce the number of drawn frames in time to meet commercial exhibition schedule demands. Therefore, the labour-intensive nature of artisanal production may have made it difficult to meet the conditions of commercial production. This (pre-1917) era of animation-making was driven by the artist and the film's needs. The artist's approach to fulfilling the film's requirements drove the production process. Thus the method of creating an animated film varied for each production and artist. This production era featured individual approaches influenced by context and costs. Artistic vision shaped process development, reflecting personal taste and budgets.

What is not known is whether capitalist interest – for example, increasing commercial viability, which will be discussed later in the section – is the sole influence on process changes in the pre-1910-20s era. Scholars have yet to investigate how workarounds might be integrated or the motivations behind their use in the early stages of these processes. The influence of individual practitioners on commercial production processes needs to be better understood and requires thorough study.

These studies (Crafton (1993), Ward (2000), Furniss (2017) and Langer (1991)) prove clear and significant artist influence on the early single-person process. The influence of single practitioners is easy to see in single-person production models. However, what needs to be clarified is how individuals can exert influence in multi-person team contexts with organisational structures, specific job roles and descriptions and capital control points, such as the approval process. This literature area demonstrates that capitalist-controlled production has reduced artist control in commercial assembly, however, the extent to which how artists, and practitioners, can exert influence within aspects of industrial animation assembly also remains unclear.

Several authors have explored factors thought to influence the introduction of labour-saving devices. The literature indicates that producers adapted many labour-saving devices to these processes. Barrier (1999, pp.17-18) highlights McCay's use of repeated cycles and animation. Both Sito (2006, p.15) and Barrier (1999, p.10) highlight that the early makers of animation introduced processes and inventions to increase the efficiency of making animation and meet the increasing weekly 1930s cinema release schedules. Crafton (1993, pp.146-147), Solomon (1994, p.22), Bendazzi (2017, p.39) and Furniss (2017, p.48) describe methods incorporated to reduce the **time** and **labour** requirements of pre-1920s assembly processes, including *printed backgrounds* and the *slash system*. However, Crafton (1993, pp.194-195) usefully highlights that these methods failed to produce perfect results, pertinently identifying that the *slash system* left a visible torn line on every frame. Subsequently, the cel was developed, allowing drawn characters to obscure backgrounds, move in and out of pictorial space and repeat motions (Crafton, 1993, p.158). Therefore, one can hypothesise that labour-saving devices in production procedures primarily rely on the principles of mass-production[1] (assembly, standardisation and interchangeability), as identified by Janet Staiger (in: Bordwell et al., 1985, pp.90-92), in her analysis of live-action assembly. These sources agree that these devices function by splitting the image up into constituent parts that can be assembled in many combinations, which is key to our discussion and will be elaborated on in *Chapter 5: Mass-production in Animation*.

Langer (1991, p.5) usefully recognises and defines the conditions of commercially viable animation production. Thus, animation's commercial viability depends on producers' ability to generate consistent animated content for exhibition – matching the release output of live-action while controlling the costs of this production.

[1] Staiger identified these principles in live-action film manufacture. This research takes these notions and applies them in the analysis of animation assembly activities, which will be discussed in greater detail in *Chapter 5*.

These early inventions focused on the reduction of labour in the making of animated series – they were changes to specific aspects in the making of animation to meet the increasing demand for content, rather than global changes to the process of making animation. All the studies reviewed here suggest that producers introduced inventions to reduce the time and labour costs of pre-1920s animation and to decrease consumption of animation production resources. Overall, these studies agree that these changes focused on animation labourer roles and on minimising repeated work rather than narrative development.

The introduction of labour-saving processes into early 20th Century animation assembly and their impact on commercial viability have been widely investigated by Callahan (1988), Solomon (1994) Crafton (1993) and Furniss (2017). A useful example of the established nature of the detailed division of labour in traditional production processes is provided by Langer (1991), who identifies that since the Bray Studio's re-organisation, based on the detailed division of labour – the: 'Taylorist principles of dividing labour for production efficiency became the hallmarks of successful animation production' (Langer, 1991, p.6), moreover, observing that Bray's top employees founded their studios based on Bray's technologies and production methods (ibid.,). Furniss (2017, p.54) also observes this knowledge transfer from the Bray Studio. Crafton's (1993, p,163) study corroborates that view that *Scientific Management* became a model for commercial animation production. Likewise, Furniss (2017, pp.38-39) highlights that the studio model of production started in the United States in the early part of the twentieth century (1900-1950s) and became the dominant animation assembly model and that 2D aesthetics were particularly suited to this process. These authors' analysis of animation process change utilised post hoc textual analysis of production documents. These sources support the idea that labour-saving inventions were introduced into early animation processes to mitigate the time and labour expense inherent to this model. These changes focused on streamlining worker roles and reducing duplicated effort rather than advancing the narrative.

Sito (2006), Solomon (1994), Crafton (1993) and Furniss (2017) support the view that the detailed division of labour and pyramidal studio structure became the standard studio model in commercial animation assembly. Practitioners who started in the Bray organisation disseminated this model as they moved on to other employment and found their own studios. Thus the transient nature of animation labour has influenced the adoption of now-standardised models. Barrier (1999, p.256) highlights Walt Disney's separating of layout, animation and character design, cemented and further segmented commercial assembly. Therefore, we can assume that individuals in senior management (animation management) positions in the studio (such as the head of the operation) coordinate the activity of animation labourers, organising labour from the top down in animation organisational structures. Therefore, standardised structure and procedures are based on the separation between animation management and animation labourers through the detailed division of labour, and the use of standardised job roles, processes and responsibilities.

The integration of these organisational structure changes with the adoption of assembly-line processes is recognised by Gadassik (2015). The case has shown that organisations have incorporated concepts like *Scientific Management* and mass-production to facilitate cost-efficient assembly, and that by adopting changes that reduce the resource-intensive nature of production, they have developed these processes into commercially viable ones. Here, the literature establishes how commercial pressures have influenced the development of animation assembly and narrative, and demonstrates how these commercial influences led to incorporating narrative and assembly models into industrial animation.

These authors provide examples of changes implemented from the *top down*. However, these researchers have not focused on how changes instigated by practitioners working on the *shop floor* have been utilised in this era of animation assembly. Researchers conducted previous studies by examining historical artefacts. This approach is limited in that it may have lost information about specific changes, their motivations, implications and applications. Much of the research on the evolution of these early processes has been interpretive, meaning that artefacts are context-sensitive and contextual data may have been discarded, leading to potentially unfocused interpretations. For example, practitioner activity accounts regarding their perception and agency concerning these changes to established production methods could provide vital contextual perspectives around change evolution in early industrial animation. Unfortunately, we may have lost many such potential accounts. Nonetheless, the literature supplies a background on commercial animation assembly process development. This informs modern production methods and their changes, aligning with the study's focus. These findings illustrate the nature of *top down* designed labour hierarchies in commercial animation studios, what is not understood is the implementation, application and design of practitioner-led device changes in digital commercial production processes.

One understandable criticism of much of the literature is using interpretive post hoc analysis of production artefacts to conduct historical analysis. As mentioned, the opportunity to collect contemporary practitioner accounts of these process changes may have passed. Therefore, the nature of contemporary practitioner opinion, agency and input into these early industrial changes needs to be clarified. The literature establishes the basic model of commercial pyramidal animation studio structure that underpins production organisational hierarchies and processes, including those of contemporary digital series-making in the United Kingdom, which is the focus of this research. These texts highlight the separation between conception and execution within labour organisations. This understanding is fundamental to the examination, articulation and understanding of animation workarounds in contemporary series-making. The existing literature demonstrates how animation techniques and processes impact the labour involved and the final product. Now that we have discussed the literature on the development of early production processes and the implications of what we know and don't know in the corpus, the section will examine the development of formalised assembly processes.

FORMALISED ASSEMBLY PROCESSES

Existing research has addressed the impact of integrating archived constituent material and assembly processes on early (pre-1927) animation production. Time-saving approaches of breaking down animated image construction into constituent parts was prominently espoused by Edwin Lutz's (1926) instrumentalist manual, *Animated Cartoons*. Animation historian Alla Gadassik (2015, pp.271-273) highlighted this model's significance, observing that the Walt Disney Studio utilised scientific motion analysis and industrial assembly methods to systematise animated sequence creation, arguing that this underlying model of deconstructing movement into distinct phases and cycles is crucial for teaching and standardising motion picture production across large teams of artists. Historian Stefan Kanfer (2000, p.52) highlights that this modular approach, based on Lutz's principles of constituent assembly, is pervasive in industrial animation. The current study's research question on workarounds in 2D reuse systems directly relates to the breaking down and reconstruction of movements, characters and environments into asset and sequence libraries. Thus, much of our understanding about utilising these archived movements and libraries comes from interpretive studies of animation production history. These authors demonstrate that archives and material reuse are fundamental to commercial animation assembly.

Such research illustrates the well-established knowledge that commercial production processes evolved to incorporate the detailed division of labour (this will be discussed in greater detail in the upcoming *Commercial Production Labour Organisation* section), assembly-line construction models utilising archived movements and image layers to reduce the total labour requirements for animation production. A criticism of the literature is the sole focus of applying mass-production principles in industrial assembly. Thus, the influence of other management and manufacturing approaches, such as *Kanban*, *Just in Time Manufacturing* or *Batch Production* has remained under-explored. The management, development and application of digital archiving in UK post-Flash 2D production contexts still needs to be studied. The literature establishes that orthodox assembly methods have developed to incorporate changes and their integration criteria. This is vital for understanding the motivations and conditions for developing, implementing and integrating animation workarounds.

These authors (Gadassik (2015) and Kanfer (2000)) establish that the use of archived material is fundamental to cost-effective animation assembly and formalised practitioner processes. This cements the study of reuse systems as a key component in understanding animation workarounds in contemporary production. Additionally, the literature outlines a baseline process crucial for understanding animation workaround development and integration by which changes can be judged. Overall, the literature establishes archives as a key part of formalised industrial methods. However, how digital tools and processes influence archive creation, criteria, design and use remains speculative.

Animation scholars have identified the Walt Disney Studio's re-formalisation of production models and narratives to mirror those of live-action assembly. Gadassik (2015, p.273) establishes that, in the 1920s, the Walt Disney Studio originally used these established models of animation narrative and assembly, based on the pyramidal structure of Bray. Wells (1998, p.23) observes this is illustrated in the early *Laugh-o-gram* films and *Alice in Wonderland* shorts. Further highlighting that Disney moved away from the surrealist tendencies of these films and prioritised the idea of mechanising animation assembly and content. In this model, the narrative structure of these films, along with many early animated films was based on a series of gags, as recognised by Furniss (2017, p.63). The Disney Studio adopted live-action assembly and narrative models to improve the quality of their animated material Disney studied storytellers such as Laurel and Hardy, Charlie Chaplin and Buster Keaton, learning how to base gags on personality and character to build comic routines, instead of placing one gag after another (ibid., p.97). In this process, Disney began scrutinising the shadow effects, editing and staging of live-action cinema, to understand how these devices stir audience emotion (Canemaker, 1994, p.14). Much of what we know about the formalisation of Disney processes and output is based on historical interpretive studies investigating process evolution by analysing textual artefacts, films and surviving accounts to generate a historical interpretation of process evolution. Overall, the extant literature demonstrates that commercial imperatives have significantly influenced the evolution of established animation production processes and narrative structures. Likewise, the corpus has illustrated how commercial influences led to incorporating principles and concepts from parallel fields and industries. Thus allowing the manufacture of quality novel animation for a regular exhibition schedule with the potential for increased revenue returns.

Furniss (2017), Bendazzi (2017), Gadassik (2015), Wells (1998) and (2002) have established the importance of Walt Disney's motivations and execution of remodelling the output of the Disney Studio during the 1920-30s and the pervasive impact these changes have had on the US-led transnational production model. Furniss (2017, pp.111-112) insightfully highlights that the development of American animation studios was closely tied to that of Hollywood film studios and that technologies, labour practices and control regulation influence project control and style. Likewise, Wells (2002, pp.48-49) calls attention to Walt Disney's desire to position his Studio's projects within this Hollywood system. However, the potential influence of individual artist approaches and decision-making on process change and evolution remains unclear. Similarly, we know very little about the changes and influences that affected pre-Disney animation processes, and how changes and practitioner agency functioned in the pre-Disney model remains uncertain. These writings establish the influences of the formal processes in which participants operate. Likewise, this review demonstrates how parallel industries and organisational models can influence commercial assembly development. Contemporary UK digital series processes are based on these principles. Therefore, these issues underpin the study of animation workarounds in contemporary series-making. Taken together, these texts establish how commercial viability influences and motivates the adoption and integration of methods and processes from parallel industries and the effect these have had on industrial animation aesthetics and narrative models. There is still uncertainty, however, concerning how practitioner agency functions in this system and the development of processual changes.

Animation scholarship has identified how commercial processes adapt to fit financial contextual factors. Wells (2002, pp.114-155) calls attention to the quasi-Fordist stages of film production at the Disney Studio. While Stabile & Harrison (2003, pp.22-23) define limited (or reduced) animation as an economic form of using fewer and less detailed drawings, backgrounds, simple repeatable movement cycles and limited character animation, such as eyes, mouth and functional limbs in addition to stressing sound over action. Likewise, Stabile & Harrison (ibid., pp.19-20) identify that Hanna Barbara's use of reduced animation was a direct outcome of financial constraints. Both Wells (2002, p.64) and Stabile & Harrison (2003, p.22) observe that American studio UPA specialised in limited 'planned' animation in the 1950s, which was later adopted by Warner Bros (ibid.,). Tarantini (2011, p.250) recognises that 2D animation assembly processes had not changed since the 1950s until the introduction of digital tools to deal with the financial challenges caused by shrinking budgets, ultimately resulting in studios expecting higher animation outputs from fewer animation artists with drastically shortened schedules (ibid., p.261).

What we know about contextually-led process changes is based on interpretive historical analysis, interview data and case study approaches to understanding process evolution. Barrier (1999, p.xii) insightfully highlights the problems of utilising subjective individual interview accounts to study the collaborative nature of film – or animation – production. These authors illustrate that even when methods become formalised with archives and the detailed division of labour, practitioners continue to change and develop established processes to increase their cost-effectiveness. This establishes that limits in animation production resources constantly influence processual change and evolution in commercial animation production. However, the fundamental elements – separating management and execution, and dividing tasks based on expense and skill – remain fundamental to commercial animation production. Thus, the organisation of making of animation is in relative flux, dependent on the unique conditions of the current production. However, industrial animation assembly depends on meeting the primary conditions of commercially viable animation and controlling production costs through the division of labour and labour-saving technology.

Much uncertainty exists about the relationship between change influence and evolution in commercial animation processes. Our understanding of how limited animation and reuse functionality in post-Flash 2D software, such as CelAction and ToonBoom, impacts contemporary individual and industrial animation processes is limited, and these techniques' role in digital series production evolution also requires clarification. For example, Tarantini (2011) focuses on the introduction and integration of Flash and ToonBoom processes through the lens of *Legitimate Periph-*

eral Participation (LPP), but does not consider the role of practitioner agency in the animation management decision to integrate digital production tools into 1990s Canadian series-making methods. Byrne (1999, p.66) establishes that asset reuse is a distinguishing feature of series animation. Material reuse and limited animation are both methods of reducing the expenditure of animation production resources to facilitate cost-efficient production. Therefore, understanding reuse systems's and limited animation's functionality, use and application in series-making is fundamental to studying animation workarounds in this context. Together, these texts demonstrate how commercial processes continue to evolve to meet the conditions of commercial production. Limited animation in digital post-Flash processes is often a stylistic and practical choice and the relationship to practitioner agency needs to be clarified.

Limited research has explored the service animation industry in the United Kingdom. Southall (1997, p.48) emphasises that the UK sector focused on advertising with studios located in and around London. This observation highlights how the location of centrally-localised production can influence and limit potential knowledge transfer. Likewise, Langer (1991, p.6) highlights that knowledge and processes from the Bray studio disseminated across the US, corroborated by Sito (2006, pp.11-12). This was because, during the 1910-20s, the US model had centres in New York, Miami and Los Angeles, unlike the one central hub in the UK. Southall (1997, p.46) further highlights that service sector work is unpredictable, therefore, production gaps make traditional production costly as animation labourers require permanent employment. Stahl (2010, p.272) corroborates this, observing extensive use of freelance employment in UK and Hollywood production. Southall (1997, p.45) observes that in this model, studios may use different techniques (ibid., p.48), highlighting that freelancing allows artists to transfer expertise and is key to the service section (ibid., p.46). Much of what we know about the UK service sectors is based on contemporary analysis of the 1990s UK animation industry. One should acknowledge that Southall conducted research during this time, and that the use of digital production tools and other economic and political factors may have changed the nature of the UK sector. Nonetheless, these authors support the idea that the UK service model consists of flatter organisational structures and working hierarchies as a subset of the US-led transnational model. The implications of this model and its impact of animation workarounds will be discussed in *Chapter 6: Organising and Coordinating Production Activity*.

These authors (Southall (1997), Langer (1991), Stahl (2005) and Stahl (2010)) established the impacts of integrating limited animation and digital production tools into North American animation assembly, which will be explored in the next paragraph. The evolution of post-1990s UK animation sectors and processes, as well as the decision-making and agency of practitioners in this context, needs to be better understood. Similarly, the influence of digital tools and techniques on post-2010 UK television production remains unclear. Notably, existing research has overlooked how freelance workers' transfer of technical, organisational, and procedural knowledge between studios impacts the integration of change within the industry. The literature establishes the employment and commissioning conditions of the UK animation sector, which are vital to understanding and examining practitioner agency and animation workarounds in contemporary series-making. While the literature in this chapter outlines the characteristics and context of the UK service sector, there remains uncertainty around how the integration of digital tools has impacted roles and processes within this industry sector. The section has examined change development and integration in mid 20th Century industrial animation production processes. The last part of the section discusses the literature concerning changes brought about by integrating and applying digital tools and processes into industrial animation assembly.

DIGITAL ASSEMBLY PROCESSES

Small-scale investigations have addressed the impact of introducing and incorporating digital tools and processes into later 20th Century production methods on established job roles and processes. In the past decade, there has been a tendency for scholars to focus on theories such as *Legitimate Peripheral Participation* (LPP) in analysing animation practitioner activity. Tarantini (2011) has observed and analysed the integration of digital tools in the 1990s Canadian series animation sector and its impact on established practitioner roles through the lens of LPP, arguing that Adobe Flash's introduction into formalised assembly methods increased efficiency and condensed job roles formally distinct under the detailed division of labour. Tarantini (2011, p.249) uses a case study approach to examine a global experience in shifting production methods and digital tool integration.

Tarantini posits that digital production tool integration increased process efficiency and condensed formally distinct job roles. However, the nature and relationship of practitioner agency in these condensed processes and organisational structures still needs to be better understood. Furthermore, what also needs to be clarified is the nature of the integration and influence of other software on commercial animation processes. The literature has focused on the artistic aspects of animation evolution, while animation scholarship has avoided the more technical and complex aspects of software development and functionality and has left these for the field of *Computer Science* to investigate. Such an approach mirrors Caldwell's (2008, pp.18-26) observation of practitioners utilising *ecumenical and eclectic* self-theorising, in that they are using complex apparatus, thinking and application to solve a production problem, but exhibit a reluctance to acknowledge and discuss the inherent complexity of their activities. Likewise, this trend aligns with Langer's (1991) observation that animation scholarship has followed the agenda of film studies. These writings show the nature and influence of digital production tool integration into established processes and the identification of their shortcomings, and this information's role in developing subsequent tools. These are key insights as they inform the understanding of this thesis's subject area and research focus. The integration of digital tools into commercial studio models has the potential to combine animation tasks that were previously distinct and associated with earlier production methods.

The wider effects of digital tool integration on established methods still need to be understood. Teevan (2011, pp.89-91) describes the integration of devices and processes developed by practitioners with decision-making authority, which reduced the expenditure of animation production resources during the production of *9* (Shane Acker, 2009). These changes to now established digital processes (*geometry optimised assets*, *generic character rigs* and *parallel workflows*, all described in more detail in the Taxonomy of Animation Workarounds) functioned on the principles of digital mass-production. These function by breaking down assets and processes into replicable constituent parts allowing for iterative assembly in a cost-efficient manner. Tarantini (2011, p.262), provides a similar observation of Flash process integration, giving artists additional agency and control of their own processes and work. Teevan's approach is based on post hoc reflection of his studio's working processes. Overall, this supports the idea that practitioners with decision-making authority can alter established processes, assets and activities to meet the conditions of commercial production. This highlights the continued influence that commercial viability exerts on changing established assembly processes.

These sources (Teevan (2011), Tarantini (2011) and Langer (1991)) establish that practitioners with decision-making authority can design and implement process changes. However, the potential for practitioners who lack such authority to implement changes and the possibility of their integration remains speculative. What also needs to be clarified is the nature of digital change development and integration in UK sector contexts, where, in smaller organisational situations, there may be a flatter and less formalised hierarchical structure compared to the US-led transnational production model. Finally, Teevan (2011) established the context of change development in a *studio for hire* situation. Nevertheless, the change development and integration within the feature and series production contexts of the transnational model remains somewhat unclear. This literature shows how reducing the consumption of animation production resources can enhance the commercial viability of established digital processes, and how animation management can instigate these changes in the transnational production model. These are key understandings for examining animation workarounds in contemporary digital series-making activity. Overall, this literature area illustrates that cost-effective change development and integration is an established part of digital production. What still needs to be clarified is how such similar changes to 2D assets in UK service or series animation contexts would function.

In conclusion, the studies show that the conditions of commercial production exert a constant influence on industrial animation assembly, causing continued pressure to increase commercial viability, and so, develop and integrate cost-effective processes and organisational changes into established methods. These findings show that commercial processes adapt to contextual conditions, undergoing continuous transformations, motivated by a need to meet the conditions of commercial production. It is, therefore, possible that many process changes may lack documentation. Thus, this illustrates a gap in current knowledge: an understanding of under-documented processes and the reasons for their generation and possible discontinuation. Thus, the thesis can examine contemporary UK series-making to excavate some of these under-documented processes, and in doing so, contribute new knowledge to animation scholarship. Having examined the literature regarding the evolution of commercial processes, the chapter examines the scholarship concerning the organisation and control of animation labour in industrial production organisations, such as animation studios.

SECTION 2.3

Commercial Production Labour Organisation

ANIMATION LABOUR ORIGINS

As with the study of early 20th Century commercial production processes, multiple authors have addressed the predominance of single-person animation labour in this early context[2]. Stahl (2005) emphasises the fact that, in early (pre-1910s) production, animation control was previously the province of the artist. This observation is inline with the findings of Crafton (1993), Solomon (1994) and Wells (1998). What we know about early animation labour is largely based on Marxist and interpretive case studies that investigate animation history. The significance of organisating of the making of animation and the animation studio itself first became apparent in John Randolph Bray's re-organisation of the Bray studio around 1913 to meet the increased labour demands of the *The Artist's Dream* (Bray, 1913), as recognised by Stahl (2010, p.276), Crafton (1993, p.137) and Callahan (1988, p.223-225). This re-organisation cemented both the conditions of the division of labour and the separation of artist and management thought and action in the making of animation. Overall, these scholars make the case that early (pre-1910s) animation production reflected single-person attraction-experience enterprise and labour.

These authors (Stahl (2005), Crafton (1993), Solomon (1994), Wells (1998), Stahl (2010) and Callahan (1988)) have well established the nature of early (pre-1913) animation. However, the nature of change development and integration in the single-person production model remains under-documented. These findings are useful because they provide a baseline understanding of the nature of early animation labour. Such research demonstrates the artist's influence on commercial processes, and that artists developed potential changes to established production processes to reduce the labour-intensive nature of this assembly. Taken together, these writings establish the nature of the artist's influence on developing processes. However, change integration into these artisanal assembly methods requires further documentation.

The integration of the detailed division of labour into 1910s and 1920s industrial assembly methods is widely investigated. Callahan's (1988, p.228) study of animation labour established that Bray's re-organisation of the Bray Studio facilitated

[2] Single-person artisanal processes were discussed at the start of the *Commercial Production Processes* section.

the detailed division of labour. A view supported by Crafton (1993, pp.155-157) who observes that Bray applied *Scientific Management* to the studio organisation structure. Barrier (1999, p.35) highlights Bray's use of shortcuts without thought of consequence on final aesthetic quality, while Furniss (2017) observes that Bray's frugal assembly methods lacked imagination. The established knowledge of organisational principles in developing industrial assembly is largely based on historical and interpretive analysis of production artefacts and documents. Overall, these researchers support the idea that animation organisational structure evolved to facilitate the labour and cost benefits of task division.

These sources support the interpretation that Bray Studio's reorganisation incorporated management structures and concepts from parallel fields, such as manufacturing and management thought, motivated by the need to meet the conditions of commercial production. Therefore, commercial forces directly influence the organisation of animation labour, task roles and processes. These sources prove that such reorganisation diminished the artist's influence on production. Thus, in commercial animation production, more expensive and higher-skilled workers complete the most difficult task portions, while less costly and lower-skilled workers complete the least difficult portions. For example, ink and paint artists paint cel colours within the lines designated by the animator.

Research by Callahan (1988), Crafton (1993), Solomon (1994) and Barrier (1999) examine how the adoption of cel production processes enabled the successful separation of animated image assembly and facilitated the incorporation of detailed division of labour into studio procedures. This adoption of new normative practices can be understood through John Caldwell's (2008, pp.18-26) *characteristics of practitioner self-theorising*. In this model, Caldwell (ibid.,) identifies the self-theorising characteristics of practitioners. Adopting organisational and management changes into new normative practices can be illustrative of *ecumenical and eclectic* practitioner self-theorising. Bray, and by extension, other animation studios based on these methods, implemented theories and systems, such as the detailed division of labour, *Scientific Management* and pyramidal organisational structure into established production processes. These complex theories were selected to decrease the time and labour necessary for producing animated content. Stahl (2010) acknowledges that normative practices have incorporated these, and that the: 'hierarchical division of labour still guides animation production.' (Stahl, 2010, p.278). Therefore, it is conceivable that animation practitioners and animation management implement complex theories and organisational systems in a common-sense manner to reduce the required labour and time in animated assembly.

The literature (Callahan (1988), Crafton (1993), Solomon (1994) and Barrier (1999)) shows that integrating the detailed division of labour in commercial assembly diminished artists' influence on production methods. However, how artists, working in this context, influenced processes remains unclear. As such, much uncertainty still exists about the relationship between the role and function of practitioner agency in changing and influencing established and developing production processes. Thus, this model for separating animated image assembly is crucially important to understanding mass animation manufacture. These texts provide useful understandings vital the to examination of animation workarounds, by establishing the fundamental conditions of commercial animation assembly and the role of practitioner agency within this model. The literature provides the understanding that commercial factors can influence industrial processes. Both factors are fundamental to the study of animation workarounds developed by practitioners in commercial animation contexts. Overall, the literature demonstrates the influence of commercial factors on animation assembly processes. However, the nature of potential artist influence and ability to change aspects of these formalised processes remains obscure.

ANIMATION LABOUR CONTROL

Animation researchers and *Production Studies* scholars have addressed power struggles within commercial animation organisational hierarchies and production contexts. Langer (1991) presents evidence of a power struggle in the Fleischer studio. Barrier (1999, p.115) and Langer (1991) highlight that control in the Disney Studio rested in the Story Department. Sito (2006, pp.33-34) makes passing observations of the existence of hierarchies *within* production departments but does not develop the argument further. While Stahl's (2010) *Privilege and distinction in production worlds* expands the significance of stratification within the organisational structure and practices of commercial animation studios. This proposes a strata-based model of the hierarchy of cultural labour, in which copyright and stratification separate authors and non-authors – "the line" between creative and technical employees (Stahl, 2010, p.55). With further distinctions between US union/non-union workers who are subject to arbitrary treatment based on whether (or not) they please their superiors, and offshore studio workers who are less privileged (ibid, pp.63-64). Thus, a shift in control in animation labour from animation worker to animation management has been enforced by the potential treatment of animation workers subject to their role, union/non-union membership and geographical location.

This has created a model of labour in commercial animation production that is based on stratification and the allocation of employment terms and copyright – privileged animation labourers (often more expensive and skilled artists working in the United States production model) afford more control of the production than less-privileged animation labourers (often less costly and skilled artists working in US and overseas studios). Therefore, what we know about power relations and struggles in commercial animation hierarchies is based on a Marxist analysis of animation organisational structures and production artefacts. This research support the case that animation labour exists in a hierarchy, which varies from studio to studio, meaning that this influencing factor varies from location to location. *Section 7.2: Power Balance in Studios* develops this discussion.

What needs to be clarified is whether creating an animation hierarchy is a by-product of integrating the detailed division of labour into 1910s commercial animation processes. While the literature has successfully demonstrated the existence of a privilege hierarchy in US/Hollywood studio animation, the criteria for privilege allocation in UK animation, both historical and contemporary, remain speculative. Likewise, the nature of controlling animation labourers in other geographic and organisational contexts needs to be better understood. Furthermore, the relationship between privilege allocation in smaller and flatter organisational hierarchies, such as those in the contemporary UK animation sector, still needs to be fully understood.

These authors' (Langer (1991), Barrier (1999) and Stahl (2010)) findings are key to this thesis's discussion of practitioner agency and its influence on process changes, as they establish the presence of a privilege hierarchy in commercial animation studios. Thus illustrating that management structures have a *grey space* for agency and control, in which, privileged practitioners can utilise to exert influence over accepted processes. In summary, the literature demonstrates the existence and nature of the privilege hierarchy in the US/Hollywood production model. However, we need to learn more about how privilege allocation functions and the potential consequences in smaller production teams, like those in the United Kingdom service and series-making sectors.

Several investigations within *Production Studies* addresses the use of labour alienation and animation management control methods. Barrier (1999, p.51) highlights the Disney Studio's use of exposure to control production labour. Stahl's (2010) Marxist analysis of labour control in studio animation production expands on Bill

Ryan's formulation that 'capitalists cannot manage artists like they can other categories of worker' (Bill Ryan cited in: Stahl 2010, pp.271-272). Stahl identifies three institutional dependencies of animation production: requiring novelty and zones of autonomy; control of production through the power to hire, fire and direct employees; and the concentration of ownership of employee-created intellectual property enabled by copyright (ibid., p.272). Thus, the control of labour in animation production itself has shifted from animation labourer to animation management.

Sabine Heller (2019) builds upon Stahl's examinations by exploring the role of *below the line* (BTL) animation labourer's task perception in contemporary 3D CGI feature-making. Like Stahl, Heller's results illustrate that creative project authorship belongs to the studio for both copyright and financial reasons. Likewise, Heller usefully highlights that the tendency to focus on *above the line* authorship and creativity means that many BTL workers implement problem-solving processes and solutions that increase production efficiency, but that their position in the studio hierarchy means that these changes may go unnoticed and undocumented by animation management, researchers and wider audiences. Likewise, Sito (2006, p.12) recognises that animation artists can see themselves as individuals when they are part of an industrialised assembly line system of animation production. Therefore, commercial studio animation has sought to control animation labour by alienating the animation labourer's creative output – the animation itself. These researchers support the case that the need to create novel content and organise labour makes the control and animation labourers distinct from similar industries. In commercial production, companies exercise control by incorporating both areas of control and agency into the assembly process and employment conditions.

It is now well established that animation management use alienation and employment conditions to channel the creative output of animation labourers, however, the nature of how creative labour control in other geographic areas, such as contemporary UK production remains somewhat speculative. Similarly, Stahl (2010) has only examined storyboarding activity contexts and has not identified how such control and alienation may vary across job roles. Sito (2006, pp.254-255) references Hanna Barbera's use of cost-efficient subcontracting and the shift in live-action feature effects to overseas labour (ibid., p.342), but focuses on labour conditions rather than content control. These writings have established that animation management channel creativity and agency to ensure cost-efficient production and control novel content generation, therefore illustrating that commercial influences exert an effect on artist agency in commercial animation assembly. Taken together, the literature illustrates how artist alienation from creative work is a part of animation management control in the US/Hollywood production model. What remains unclear is the nature of alienation variation considering different animation labourer roles and their relation to *the line*, organisational structures or differing geographic locations and contexts.

Employee interaction and esoteric control methods and their impact on working processes has been addressed to a limited extent. The need for commercial animation to generate novelty, artist-content alienation and animation labour control through employment contracts is expanded by Gowanlock (2020), who reflects a computational model analysis of Pixar labour management. Observing that Pixar allows animation labourers to explore creative ideas and share responsibility for the organisation's creative output, likewise, highlighting how workplace design achieves labour and artistic content control. Concluding that these methods are in tune with Fordist and Post-Fordist principles for employing computational logic for problem-solving, maximising control and responding to unforeseen change (ibid.,). However, Pallant & Price (2015, p.157) argue that Pixar has a more meritocratic environment, while Stahl (2005) asserts that Pixar is 'the only major feature studio run by an artist' (Stahl, 2005, p.94). This view is corroborated by Herhuth (2017, p.29) who highlights that Pixar's training of artists is appropriate to the creative ideals of Neo-liberalism. Thus it is possible to observe a limited control shift back to the artist in very limited profit-focused contexts.

Research outside animation scholarship has focused on technical production aspects and control. Shichijo et al. (2014) propose an ambitious model of organising layout and animation tasks to increase the pace of series production, advocating an order of decision-making calculations and informing animation labourers that production deadlines are 30% earlier than they are to increase shot progression. However, Barrier (1999, p.43) pertinently highlights an alternative pragmatic example, observing that Walt Disney[3] used to offer bonuses for prompt cartoon completion and would then base the schedule on this incentivised progression. Shichijo et al.'s modelling is broad-scale, and like other models of breaking down individual tasks, such as Therbligs, cannot overcome the limitation that practitioners require different times to perform similar tasks. Shichijo et al.'s study takes a technical stance of layout and animation tasks, modelling these as simplistic routine processes of

[3]Wasko (2001, pp.89-90) offers further detail on Disney's control approaches for studio and theme park workers, which is outside this thesis' immediate discussion.

importing and moving assets, and thus failing to consider the complex problem-solving aspects of animation activity identified by Blatter (2007). Likewise, a key limitation of Shichijo et al.'s model is a failure to to account for unforeseen problems that may arise during production, such as loss of work, client-requested changes and asset or software incompatibility or failures.

What we know about esoteric control methods is based on case study interviews and ethnographic analysis of production workspaces. It is also clear that the applicability of conceptual frameworks to improving production efficiency needs to be sensitive to local and contextual realities to maintain practicality, functionality and relevance. The literature makes the case that animation management tool selection can channel animation labourer activity. Thus demonstrating that animation management control, like animation processes themselves, adapts to new tools to maintain and increase channelled creativity and meet the conditions of commercial production. This use of novel methods is *ecumenical and eclectic* self-theorising, as identified by Caldwell (2008, pp.18-26), in that, animation management use complex methods to cost-effectively manage creativity and labour.

The nature of managing labour in creative organisations, such as animation studios differs from that of other businesses. This is because the making of animation requires the creation of novel creative content. The nature of the standard pyramidal commercial animation studio structure means animation management – often located in the higher levels of the hierarchical pyramid – holds production control. Thus, animation management may control animation labourers and their creative output through stratification based on privilege and distinction, employment conditions and content alienation in this hierarchy. Modern animation studios have sought to control novel content generation by providing safe creative spaces for idea exploration and the implementation of *Total Quality Management* (TQM) principles, fostering a sense of worker responsibility for the final product. These methods are designed to generate novel creative animation content within the conditions of commercial production. In these conditions, 'the division of labour pioneered by Bray and the mode of its representation set out by Disney...remain the norm' (Stahl, 2005, p.95) for commercial studio animation production.

Much uncertainty still exists concerning animation management means of controlling labour and creative output in historical and contemporary UK series-making production contexts. What still needs to be clarified is the relationship between location and control. Likewise, understanding of labour control for outsourced and freelance animation labourers remains incomplete. This raises the implication of the poorly understood relationship between location and control in contemporary production. As such, the nature of control and alienation for remote animation labourers remains poorly understood. The literature establishes that tools, processes and environments may control and influence animation labourers and novel content generation. These are comprehensions vital to understanding animation workarounds in modern series-making contexts. Overall, the literature establishes that contemporary production control strategies utilise tools, processes and environments to align and channel creative content creation. However, it remains to be seen how labour and novel content generation are controlled in smaller production contexts, such as UK production, which may utilise smaller teams and additional freelance animation labourers.

To conclude this section, the literature has shown that commercial influences affect practitioner roles, tasks and studio organisational structures, channelling and potentially reducing practitioner agency within industrial assembly. Likewise, the section demonstrates that animation management use and channel practitioner agency to control and organise cost-effective creative content in commercial animation assembly. Finally, the section has highlighted that a *grey space* exists within these organisational control systems wherein privileged practitioners and departments can exert a limited influence of control over established methods. These findings establish a shift in artist agency, brought about by changing commercial studio structure, thus illustrating the conditions of control and agency in industrial production. These literature findings imply a decline in artist influence in commercial studio processes.

However, what needs examination is how practitioners influence process change in modern digital production contexts. The nature, extent and influence of privilege allocation in modern UK series-making contexts needs further examination for deeper comprehension. Similarly, the role of practitioner agency in modern UK series assembly is under-researched. Having discussed the current state of knowledge concerning labour organisation, control and practitioner agency in commercial production literature, the discussion will examine and evaluate the corpus concerning storyboarding practice and theory.

SECTION 2.4

Commercial Production Storyboarding

STORYBOARD CONCEPTUALISATION

Researchers have analysed traditional approaches to conceptualising storyboarding activity in animation scholarship. Blatter's (2007) case study examination of Canadian series animation identifies the mediation of decision-making processes in cooperative production environments, highlighting that storyboards facilitate three aspects of animation production: organisation, story logic and filmic storytelling and continuity in a *Classical Hollywood Cinema* (Bordwell et al., 1985) filmmaking mode. Blatter's argument is based on observation of storyboard artists and meetings. However, Pallant & Price (2015, p.157) usefully identify that contemporary production processes seek to reach the development of pre-visualisation and animatics swiftly, thus often bypassing the storyboard. Further highlighting a limitation of Blatter's analysis: a sole focus on storyboards, ignoring animatics and other forms of previsualisation. Such observations highlight contextual factors that may impact the applicability of Blatter's model to other production processes. Therefore, what we know about storyboard decision-making is based on case study investigations of storyboarding activity. Nonetheless, Blatter's theory is useful for understanding and categorising the activities involved in industrial animation production, specifically planning and producing animation, providing a useful base to analyse and categorise production activity. Here, the literature demonstrates how storyboards conceptualise narrative and practical decision-making and activity, thus providing a framework for understanding storyboarding decision-making and actions.

This literature illustrates the nature of the traditional storyboarding approach concerning storyboarding processes and artefacts. However, the relationship of *fictive*, *filmic* and *directive* decision-making mediation to other production artefacts and processes, such as pre-visualisation and animatic creation, has yet to become clear. It is also ambiguous how this decision-making is articulated and conducted when process stages are bypassed or reduced and save production **time** and **budget** to reduce expenditure of animation production resources. It is now well-established how storyboards can mediate cognitive and pragmatic decision-making processes in commercial production. However, what still needs to be clarified is how other production artefacts, such as layouts and assets, mediate cognitive production decision-making. Blatter's study is particularly relevant because it provides a framework for examining, categorising and modelling decision-making in the storyboard-layout transition, which is key to the current study's research focus. The literature illustrates and models how storyboarding processes and artefacts can mediate pragmatic, aesthetic and narrative decision-making. However, how other artefacts and processes, such as layout, mediate decision-making in commercial production, still needs clarification.

Understanding of the application and consequences of real-time generation and evaluation of creative content in commercial production contexts remains limited. Davis et al. (2011) conducted a grounded theory-based case study investigation of narrative decision-making in single-person non-profit machinima animation production contexts. Observing how the process of testing out ideas in real-time and evaluating them allows creative decision-making and cognition to be distributed onto the animated scene itself. Highlighting that this process allows users to make new and serendipitous connections (story, shot and action ideas) not possible when using traditional storyboarding and pre-planning production methods (ibid., p.209). Davis et al.'s arguments and conclusions are based on semi-structured interviews with machinima filmmakers.

Likewise, Pallant & Price (2015) highlight that commercial storyboard artists at A+C have used *Lego* characters and scenes to generate and test narrative ideas, but fail to connect the process to the concepts of *Distributed Cognition* and the *Geneplore Model of Creativity* like Davis et al.. Although, Pallant & Price (2015, p.7) do rightly highlight that the idea of storyboards acting as *blueprints* is problematic, as it posits a film-type hostile to improvisation. Ward (in: Honess Roe, 2020) highlights the significance of how pre-production processes like storyboarding manage labour in the animation production process. In his argument, Ward contends that storyboards occupy a contradictory space – they are essential to the animation pipeline but are underestimated as a subordinate element of the production process (ibid., p.155). Contending that storyboards "tell the story" but also serve as production management and planning tools that have two orders of business: articulating the story and enabling smooth planning and shot management – dealing with the practicality of shots, budgeting, and overall planning (ibid., pp.160-163).

Thus, these researchers illustrate that the storyboarding process's ability to articulate the animated narrative and manage animation labour is substantial and depends on the size of the production and the capital investment. These factors impact the extent to which storyboarding processes may organise the project. For example, the storyboarding process and organisation for a large-scale studio feature production requires a tighter control of animation labour and schedule than a single-person homemade animated film. Thus what we know about the traditional storyboarding approach and the real-time evaluation and testing approach is based upon case study methods utilising semi-structured interviews with professional and amateur practitioners. Overall, the sources firmly demonstrate that practitioners can use real-time ad hoc decision-making, testing and evaluation to generate narrative ideas and choices not possible when utilising the traditional storyboarding approach.

The nature of the real-time evaluation and testing approach in single-person non-profit production contexts has been established. However, there is still uncertainty regarding how the real-time evaluation and testing approach functions in commercial production with multiple practitioners generating, swapping, evaluating and developing novel ideas. Likewise, the use of this real-time method in changes made to other production artefacts, such as assets and layouts, needs to be better understood. The identification and modelling of the real-time evaluation and testing approach is key to understanding how changes to designed assets, sequences, storyboards and layouts function in industrial assembly contexts, such as modern series-making, which makes this a key insight for the study of animation workarounds in contemporary series-making. Here the literature demonstrates how the nature of ad hoc decision-making, testing and evaluation can function in narrative animation creation. However, the nature of how the real-time evaluation and testing approach functions in commercial production series remains unclear and speculative. Having outlined the literature theorising storyboarding activity, the section will now examine discussions concerning storyboard practice.

STORYBOARD PRACTICE

Instrumentalist literature widely addresses contemporary commercial storyboarding practice. Halas's (1976) *Visual Scripting* describes the theoretical approaches of Eisenstein, mid 20th Century animation and live action production methods. Singer (1992) expands this detailed step-by-step instrumental approach to storyboarding and visual storytelling and character motion mechanics. While Hart (1999) provides an early attempt to combine the historical and instrumentalist approaches, with a unique focus on the concept of maintaining a coherent inner logic to the storyboard, much like Wells's (2007), later concept of inner logic in story development. Thus, as with the late 20th Century approaches of Noake (1998) and Patmore

(2003), the combination of education and pragmatic focus can be seen in animation instrumentalist texts. Byrne (1999) explores the significance of standardised processes of 2D-drawn layout and storyboarding techniques, presenting these using industry methods for prospective layout artists. Wright (2005) continues this combination of theory and instrumentalism, maintaining a focus on students to develop ideas that are suitable for marketing and distribution within the commercial American-centred animation industry. Thus 20th Century instrumentalist texts aim to orientate students into established assembly-line methods.

Post-2000s instrumentalist literature reflects the pervasive use of digital tools in production and exhibition of feature and series assembly. Wellins (2005) prioritises the use of industrial and prosumer digital tools to communicate artist intentions in considerable technical and step-by-step detail. While Levy (2009) maintains a focus on established industrial ideation and development drawn from anecdotal experience. However, while these theories are valid, the focus of Wellins (2005) and Levy (2009) tends towards experimental approaches rather than teaching standardised processes. *Scriptwriting* (Wells, 2007) attempts to apply some of Wells' theories of animation forms and approaches. While Williams' (2009) approach focuses on the in-depth technicalities of character mechanic, motion and emotion for students. Thus, the mid-2000s saw an emergence of the practical application of animation theory in the practice of developing animated content in orientating prospective workers into industry.

Post-2010s texts reflect the integration of digital process and the remediation and synthesis with established industrial production methods. Ghertner (2010) addresses the technicalities of storyboarding and layout processes for multiple animation mediums (2D cel animation, and 3D CGI animation, for instance), updating and expanding on the layout illustrations provided by Byrne (1999). Glebas (2013) expands this technical step-by-step approach with detailed sections on the animation pipeline, story structure and components, asset creation and idea generation. Tony Bancroft (2013), a former director of Disney features, explores the technicalities of the Disney Studio's story-led approach to directing animation, reflecting a *directive* focus. These texts are representative of the shift in U.S.-led contemporary animation feature output towards 3D CGI animation. Overall, instrumentalist texts provide step-by-step instructions for students to assimilate into established studio processes. These instrumentalist texts are a product of incorporating the detailed division of labour, and later digital production tools, and their subsequent impact on orthodox processes.

Thus, the review has established the nature of the traditional storyboarding approach in commercial production. In recent years, the functionality and use of generative artificial intelligence (AI) in commercial processes has increased. However, the exact nature of assimilating AI and digital tools into established production methods remains unclear.

The traditional role of instrumentalist texts has been to inform and orientate students into working in industrial assembly. It is possible that digital tool adoption and their generative capabilities may cause industrial methods to advance faster than instrumentalist texts can respond, because of traditional publishing speeds. Thus raising the possibility that relevant skills training may shift to other publication forms, such as the internet, digital tutorials and blogs. Although it should be acknowledged that it could be argued that the role of instrumentalist texts is to educate students and prospective employees on the *underlying principles* of studio production processes, which the student can then use to inform their use of new generative tools and methods. Nonetheless, this raises the question of the place of instrumentalist learning in contemporary and future processes. However, such discussion is slightly beyond this thesis's scope.

These instrumentalist texts thus provide a relevant understanding of how practitioners gain knowledge and assimilate into changing production processes. This is key to understanding the nature of the role of established methods and changing tool usage plays in the development and implementation of animation workarounds in modern-series making. Instrumentalist texts aim to prepare students for contemporary industry work by orienting and acclimating them into industrial methods. However, it remains to be seen how these texts can keep students informed about rapidly evolving digital processes.

The review demonstrates that there is a lack of understanding regarding storyboard artefacts and process decision-making in commercial settings. Instrumentalist texts reflect how industrial studio structure and organisational methods shape the roles and activities of practitioners. It is still being determined how instrumentalist texts will adapt to transforming digital production processes, seeing that they aim to educate, prepare and orientate students to work in contemporary industry. Nonetheless, these are instrumental findings for understanding practitioner decision-making and agency in contemporary processes besides how practitioners orientate and assimilate into modern 2D series-making organisations and methods.

Overall, the literature demonstrates that ad hoc decision-making allows practitioners to generate new creative outcomes and potentially adapt to unforeseen contextual obstacles, errors and anomalies, thus continuing production and work progression despite these potential occurrences. This section has reviewed the key aspects of the literature concerning storyboarding practice and theory, now the discussion will turn to demonstrating the gap in current knowledge addressed by this thesis.

SECTION 2.5

Research Gap

This literature review has demonstrated a lack of knowledge in current procedures concerning: how practitioners alter devices and methods, how digital tools impact change integration, the role of practitioner agency in post-Flash production activity, how complex processes impact practitioner agency, and the nature of the impacts of changes to 2D assets during production remains under-explored. Likewise, what is not yet clear is how artefacts change commercial processes, how privilege is allocated and functions in UK production teams, and how alienation and labour control vary in differing production contexts – specifically, in the cases of UK small series teams and remote workers. The role of other production artefacts in creative and decision-making processes is obscure. Practitioners' use of the real-time evaluation and testing approach in commercial assembly lacks thorough research.

Animation scholarship has failed to investigate these areas, representing a classic literature gap. The present study addresses this gap by examining the function of workarounds in contemporary animation series-making. This is the first study to use the *Theory of Workarounds* (Alter, 2014) to examine practitioner activity accounts. Thus, the study also addresses a methodological gap within animation scholarship, addressing the current literature shortcomings with a specific focus and framing of animation workarounds in contemporary series-making.

RESEARCH CONTRIBUTIONS

The literature review substantiates the present study's claim to generate and provide new knowledge. Firstly, this thesis offers a new understanding of animation workarounds to animation scholarship, thus, addressing the current research gaps concerning practitioner agency regarding process changes, changing roles and process integration into contemporary processes. Having established the research gap in the literature and how this study addresses these, the final part of the chapter provides a summary of the aspects discussed in this part of the thesis.

Conclusions

To conclude this chapter, the literature has established the influence of commercial factors on production processes and their evolution, besides established industry job roles. This review demonstrates that commercial production processes are fluid and adapt to contextual conditions to maintain and increase commercial viability and efficiency. Likewise, this review has shown that integrating the detailed division of labour has limited artist agency, which is now used by animation management to channel practitioner behaviour and activity within industrial studio organisational structure and assembly processes. The review has also established the presence of privilege hierarchies in production organisations. Certain privileged practitioners and departments can leverage a *grey space* of agency and control that falls outside the scope of organisational processes and role definitions. This allows them to exert a degree of influence over established routines and methods. Finally, the literature presented here illustrates that production artefacts mediate decision-making and that instrumentalist texts orientate and integrate students into established studio processes and, as such, result from the integration of labour-saving devices and processes into established animation assembly methods.

Overall, these studies highlight gaps in existing knowledge. The extent to which practitioners can influence digital processes and the potential influence of practitioner-led device development and integration, is unknown. Prior research has overlooked the impact of horizontal organisational structures on the evolution and incorporation of modern-series making techniques. The existing literature within animation research and *Production Studies* fails to address how digital tools and processes impact archive creation, design and usage in contemporary production. Likewise, existing examinations still need to consider the impact of changing practitioner agency and change development in post-Flash animation assembly. The impact of digital tools on smaller UK production teams remains unclear. Moreover, researchers have yet to explore privilege allocation, distribution and impacts in UK production teams.

Most of the work conducted in the study of animation assembly needs more clarity regarding how specific software and application familiarity and working processes affect wider production methods. No previous study has considered understanding how 2D processes and assets are altered for cost-effective assembly. The impact of artists' alienation on professional roles and processes other than storyboarding remains unexamined. We still need to understand how artefacts and processes other than storyboarding mediate decision-making in commercial assembly. The utilisation of the real-time evaluation and testing approach in industrial series-making is under-studied. Finally, existing writing needs to understand how future instrumentalist texts can adapt to keep pace with rapidly evolving digital processes to continue orientating and integrating students into future contemporary production.

These gaps highlight areas for future research in animation labour, tools and artefacts in mediating decision-making. Further research is required to evaluate the impact and effects of practitioner agency and influence on contemporary production processes. Likewise, work is needed to ascertain the influence of flatter organisational hierarchies on animation workaround development and integration. Further investigations are required to explore the effects of privilege allocation and function in contemporary UK production processes. Moreover, future examination of alienation and labour control in smaller and remote UK production teams is needed.

Turning to the gap in the current understanding of animation tools and processes, further work is required to evaluate the impact of digital production tools on digital library creation and usage in animation assembly. Likewise, further work is required to assess the impact of digital tool integration on the working processes of smaller and more flexible UK production teams. Finally, additional investigation is required to show how other production artefacts and processes mediate practitioner decision-making. In the same vein, more investigation is required into the use and impact of the real-time evaluation and testing approach in commercial assembly. Lastly, further work is needed to assess the role of contemporary and future instrumentalist texts in light of evolving processes.

Thus, a research gap exists in the study of process development and alteration in contemporary digital assembly and the role, limitations and impacts of practitioner agency within this model. This is the first study into the motivation, development and utilisation of animation workarounds in contemporary production processes. The present study addresses the gap in current knowledge by answering these research questions:

1. **How do workarounds function in the transition from storyboard/animatic to layout?**
2. **How do workarounds function in reuse systems?**

3. **How are pre-designed assets and sequences changed when combined in layout?**

    a. **What constraints motivate asset changes?**

    b. **Why do these constraints occur?**

4. **How are workarounds viewed in contemporary series production? (by practitioners, management and studios?)**

Having discussed the state of current literature and demonstrated a gap in contemporary scholarship and how the present study addresses this, the next chapter provides an account of this thesis's research methods and methodology.

CHAPTER 3

Research Methods

This study examines the motivations, development and effects of animation workarounds in modern series assembly processes. This thesis focuses on how workarounds impact and motivate the storyboard-layout transition, reuse systems, changes to pre-designed assets and sequences, and how practitioners perceive these changes. This chapter provides an outline of the methodological approach used in this study. The chapter starts by describing the *Research Philosophy*. It will then outline the *Research Approach*. The *Research Design* is discussed in part three. Section four examines the research *Sampling Strategy*. *Data Collection Methods* are covered in the fifth section. The sixth part outlines *Data Analysis Methods*, while *Methodological Limitations* are identified and discussed in the final section.

SECTION 3.1

Research Philosophy

The following section explains the philosophical stance of the research and how this relates to answering the research questions. The research utilises an interpretive philosophy of understanding and interpreting subjective human behaviours and motivations. The project adopted this approach to seek an in-depth understanding and interpretation of animation practitioner behaviours and motivations, such as decision-making in production contexts. The benefit of such a philosophy is that it allows the generation of interpretations and understandings concerning animation workarounds and their motivations and conditions regarding the storyboard-layout transition, reuse systems, asset and sequence changes in addition to animation labourer and animation management perceptions. The research approach gathered and analysed detailed accounts of practitioner activity to excavate new understandings concerning workaround processes in contemporary animation-making contexts. Many researchers have utilised this research philosophy to excavate new understandings of animation practitioner behaviour within studio production, including: Blatter (2007), Tarantini (2011) and (Ward in: Honess Roe, 2020).

This research adopted a *Production Studies* paradigm to gain a deeper insight into practitioner activity, behaviours and motivations within commercial production contexts. *Production Studies* is one of the most successful paradigms for understanding how practitioners act within and make content in commercial media organisations (Mayer et al., 2009, pp.2-4). This paradigm was adopted to capture the complexities of the phenomenon of workarounds in contemporary series-making. Answering the research questions required an accepted paradigm for understanding and modelling the political factors concerning practitioner agency and activity in industrial production. A key advantage of the paradigm is the modelling of studios as political organisations. This facilitated the excavation of motivations and decision-making of animation workarounds concerning the storyboard-layout transition, reuse systems, asset and sequence changes and practitioner perceptions of workarounds. *Production Studies* is a commonly used paradigm for understanding animation aesthetics and construction, having been used by Stahl (2005), Pallant & Price (2015), Langer (1991), Tarantini (2011) and Ward (in: Honess Roe, 2020).

This section has reviewed the research philosophy and paradigm, establishing the project's use of an interpretive philosophy and a *Production Studies* paradigm to excavate, understand and interpret practitioner agency in contemporary production contexts. The following section reviews the research approach.

SECTION 3.2

Research Approach

This section examines the research approach and its relevance to addressing the study's aims and questions. The research used a qualitative approach, focusing on understanding and interpreting the meaning and context of subjective animation practitioner experiences. A significant advantage of using qualitative data is that only this data type can provide the in-depth practice-specific information needed to answer the research questions. An additional benefit is that this in-depth data is used to understand and interpret practitioner behaviours within the political and practical considerations of contemporary production contexts. Jennifer Mason (2005, p.3) recognises that generating qualitative data can be flexible and sensitive to the social context in which the data has been produced. Therefore, qualitative data is a highly relevant technique for generating practice-specific knowledge concerning animation workaround activity relating to the storyboard-layout transition, reuse systems, sequence and asset changes and animation labourer and animation management workaround perceptions.

Practitioners were asked about specific practice areas. For example, changes to predesigned assets and sequences. Questions were developed and asked about each specific area, and participant answers formed data scripts. (The *Interview Questions Appendix* provides a list of questions asked during the semi-structured interviews.) These were then analysed for data themes required to answer the research questions. Scholars like Langer (1991), Furniss (2009), Bordwell et al. (1985), Stahl (2005), and Stahl (2010) have traditionally used qualitative techniques and data in film and animation research.

This section has reviewed the research approach, outlining the advantages of utilising a qualitative approach to generate the in-depth specific understandings of practitioner activity required to answer the research questions. The next section will move on to consider the research design.

SECTION 3.3

Research Design

What follows is a review of the research design used in this study. The research used a variation of a case study approach, taking practitioner activity accounts and placing them in conversation with each other to generate new understandings of behaviours, motivations and agency within production contexts. A significant advantage of using this approach is that it enables the acquisition of different specialist practitioner understandings and holds them *in check* with each other to confront potential biases in subject activity accounts. This approach is also aligned with the interpretive research philosophy.

A major advantage of a case study approach is that it allows the development of new understandings concerning practitioner agency and behaviour in series-making which are key to understanding animation workarounds. This research used a modified case study approach to explore animation workarounds in the storyboard-layout transition of modern series-making. Practitioners were asked role-specific questions based on their specialism and the type of studio organisation they worked in. Participant responses formed a script. These accounts were then thematically analysed to identify data trends, which were then woven together to form the basis of this written discussion. Studies of animation production activity have traditionally based their approaches on a case study method, for example, Blatter (2007), Tarantini (2011) and Ward (in: Honess Roe, 2020).

This section has described the research design employed in this study, highlighting the project's use of a variation of a case study approach to generate in-depth specialist practitioner activity accounts and hold these in check against each other to prevent biases in the research data influencing the final conclusions. The following section presents the sampling strategy used to generate data.

SECTION 3.4

Sampling Strategy

The section below describes the sampling strategy used in this project's execution. The research utilised a non-probability and purposive sampling strategy. Participants were purposely selected for a range of organisational and studio contexts and roles to avoid potential biases and generate a range of relevant in-depth activity accounts. Animation workarounds in the storyboard and layout transition of contemporary series-making is a deeply specialist area. The research required specific practitioner data across various production contexts to understand this area. A major advantage of using a purposive sampling strategy is that it allows potential participants to be selected based on their experience, role and studio context to generate varying accounts, creating a rich data pool for analysis and discussion in this thesis. The interpretive philosophy and qualitative approach focus on understanding and interpreting behaviours and motivations. This is key to understanding practitioner agency and the use of animation workarounds in production contexts.

A major advantage of a selective sampling strategy is that it allows the prescriptive gathering of activity accounts from specific individuals. Thus a non-probability sampling strategy was chosen to allow a deeper insight into animation workarounds by selecting participants holding specific knowledge required to answer the research questions. Participants were selected for their in-depth knowledge of studio assembly processes, and to reflect a range of opinions across positions, studio organisation sizes and contexts and practitioner places within these hierarchical settings. A selective sampling strategy is one of the most well-known approaches for understanding production activity within animation scholarship, having been used by Ward (in: Honess Roe, 2020), Blatter (2007), Tarantini (2011), Stahl (2005) and Stahl (2010).

This section has reviewed the sampling strategy, describing the prescriptive method by which participants were selected for their specialist knowledge and organisational contexts to generate a rich pool of qualitative data for the research discussion. The following section reviews the specific data collection methods utilised in this study.

SECTION 3.5

Data Collection Methods

In the section that follows, the discussion will describe the data collection methods and how they relate to gathering the required knowledge to answer the research questions. The research utilised a cross-sectional approach to gather data. The study sought an in-depth understanding of production activity at a specific point in the contemporary animation assembly process, limiting the applicability of a longitudinal approach. The research required detailed practitioner-specific knowledge of a particular point in contemporary series-making methods. A key advantage of a cross-sectional approach is the focus on gathering in-depth data from a specific period, namely, the storyboard-layout transition in modern animation assembly. Another important benefit of using a cross-sectional approach is the ability to place contemporary accounts in conversation with each other to generate new in-depth understandings of practitioner activity and behaviours and to challenge potential assertions and biases in the data. Therefore, cross-sectional data gathering is one of the most successful techniques for understanding the subject and the in-depth nature of human behaviours in specific contexts. A factor that is aligned with this project's interpretive philosophy.

One distinct advantage of using a cross-sectional approach is the targeted data-gathering and understanding from specific practitioners working at a particular point in the animation assembly process: the storyboard-layout transition. This allowed questioning around the areas of animation workarounds used at this process point, in reuse systems, asset and sequence changes as well as animation labourer and animation management perceptions of workarounds. Thus, a cross-sectional approach facilitated the collecting of detailed practitioner activity accounts relevant to answering the research questions. This approach selected participants in the contemporary industry and asked them to describe their working processes and recall when they changed them in response to production constraints, errors and management expectations.

Research data was collected utilising semi-structured interviews. The research required an in-depth understanding of specific practitioner processes and activity changes in the storyboard-layout transition in modern animation assembly. Semi-structured interviews are among the most successful methods for gathering detailed practitioner activity accounts in sensitive contexts. A major advantage of semi-structured interviews is that they allow the collection of targeted information from participants while allowing for deviations and flexibility in the interview process, thus facilitating the potential to explore unforeseen relevant discussion areas. Therefore, semi-structured interviews were heavily suited to collecting subjective and detailed accounts of practitioner behaviours and motivations concerning activity changes in modern series-making.

A semi-structured approach allowed the data-gathering to respond to participants' subjective responses concerning production behaviour and motivations. Thus, the approach is aligned with this study's interpretive research philosophy and qualitative approach, facilitating a deeper insight into participants' responses to develop a new detailed understanding of practitioner activities in contemporary production contexts.

Likewise, the flexibility afforded by a semi-structured approach allowed the data-gathering to deviate into practitioners' specialist discussion areas not originally included in the question scripts. Before commencing the study, ethical clearance was obtained from both the Arts University Bournemouth and University of the Arts London Research Degrees Committees. Moreover, preceding data collection, participants were contacted informally, either in-person or via email, and were provided information sheets detailing the process and their capacity to withdraw and claim anonymity at any time in the activity.

To begin this process, the key questions required to answer the research questions were generated (these can be seen in the *Interview Questions* appendix, located in the back matter of the thesis). These questions were organised into themes relevant to specific practitioners. Questions for email interviews were likewise divided into themes to facilitate detailed responses and deviations. For example, storyboard artists were asked storyboard-focused questions. Live interviews were conducted via video conferencing and lasted approximately one hour. Transcripts for these interviews were recorded for data analysis, which is discussed further in the next section. The data gathering approach broadly followed the seven-stage interview inquiry process set out by Kvale Steiner (in: Flick et al., 2007, pp.35-36). A detailed explanation of the data-gathering process can be seen in *Table 3.2*. Within animation scholarship, many researchers have utilised semi-structured interviews to study production contexts, including, Blatter (2007) and Ward (in: Honess Roe, 2020).

This section has reviewed the study's data collection methods and their relevance to answering the research questions. Specifically, the cross-sectional approach examines the processes of storyboard and layout in modern animation assembly. It has also explored the use of practitioner-specific questions and semi-structured interview processes to facilitate exploration into unforeseen areas of practitioner knowledge. The following section outlines the data analysis methods utilised in this study.

SECTION 3.6

Data Analysis Methods

This overview outlines the data analysis methods used to extract meaning from the collected data. The research required in-depth accounts of practitioner behaviours, activities and production contexts to understand animation workarounds in the

Table 3.1: Data Collection Process

Data Collection Stage	Explanation and Justification
Interview Question Formulation	Research questions were dissected to identify the information required to answer them. These sub-areas were divided into individual questions, each designed to generate the constituent sub-knowledge required to answer the integral research questions.
Participant Identification and Selection	Participants were selected to reflect a range of relevant studio positions, including storyboard and layout artists, riggers, producers and software CEOs. Selected participants were contacted, before the interview execution, in which, participants were sent information sheets that detailed the research process and their right to withdraw and request anonymity at any time. Likewise, participants were asked to sign a consent form, in line with ethical approval, to ensure they understood the process. Participants who agreed and returned consent forms were contacted for interviews.
Individual Interview Script Design	Interview questions were selected from the script and grouped, focusing on the participant's role and studio context to avoid overwhelming the participants with long question lists. The research approach selected many questions for a participant. These were split and asked over many interviews where required.
Interview Execution	The approach conducted interviews, with email interviews including a shorter list of questions and answers to provide insight into practitioner practices and deviations, and live interviews featuring a list of relevant questions to allow for specialisation and insight from practitioners.

storyboard-layout transition of modern series-making. The study employed a variation of *Thematic Analysis* to analyse the research data. A key major advantage of *Thematic Analysis* is the excavation of themes in textual data, in this case, detailed practitioner activity accounts from professionals working in contemporary animation production. The interpretive research philosophy sought new understandings of practitioner activity and motivations within production assembly contexts. *Thematic Analysis* identifies themes in participant responses, facilitating the excavation of practitioner motivations and activities in contemporary production. Thus, *Thematic Analysis* was a very suitable data analysis method for this study.

A *Thematic Analysis* process was used to analyse interview accounts from practitioners working in specific roles within the contemporary industry, for example, layout and storyboard artists. Focusing on the analysis of specific practitioner accounts allowed the identification of data themes relevant to distinct roles and contexts in modern animation assembly. Likewise, analysing data in this manner allowed the identification of data themes relating to animation workarounds in the storyboard-layout transition, reuse systems, asset and sequence changes, as well as animation management and animation labourer perceptions of workarounds. Thus illustrating *Thematic Analysis* as an appropriate method for extracting data themes to answer the research questions.

Before analysing the interview data, transcripts of interviews were made, these were checked to ensure they matched the content and experience of the interview and for spelling and grammar to aid future comprehension. When formatting these transcripts, care was taken to ensure they matched the subjective focus of each practitioner, allowing different perspectives to be placed in conversation and in check with each other to prevent potential biases from filtering into the analysis. First, the transcripts were read individually to acquire familiarity with the data. Then, key information relevant to the research questions was identified. Likewise, broader meaning patterns across the data were identified. Similar themes from the data were placed in conversation with each other to generate a broader grouping of themes. Finally, these themes were woven together into the written discussion and contextualised against relevant literature concepts. A detailed breakdown of the data analysis process employed in this study can be seen in *Table 3.2*.

The section has reviewed the data analysis method used to extract relevant meaning from participant activity accounts. This variation of *Thematic Analysis* allowed the research approach to excavate new understandings of animation workarounds from practitioner accounts. The final section reviews the limitations of this research

Table 3.2: Data Analysis Processes and Justification

Data Analysis Stage	Explanation
Transcript Generation	After data collection, the interviews were transcribed into a recognisable and editable script using text files for email interviews or online transcription for video interviews. Copies were made of all transcripts for editing, thus preserving the original data. All data was stored on a password-protected drive in line with Arts University Bournemouth and University of the Arts London ethical approval.
Transcript Review and Edit	The transcripts were then edited. They were refined to match the structure and content of the recent interview.
Initial Reading	Interview transcripts were read and reread to become immersed and familiar with the data, in line with the *Data Familiarisation* stage of *Thematic Analysis* (Braun & Clarke, 2022, pp.42-49).
Initial Theme Identification	Transcripts were examined, allowing for identification of broader meaning patterns and areas of interest within the data. All data relevant to a potential theme was collected together, allowing a review of each theme to determine viability. This was conducted in line with the *Generating Initial Themes* stage of *Thematic Analysis* (Braun & Clarke, 2022, pp.73-84).
Theme Check Against Data	Generated themes were checked against the original interview transcript to ensure they represented the data and answered the research questions. If an issue arose, themes were edited, combined or discarded. A technique conducted in line with the *Reviewing Themes* stage of *Thematic Analysis* (Braun & Clarke, 2022, p.97).
Theme Extraction	Each theme was analysed, working out the scope, focus and narrative of the themes, applied in line with the *Defining and Naming Themes* stage of *Thematic Analysis* (Braun & Clarke, 2022, pp.108-115).
Writing Up and Analysis	Analytic and relevant data extracts were woven together with relevant literature to form the basis of the thesis structure and argument, executed in line with the *Writing Up* stage of *Thematic Analysis* (Braun & Clarke, 2022, pp.121-124).

approach.

SECTION 3.7

Methodological Limitations

This final section describes the methodological limitations of the research design employed in this study. The dataset size meant that it was not possible to investigate every production context. For example, how a *studio for hire* or outsourced studio may utilise animation workarounds in contemporary production activity. Likewise, the *cross-sectional* data-gathering process has limited the research findings, by focusing on post-2010 production methods and the study of animation workarounds in earlier iterations of animation fabrication methods. A major problem with a longitudinal data-gathering approach is its inability to generate in-depth data on assembly activity and processes. Therefore, the research utilised a cross-sectional technique to generate new understandings of animation workarounds in contemporary series-making. Although the research approach could not excavate detailed accounts of process changes over a longer period, a key strength of the study is the generation of in-depth understandings of animation workarounds in the storyboard-layout transition in contemporary production processes.

To determine exactly how the context of animated feature production affects the development and implementation of animation workarounds, researchers need to collect further data on potentially longer sequential projects and development cycles and periods. 2D cut-out production processes and assets may have substantial differences, and similarities, to other animation forms (such as, lens-based or computer-generated imagery). For example, Tarantini (2011, p.253) asserts that 1990s (and subsequently post 1990s) 2D series assembly methods have been influenced by 3D (CGI) processes. The research focused on 2D cut-out series to understand animation workarounds in modern animation assembly generally. The principal disadvantage of gathering data from both feature and series production contexts is the inability to conduct an in-depth analysis of the data and subsequently generate detailed and relevant new understandings of practitioner activity in commercial production. Nonetheless, the strengths of the study included the in-depth analysis of animation workaround activity and development and implementation in 2D cut-out production processes.

The focus on the storyboard-layout transition limits the research approach. A limit of studying a wider range of points in the production process is the need for more in-depth data. This affects the analysis and conclusions about animation workaround activity and practitioners' motivations in production contexts. The research approach focused on the storyboard-layout transition because the tangible nature of the artefacts allows practitioners, fellow and future researchers to understand the concept of animation workarounds in both an abstract and concrete manner. This is because processes and decision-making can be visually observed in the storyboard-layout transition and artefacts. Although the results of this study should be extrapolated with caution to other parts of the production process, a key strength of the research approach is the focus on the storyboard-layout transition, allowing the generation of in-depth interview data concerning practitioner activity and animation workarounds in modern series-making.

Finally, further observational and textual data is required to understand both the motivations and developments of animation workarounds in the storyboard-layout transition and the production process generally. The original research design included in-person observation of production, storyboard and workbook meetings and textual analysis of production artefacts such as storyboards, layouts and assets. The COVID-19 pandemic occurred during 2020-2021, limiting the planned data-gathering activities and constraining these initial data-collection methods. The research approach could have conducted these remotely and, in some cases, managed to gather initial data regarding artefacts. However, the research approach adapted to focus on one data collection mode and increase the depth and focus of the analysis to generate more substantial results and conclusions concerning animation workarounds and practitioner activity in the storyboard-layout transition. Although the findings are generated from one data type, a key strength of the study was the detailed analysis of specific practitioner activity accounts to create new in-depth understandings of practitioner behaviours and motivations in modern series-making.

The current section has reviewed the limitations of the study's methodological approaches and techniques, outlining and justifying the decisions made in the research project design and their relevance to answering the research questions. The final section summarises the methods described in this chapter.

Concluding Summary

The study used an interpretive research philosophy to examine and understand practitioner behaviours and motivations in contemporary production activity. This philosophy was complemented by using a *Production Studies* research paradigm to understand how practitioners make media and navigate the political and practical complexities of commercial media organisations, such as animation studios. The investigation adopted a qualitative approach to gather in-depth accounts of practitioner experiences. The research philosophy and paradigm influenced the understanding of this data to generate novel detailed comprehensions of animation workarounds in modern animation assembly.

The research utilised a variation of a case study approach, focusing on collecting relevant detailed accounts from a range of specific individuals and weaving these accounts in conversation with each other to generate original understandings of practitioner activities in the storyboard-layout transition of contemporary series assembly. The research approach involved the selective sampling of practitioners, based on their role and studio type in modern UK series-making to generate varied and detailed narratives concerning animation workaround development, integration and perspectives in commercial assembly.

This data was gathered using semi-structured interviews with these relevant individuals. A process that allowed targeted position-specific questioning and deviation for unforeseen areas of practitioner-specific insight. The research approach transcribed these accounts and identified data themes using a variation of *Thematic Analysis* to uncover novel understandings of practitioner behaviour, motivations and the development and implementation of animation workarounds in contemporary series-making.

The research design was limited by its narrow focus on a single stage of the production process – the storyboard-layout transition – and an emphasis on 2D cutout series-making techniques, as well as a lack of observational and textual analysis data. Although these limitations mean that the study's conclusions should be extrapolated with caution to other production contexts and conditions, a major strength of this research design is the gathering of focused activity accounts from relevant practitioners concerning the conditions, motivations, development and implementation of animation workarounds in contemporary series-making.

CHAPTER 4

An Examination of The Theory of Workarounds in Relation to Animation Production Activity

This chapter discusses Alter's (2014) *Theory of Workarounds*, and applies the model in analysing examples of historical and contemporary animation practice to generate new understandings of production processes. To date, only a limited number of studies have examined changes to established manufacturing methods within animation scholarship, as such, there has yet to be a definitive analysis of workarounds in animation production. The present study addresses this knowledge gap by directly applying Alter's (2014) models to animated content production. In doing so, this study provides the exciting opportunity to advance our understanding of workaround development, functionality, integration and their consequences in commercial animation image-making.

The chapter recontextualises Alter's (2014) *Theory of Workarounds* specifically for the context of animation production, addressing some the of model's limitations in relation to specific contexts. This chapter consists of five sections. *An Examination of Alter's Typology of Workarounds* explores the different types of workarounds and discusses the nuances of these changes in animation making. *Steps in the Theory of Workarounds* explores the stages in workaround development and implementation in animation and parallel industries. *Workaround Effects and Perspectives* discusses the impacts and effects of these changes on established working methods. *Organisational Challenges and Dilemmas Related to Workarounds* discusses the organisational dilemmas related to workarounds, while the final section examines the *Phenomena Associated with Workarounds*.

SECTION 4.1

An Examination of Alter's Typology of Workarounds

This section of the chapter will examine Alter's (2014) typology of changes and discusses the function of these in animation production and other industries. As discussed in the previous chapter, and shown in *Table 2.1*, the model consists of ten workaround categories: *Overcome Inadequate IT Functionality*, *Bypass Obstacles Built into Existing Routines*, *Respond to Mishaps with Quick Fixes*, *Augment Existing Routines Without Developing New Resources*, *Substitute for Unavailable or Inadequate Resources*, *Design and Implement New Resources*, *Prevent Mishaps*, *Pretend to Comply*, *Lie, Cheat, Steal for Personal Benefit* and *Collude for Mutual Benefit*. We can observe that Alter's (2014) typology is broad. This results from Alter's industry-neutral approach, which may be too broad in application to specific industries, such as animation production. After dissecting these industry-neutral categories in light of the animation industry and other sectors, the current study remodels these specifically for contemporary series-making in the *Typology of Animation Workarounds* in *Chapter 10: Discussions, Conclusions and Contributions*. Thus overcoming the limitations of Alter's model.

OVERCOME INADEQUATE IT FUNCTIONALITY

The first category in Alter's (2014) model is *Overcoming Inadequate IT Functionality*. Alter (2014, p.1050) distinguishes that workarounds arise because available hardware and software lack functions and capabilities required to perform specific work steps and record data. Alter provides an interesting example, observing the limitations of customer transaction systems' inability to process $0 items, such as promotional coupons. In this situation, customer service agents may enter *dummy data* into the *customer relationship management* system (ibid.,). However, in animation production, practitioners may have to overcome a lack of specific software features, such as a lack of an autosave function in CelAction. Interview participant and animation rigger Mat Dame (2021) provides a useful illustration of the processes used to overcome this limitation in software functionality, by taking regular screenshots as his work progresses, using technology in non-standard ways to prevent potential errors, such as lost work, from IT malfunctions.

The amount of available time decisively motivates potential solution development to overcome IT features and functionality limitations. For example, customer interactions must be completed swiftly to ensure customer satisfaction and a cost-effective and profitable amount of transactions. Likewise, in animation production, project cost-effectiveness is dictated by the amount of time and budget spent on its production, in alignment with the conditions of commercial production, as identified by Langer (1991, p.5). However, the retail context is more temporally immediate than animation production due to the nature of human interaction in transactions.

These examples show that in other industries, such as customer relations, IT interaction is about service and record keeping. To expand on the idea of *dummy data*, it is useful to think about its implications. Using *dummy data* may have potential consequences further along in the transaction process, such as the creation of inaccurate transaction records, which can be problematic if such records do not match the actual movement of funds to, and from, requisite bank accounts for a specific period of the companies' transactions. A potential discrepancy may lead to the implications of fraudulent transaction investigations and proceedings against the company and the individual handling said transactions. Therefore, animation practitioners seemingly use *dummy data* to overcome organisational obstacles to prevent potential production and personal workload delays.

BYPASS OBSTACLES BUILT INTO EXISTING ROUTINES

The second category of changes in the *Theory of Workarounds* is *Bypassing Obstacles Built into Existing Routines*. Alter calls our attention to the notion that '[s]ome workarounds address transient anomalies or mishaps' (Alter, 2014, p.1050). For example, Koppel et al. (2008, p.408) found that in other industries, manufacturers may have to overcome equipment limitations. For example, Alter (2014) recalls, that in paper manufacture, machine operators often need to overcome the limits of control systems to ensure production deadlines are met. However, in animation production, practitioners may have to overcome potential bottlenecks generated by the approval process and the need to control creative work fabrication. These bottlenecks may be caused for two reasons. Firstly, practitioners are limited in the changes they can action before approval, as these changes may not be approved, meaning the time and labour spent on these changes might be wasted, requiring further time and labour expense in altering said changes, doubling the original time and labour cost of the alterations. Secondly, the approval process may generate additional changes as revisions, adding to practitioner workloads.

Likewise, practitioners may have to overcome embedded processes in the organisation of production activity, such as set ways of conducting specific tasks and relaying information. Dame (2021) provides a useful example of how practitioners can invent procedures to bypass obstacles built into existing routines, identifying *safe to start rigs* – character models on which he can action changes without approval. These results indicate that the obstacles built into existing routines in animation production might be organisational. Unlike those routinised obstacles in other industries, they are unlikely to cause serious implications save for project completion and practitioner workloads.

As shown, potential obstacles in other industries can be organisational or physical. It should be acknowledged that animation production has less documented physical limitations than the examples from other industries provided here. This is especially true with 2D Digital cut-out animation. However, this may be less true in productions that use physical animation media, such as 3D stop motion. These examples show that the potential obstacles present in existing series-making routines are organisational, and are specifically related to controlling the generation of creative work. These potential obstacles are imposed and created by the conditions of commercial constraints inherent to studio production, and may not exist in experimental animation forms. Therefore, practitioners use animation workarounds to overcome situational constraints inherent to the conditions, of and control systems within, commercial series-making.

RESPOND TO MISHAPS WITH QUICK FIXES

The third group in the model is *Responding to Mishaps with Quick Fixes*. Alter emphasises that '[p]roducing quick fixes to get around mishaps and other transient problems is an inherent part of many service jobs' (Alter, 2014, p.1050). However, such a position assumes system participants conceptualise, problem-solve and seek to constantly improve the work system during the course of their employment, which may only sometimes be the case. Nonetheless, Alter (ibid.,) provides a useful example in the healthcare industry, where prescribed medication interaction times are often different from the practicalities of administering said medication.Further highlighting that nurses may have to work around the prescribed medication timings to accommodate patient routines and appetites. A temporal dimension similarly impacts specific aspects of animation production processes. Senior Layout Artist and interviewee Anye Chen (2022b) provides a pertinent illustration of how layout artists may use placeholder assets to complete scenes when the required assets, such as character models, are not completed on schedule for inclusion in the final layout. This is a quick response made to prevent potential production delays.

Likewise, practitioners may look forward and discuss how to prevent mishaps when planning their work. Dame (2021) provides an especially effective example, explaining that riggers and storyboard artists may discuss how to utilise cutaways, thus avoiding complicated actions that would otherwise require additional time and labour to construct and animate. Another useful example of this process can also be seen in machinima[1] production, where a machinimator might direct the camera away from action and model glitches, using sound to convey narrative action instead of visuals (Michael Nitsche Mark Riedl, and Nicholas Davis, 2011, pp.58-59). These cases are instances of bricolage – using available materials. Nurses[2] may alter prescribed medicine timings to account for contextual factors, whereas the layout artists use available props and character models in the scene to ensure delivery within the production deadline. These examples show that time is a key factor in workaround design and implementation. However, it should be acknowledged that in animation production, the workaround example is meant as a stopgap temporary measure, whereas, in the nursing example, this change becomes permanent if the original required conditions and materials are not provided within the time needed. Therefore time has a major influence on the choice, design and implementation of animation workarounds.

AUGMENTING EXISTING ROUTINES WITHOUT DEVELOPING NEW RESOURCES

The fourth workaround type is *Augmenting Existing Routines Without Developing New Resources*. Alter highlights that '[s]ome repeated workarounds do not require new resources' (Alter, 2014, p.1050). Nevertheless, uncertainty is created by Alter's failure to specify what new resources entail. To overcome this limitation, the current study considers the development of any device or procedure that costs additional animation production resources to be a new resource. Nevertheless, Alter provides a useful example of how agents augment existing routines without developing new resources, observing that computer users may allow others to use their computer accounts in situations when multiple logins are common, such as data entry (ibid.,). Likewise, in animation production, practitioners may use quick changes to existing routines to overcome potential problems. For example, interviewee and animation director David Blanche (2021) remembers a useful illustration

[1] A form on animation created using video game engines, environments and assets.
[2] As described in Typology of Workarounds (Alter, 2014, pp.1050-1051).

where the aesthetic of the final film his production team were working on did not meet the required standard and there was not enough time to redesign the project. To compensate for these conditions, Blanche applied a *look up table* (LUT) to the animation in an edit suite, improving the final image quality with a minimum of additional time and labour expenditure before project delivery. Likewise, storyboard artist and interviewee Liz Strawbridge (2021) observes that storyboard artists will quickly draw a 3D storyboard grid on a blank panel in Storyboard Pro to assist the artist in drawing the correct panel perspective and scale. This is a quick augmentation to established storyboarding processes to improve three-dimensional drawing. Strawbridge (ibid.,) provides another useful example of augmentations to storyboarding processes, observing that storyboard artists may break down character models into basic shapes. This augmentation facilitates two key functions. Firstly, it reduces the time needed for drawing each storyboard panel, thus increasing production efficiency. Secondly, this allows the storyboard to continue to function as a narrative development device in light of changing character designs.

Augmentations to existing animation production processes can also be designed and implemented by animation management. Such changes can augment practitioner working activity in multiple production processes. Teevan (2011, p.89) provides a useful example, observing that while making *9* (Shane Acker, 2009), the production process was organised so that key character models were completed first, allowing key scene animation to commence while additional character models were still being constructed. Thus reducing the total production time needed to complete the animated feature. However, Teevan (2011) fails to consider the extra time and animation production resources required in developing new processes and methods, instead espousing their time and cost efficiency with a lack of a comparable baseline process. These examples are also instances of bricolage, as agents use available materials. These results demonstrate that, in animation production, practitioners attempt to complete work despite the impact of obstacles and use labour and time-reducing solutions to achieve this aim.

These sources show that practitioners prioritise objective completion, and consequences may not be considered in change implementation to achieve this aim. For example, the implications of entering incorrect data under the *General Data Protection Regulations* (GDPR). Likewise, practitioners may not consider potential copyright issues, such as using a third-party asset like a *Look Up Table* (LUT) when under extreme time restraints, such as looming project delivery deadlines. The findings demonstrate that available time is a key factor in practitioner decision-making when designing and implementing animation workarounds. This lack of available production time to develop a new aesthetic heavily influenced Blanche's (2021) choice to implement a *Look Up Table* (LUT), a solution facilitated by an available third-party plug-in in the edit suite, an easily accessible choice implemented in improving a project with a looming delivery deadline. Thus the findings show that the available time, or limit thereof, is a key motivating factor in augmenting existing routines in commercial series-making.

SUBSTITUTE FOR UNAVAILABLE OR INADEQUATE RESOURCES

The fifth variety of change is classed as *Substituting for Unavailable or Inadequate Resources*. Alter draws our attention to the idea that: '[w]orkarounds often involve substitutions when inadequate staffing or in-availability of resources calls for a workaround' (Alter, 2014, p.1051). Alter (ibid.,) provides a useful example, observing that in emergencies, nurses may proceed with administering medically acceptable treatment until a physician arrives, whereas in animation, practitioners may feel the responsibility to take on extra tasks to prevent production delays, as usefully observed by Chen (2022c). As before, Alter's argument posits a type of worker who is constantly considerate of process improvement and possesses the required knowledge and ability to make processual changes. Nonetheless, the sources suggest that taking on extra responsibility beyond that mentioned in the job description is a key factor of this type of workaround.

These changes are enabled by practitioners possessing relevant contextual knowledge and understanding required to perform these extra duties without creating additional errors and problems. This necessary knowledge can be gathered through observation. For example, nurses work in the healthcare environment, observing doctor's duties, procedures and step-by-step actions in context. Time limitations mean action must be taken swiftly to avoid problem escalation, as a patient's condition may worsen if a nurse waits before taking action. Likewise, animation departments and practitioners work alongside each other. However, in animation production, the potential consequences of inaction are not as life-threatening. Instead, inaction and subsequent problem escalation may generate a potential project delivery delay and a subsequent loss of income, and therefore, practitioners may take on extra *short term* duties to prevent such problems from escalating.

These findings reveal that the motivations of animation labourers seek to reduce individual project labour – personal workloads, while animation management focus on maintaining series production value. Situational knowledge allows practitioners to extend their skills beyond the scope of job responsibilities by substituting for unavailable or inadequate resources. Likewise, available time is a key factor in these decisions. In both examples, nursing and animation, the new resources are seen as both a legitimate process and a parallel system. Therefore, the conditions of commercial production – which limit the resource expenditure to control production costs – directly influence and channel practitioner decisions to use available materials in overcoming lacking and unavailable resources.

DESIGN AND IMPLEMENT NEW RESOURCES

The sixth grouping of workarounds is the *Design and Implementation of New Resources*. Alter observes that '[i]n some situations, work system participants and technical specialists develop and implement software workarounds, shadow systems, modifications of existing software, or other resources that were previously unavailable in the setting' (Alter, 2014, p.1051). Further observing that such parallel systems may be unsanctioned apparatus addressing shortcomings in sanctioned arrangements (ibid.,). A finding supported by Brazel & Dang (2008). Fitzpatrick & Ellingsen (2013) develop the idea, observing that paper-based record systems can be used to augment electronic ones (Alter, 2014, p.1051).

In animation production, the design and use of new resources can be integrated into the organisations' operational methods. Interviewee Tony Tarantini (2021), Professor of Animation Studies at Sheridan College, and a 20-year veteran of Canadian animation studio Nelvana provides a useful illustration, observing that reuse systems can be integrated into and coordinate work across multiple animation departments. Highlighting that when the production team have invested the required time and resources in building an asset library, a storyboard artist can call for the reuse of an existing background, which is then actioned by the layout and background artists, reducing the time and labour required in episode completion, compared with creating a new shot from scratch. Tarantini (ibid.,) usefully further observes that reused assets, such as props, backgrounds and characters, can continue to be used in this manner until a drop in quality is noticed. Likewise, layout artist Mark T. Byrne (1999, p.66) observes that asset reuse is a defining feature of series animation and that overusing the same assets can lower series production value. Head of Production at Starz Animation, Matthew Teevan (2011, pp.89-96), provides two useful examples of new resources designed and implemented while making *9* (Shane Acker, 2009). The production team designed and created *geometry optimised assets*, reducing the required project production time and labour. These assets, such as a background piece of rock that looked like different rock pieces from distinct angles, allowed use of the same asset in different scenes while avoiding audience recognition of the repeated use of a single element. Thus facilitating the time and labour-saving reductions of reuse systems across the whole production without the normal loss in production value associated with extensive asset reuse. Likewise, Teevan's (ibid.,) production team created *generic character rigs*. These character models were created from one primary rig, which was digitally iterated and amended, creating additional character models. Thus allowing swifter multiple-character model creation compared to designing many characters from scratch. *Chapter 5* explores the implications of digital asset creation and management in commercial series-making.

It has thus been established that, parallel systems, such as reuse systems may be considered as lowering series production value when they are overused, as observed by Tarantini (2021) and Byrne (1999). However, reuse systems are also seen as legitimate practices in reducing unnecessary practitioner time and labour expenditure, as observed by interviewees and Senior Storyboard Artists Kayvon Darabi-Fard (2022) and Rosie Cash (2022). Therefore, it is possible to observe a balance between shadow-parallel systems and legitimate systems and processes in commercial series-making. This combination of shadow and legitimate-sanctioned processes results from the nature of the conditions of commercial production. Practitioners might utilise shadow reuse systems – the unsanctioned reuse of assets to reduce production labour expenditure – with the *local* objective of reducing their workload, and the *broader* objective of ensuring the project's commercial viability through the reduction in required assembly time and labour. These findings show that both these *local* and *broader* objectives are inextricably linked within commercial processes and practitioner actions. Therefore, commercial influences on series production create a dynamic interplay between legitimate and shadow processes in contemporary series-making.

PREVENT MISHAPS

The seventh sort of change focuses on *Preventing Mishaps*. Alter calls our attention to the indication that computerised systems emphasise productivity increases, inaugurating a 'single version of the truth' (Alter, 2014, p.1051). Further identifying many instances and circumstances in which participants attempt to prevent mishaps by manually double-checking paper records and personal databases to ensure they have accurate information (ibid.,). Animation director David Blanche

(2021) provides a useful illustration of the procedures and artefacts designed to prevent mishaps by animation practitioners, observing it is useful to *double-check* the composition settings in Adobe After Effects before exporting a project. Likewise, animation rigger Mat Dame (2021) creates a *procedure list* – a list that details the specific working processes and artefacts of the production team Dame is working with, such as project-specific Toon Boom colour palettes. Dame uses these lists to better integrate himself into the established processes of the new working team, preventing potential errors generated because of a lack of familiarity with the team's working processes, software and methods. Likewise, Dame (ibid.,) also creates *personal schedules* for himself, translating information provided in charts and schedules created by the production department into an easy-to-understand and action format. Both examples take the form of double-checking data to prevent potential future errors.

These checks are done at the individual *micro-level*, rather than at an institutional *macro-level*. This shows that individual practitioners feel tacit responsibility to prevent errors, which may be simply wishing to keep their jobs. These findings suggest that, in animation production, practitioners actively augment processes and methods to prevent future mishaps. A process that appears to be embedded into individual working methods in the commercial animation production model. It is likely, therefore, that this is motivated by both the paradox observed by Sito (2006, p.12), that animation workers view themselves as both workers in a commercial organisation and as artists with a vested interest in creative output quality, exhibiting a desire to minimise disruptions and problems in workload completion. As a result, practitioner processes in modern series-making are implicitly designed to prevent accidents, and this motivation may come from the conditions of commercial production in which practitioners work.

PRETEND TO COMPLY

The eighth grouping of workarounds is *Pretending to Comply*. Alter highlights that '[s]ome workarounds try to create the appearance of compliance with management goals, regulations, or behavioural expectations' (Alter, 2014, p.1051). Alter (ibid.,) observes that participants using online or digital training platforms may continually press the *return* key to progress the program, rather than pay attention to the content, or may enter *substitute data* onto a form. In animation, practitioners may control the *content* and *timing* of material sent for external client approval. This is because, in commercial production organisations, the approval of creative work, such as storyboards, can create potential production bottlenecks, as artists cannot action changes whilst deadlines move ever closer. One participant provides a useful illustration of how storyboard artists *pretend to comply* with the approval process and external clients. These clients, such as illustrators, may not understand specific production process aspects, such as changeable character representations in storyboards. This can cause potential delays when the illustrator requests character model changes based on the functional character representations in storyboard panels, not understanding that the final animated characters may look different to the panel representations.

To overcome the impact of potential revisions requested by clients, the interviewee observes that storyboard artists may send old storyboard panels – containing character illustrations closely resembling the character model – to the external client for approval, thereby preventing potential revision requests based on the client's misunderstanding of the storyboard's functional nature. Likewise, Liz Strawbridge (2021) pragmatically illustrates that storyboard artists may use representational shorthands to reduce panel drawing time. These examples reveal a mismatch between the intentions of animation management and animation labourers. The goals of both parties may be broadly aligned, as both seek to reduce unnecessary work because said work might be costly in terms of the production budget, labour and time, such extra expenditures may prevent the project from meeting the conditions of commercial production. However, control point execution potentially creates delays and extra work for practitioners, a factor that might not be considered by animation management, generating mismatches in practitioner and animation management intentions. Therefore, practitioners attempt to overcome this by using animation workarounds, such as delaying the sending of information needed to satisfy the control point conditions. Therefore, practitioners use animation workarounds to balance the effects of mismatches between animation management and animation labourers in workload management concerning control points, such as the approval process.

LIE, CHEAT, STEAL FOR PERSONAL BENEFIT AND COLLUDE FOR MUTUAL BENEFIT

Category nine in the *Theory of Workarounds* is *Lying, Cheating, and Stealing for Personal Benefit*. Alter draws our attention to the darker side of workarounds, observing that 'people sometimes use workarounds for lying, cheating, or stealing' (Alter, 2014, p.1051). Alter (ibid.,) provides a sobering example of *Lying, Cheating, and*

Stealing for Personal Benefit, observing that physicians may diagnose medical problems based on payment codes, rather than the patient's conditions, thus ensuring a higher payment. A key limitation of Alter's modelling of this category is the nature of the primary data required for investigation. This raises an important question: *would such participants be honest in their accounts?* Alter interprets secondary data to reach the required conclusions. However, misinterpretations of secondary data and inherent biases may obscure generated conclusions. Due to the sensitive nature of this topic, the current study did not attempt to collect examples of this workaround type from animation professionals.

The final group in Alter's (2014) model is *Collude for Mutual Benefit*. Alter (ibid.,) develops the model by distinguishing that *Colluding for Mutual Benefit* may be pursued with management encouragement and acquiescence. Alter (ibid.,) provides a pertinent example of management colluding for mutual benefit, observing that hospitals in the United Kingdom have been observed to add extra staff on duty on the weeks when audits are scheduled. However, examples of colluding for mutual benefit in animation production are quite different. Independent filmmaker and animation festival organiser Carla Mackinnon (2021) usefully identifies that funding applications can be considered the *original workaround* in animation production, observing that often a project cannot begin production until funding is secured. Mackinnon (ibid.,) identifies that the proposed aspects of the animation project are tailored to suit specific application funding criteria to help secure project funds. Both examples are similar in their attempts to portray a suitable view of the organisation to external regulators. The healthcare example is fundamentally dishonest at an organisational level, while the animation example is seen as a necessary step in securing project funding. For example, funding a particular project may require applications to multiple funding bodies, each with different criteria; therefore, securing enough funds requires tailoring the project to each funding body. Consequently, it is reasonable to infer that, in industrial animation production, practitioners might be motivated to collude by commercial factors, such as the need to secure project funding.

Thus far, the section has shown that time is a key factor in animation workaround development. It has also been shown that organisational constraints result from commercial studio organisation. For example, control points organised by animation management can impact individual practitioner processes. The results have demonstrated that practitioners can mitigate such potential impacts with local workarounds, often taking the form of distorting information in an attempt to *pretend to comply* with management control points, such as the approval process. This section has revealed a delicate balance between legitimate systems and unsanctioned *shadow* practices, such as unauthorised material reuse in animation production. The section has also shown that the paradoxical nature of artists' place within the commercial organisation creates tacit investment in production process efficiency. Furthermore, these findings reveal that this vested interest manifests in the devices and procedures practitioners use in mishap prevention.

The findings are important because they reveal a complex dynamic between animation practitioners and management, as the very structure of commercial animation production aligns their intentions – cost-effective assembly and commercially successful output – despite the inherent tensions between these groups. However, the findings demonstrate mismatches in the execution of goals and interests between management and practitioners, showing that practitioners use animation workarounds to align working processes with their own goals and interests in light of organisational conditions and constraints. Therefore, the findings presented here are important as they illustrate that animation workarounds can function as *boundary objects*, mediating the mismatches between the intentions, goals and interests of both animation labourers and animation management in contemporary animation production. Therefore, the section has demonstrated that animation workarounds are an intrinsic part of commercial production processes, in that, these changes are needed to mediate the different approaches of animation labourers and animation management to ensure the commercial viability of industrial production processes. The next section explores the *Steps in the Theory of Workarounds* and how they apply in contemporary animation production and parallel industries.

SECTION 4.2

Steps in the Theory of Workarounds

This part of the chapter lays out the *Steps in the Theory of Workarounds*, consisting of seven distinct stages: *Intentions, Goals, and Interests*, *Structure*, *Perceived Need for a Workaround*, *Identification of Possible Workarounds*, the *Selection of Workaround to Pursue, if Any*, *Development and Execution of the Workaround*, and *Local and Broader Consequences*. This section examines each stage's nature and implications for animation workarounds in animation series-making. Though it may seem unfeasible, especially from a pragmatic perspective, such as implementing quick ad hoc changes, that all workaround development goes through these stages, these categories are nonetheless useful for conceptualising and analysing workaround activity and form the basis of *The Theory of Animation Workarounds* presented in *Chapter 10: Discussions, Conclusions and Contributions*.

INTENTIONS, GOALS, AND INTERESTS

The first stage in workaround development is *Intentions, Goals, and Interests*. Alter (2014) distinguishes that this first stage of workaround development involves interaction between the personal goals, interests and values of *management* and *participants*, further highlighting that communication between these two parties can be flawed when a designed work system is 'misaligned with both sets of intentions' (Alter, 2014, p.1057). Alter (ibid.,) usefully identifies that workarounds allow the completion of work when conditions get in the way, spotting incompatibility between the three main contributors of the workaround: 1) *Management*, 2) *Designer*, and 3) *System Participants*. For example, burdensome systems implemented by animation management may make participants develop their own goals. Animation generalist and interviewee Mat Dame (2021) illustrates that storyboard artists and riggers may discuss which shots and actions are necessary to convey the narrative action in a scene. Moreover, research participant and CelAction CEO Andy Blazdell highlights that 'workarounds can happen at any time in production and can cost' (Blazdell, 2022), recognising that effective animation workaround ideas need to work over numerous shots (rather than just one shot, for example). It seems Blazdell's wider conceptual perspective provides a more evaluative view of change consequence.

Three key factors influence animation production processes for practitioners: resource limitations, equipment constraints, and organisational requirements. These directly influence the intentions, goals and interests of both animation labourers and animation management. The goals and intentions of both animation labourers and animation management are broadly aligned in commercial production: both parties wish to minimise production costs. It should be acknowledged that the interests of these two parties are more nuanced. For example, animation management may be more concerned with the monetary and time costs of the animation project, potentially manifesting in a focus on overhead costs. These considerations only contemplate the labour hour cost involved in making animated content. Conversely, animation labourers may focus on the working details of their tasks, an aspect potentially overlooked in the aforementioned animation management perspectives. Therefore, there is a potential mismatch between the interests of animation labourers and animation management. This mismatch is the potential starting point of many animation workarounds observed in the data. *Chapter 5* and *Chapter 7* discuss this in more detail. A key point to consider here is the *Products/Services* aspect of the *Work System Framework*, as Andy Blazdell and CelAction are providing a product/service – the animation software, and Blazdell is acting as a consultant/troubleshooter to *Customers* – the external client, in this case, the *Sarah and Duck* production team. Therefore, the impact scope of any potential change determines animation workaround cost-effectiveness and success.

However, differences in creative and management approaches can cause potential problems. For example, interviewee and Senior Layout Artist Anye Chen (2022c) recognises that producers are skilled in organising schedules but may lack creative backgrounds and understanding of process mechanics, resulting in instances where producers suggest improvements to accelerate processes that generate additional problems. Alter (2014, pp.1048-1049) highlights that workarounds can create additional problems if designers do not understand why existing procedures are in place. This is a key observation and major advantage of Alter's model and analysis: understanding of the motivations and perspectives of existing controls and procedures. This lack of understanding on the part of producers and artists of others' rationale can lead to suggestions and alterations lacking the required knowledge of each other's working processes.

Said hypothetical alterations, made without the requisite knowledge, can create knock-on problems to accepted activity areas. For example, animation management may focus on project overhead costs and reduce the number of artists, increasing individual workloads, and potentially resulting in artists producing work in unfamiliar areas and skill sets. Producers may only notice an impact of the decision when a drop in quality and delivery delay is perceived. Therefore, knowledge areas need careful consideration in alterations of accepted activity to prevent knock-on errors and maintain timely delivery and quality. These differences in creative and management approaches result from misaligned goals and interests in the animation work system.

STRUCTURE

The next stage in the generation of workarounds is *Structure*. Alter draws our attention to 'the architecture and characteristics of the work system, work system performance goals, the monitoring system, and the reward system' (Alter, 2014, p.1057). Further highlighting that designer and management intentions inform the policies, architecture, business rules and performance goals of a work system and that *emergent change* can impact work system structure. This wide-ranging definition stems from Alter's industry-neutral approach. The characteristics and structure of the work system and emergent change may affect the systems, architecture, policies and business rules of the work system (ibid.,). To streamline the analysis of this aspect for animation production, this thesis will consider the hierarchical and pipeline aspects of *structure*, as these are the most pertinent to animation workaround analysis.

Studio hierarchy and team member knowledge are sources of animation workaround resistance in animation production. Interviewee and Senior Layout Artist Anye Chen (ibid.,) also recognises that the hierarchical position of practitioners suggesting potential alterations influence decisions regarding proposed solution implementation, arguing the importance of supervisors being open to proposals as practitioners may have relevant experience and knowledge to suggest. This situation is compounded if the person suggesting changes does not occupy a supervisory position, as difficulties may arise when fellow team members, such as production assistants and coordinators, lack specific knowledge requisite in understanding *why* a particular change could be useful. Therefore, the design and implementation of **normative workarounds** are subject to the conditions of commercial production and studio hierarchy, as practitioners are often unwilling to implement changes that risk the additional expenditure of animation production resources.

Likewise, colleagues and superiors are more open to change suggestions after witnessing a successful alteration in animation contexts. Chen (2022c) recognises that practitioners are consistently open to improving the efficiency of production processes. However, pertinently highlighting that resistance can arise when attempting to persuade superiors of the benefits of unfamiliar approaches, observing that supervisors may be used to doing things a certain way when meeting the requirements of another department. This resistance to implementing successful changes may represent reluctance to make substantial and potentially costly alterations, amplified by supervisory personnel's comfort zones. The decision to implement changes to established practices is heavily influenced by animation management's comfort zones and familiarity with existing processes. It can thus conceivably be hypothesised that hierarchical position within the studio and team member knowledge can be sources of resistance to implementing and integrating animation workarounds.

PERCEIVED NEED FOR A WORKAROUND

Alter describes the third stage as consideration of the *Perceived Need for a Workaround*, demonstrating that this stage is 'based on a combination of the work system's architecture and performance goals, situational constraints, obstacles, and anomalies, and participant goals related to the work system' (Alter, 2014, p.1057). As with the *structure* stage, this is a wide-ranging definition, resulting from Alter's industry neutral *Information Systems* approach. This needs confining and definition before industry-specific application. Therefore, this thesis considers the separate perspectives of animation management and animation labourers in animation workaround development. For example, in animation, assets and sequences are perceived as complex and time-consuming to alter. This informs the perceived requirement to change storyboards, as observed by interview participant and rigger Mat Dame (2021). Commercial animation production often requires workarounds due to a disconnect between the goals, interests, and organisational constraints of practitioners and management. Alter (op cit.,) observes that unplanned mishaps and anomalies may also be a major contributing factor. Animation management goals are based on meeting the conditions of commercial production from a planning and organisational perspective, while the interests of animation labourers might focus on the practicalities of completing their workloads. It can therefore be reasonably hypothesised that practitioners create animation workarounds to overcome the potential impacts of this mismatch while attempting to meet the conditions of commercial production.

IDENTIFICATION OF POSSIBLE WORKAROUNDS

The fourth step is the *Identification of Possible Workarounds*. Alter highlights this step is 'triggered by the perceived need for a workaround' (Alter, 2014, p.1057). Usefully identifying that this process consists of a consideration of benefits, costs and risks – typically starting with obstacles in the current situation and the perceived need for a workaround, and the available knowledge for designing workarounds is essential in seriously considering any workaround (ibid.,). As before, Alter's argument is contingent on a type of worker who conceptualises improvement and efficiency as part of their normal duties. This is unlikely to be the case of every worker. Nonetheless, the discussion will concede that artists feel individual attachment to their work quality and processes.

In animation production, identifying shots required to further the narrative and selecting possible cutaways occurs when deciding to cut away from complicated action, as identified by interviewee Mat Dame (2021). Likewise, in commercial production, animation management (supervisory personnel and studios) also prioritise familiar solutions and processes. Chen (2022c) recognises that there are multiple ways to create and solve problems in studio production, observing that practitioners may believe they are executing a task as efficiently as possible, when in reality they may be pursuing the only method they know. For example, updated software often includes new features that can accelerate practitioners' workflows, but practitioners may miss these improvements. It is therefore possible that proven positive processes can become habitual. These results suggest that uncertainties develop when unfamiliar problems arise which cannot be solved by these familiar means. Consequently, resistance to unfamiliar solutions may prevent the development of potentially positive changes. It is possible to hypothesise that resistance to new methods limits access to new unforeseen improvements.

SELECTION OF WORKAROUND TO PURSUE, IF ANY

The fifth step in the *Theory of Workarounds* is the *Selection of Workaround to Pursue, if Any*. Alter identifies this stage reflects 'attitudes toward the behaviour, subjective norms, and perceived behavioural controls, plus concepts from agency theory such as moral hazard and information asymmetry' (Alter, 2014, p.1057), and that these inform workaround selection. This is a wide definition, and as such is open to ambiguity, resulting from Alter's industry-neutral approach and secondary data use. To refine the discussion to animation production, the thesis will focus on industry-relevant factors.

Thus, in animation, the amount of available time and labour constrain animation workaround development. Interviewee and CelAction CEO Andy Blazdell (2022) identifies that production deadlines constrain the development of potential animation workaround ideas, as there is often not enough time to develop the solution before the project delivery date. For this reason, Blazdell advises that 'it is best to develop workarounds at the start of the show' (Blazdell, 2022). For example, the making of *Sarah and Duck* (Harris and O'Sullivan, 2013 – 2017) featured a specific puppet rig. The Sarah character needed a bitmap image of a zip blended with the CelAction skeleton. Blazdell allowed access to a feature from the program code, creating a dialog box for the animation team to access previously hidden functionality. These findings suggest that time and cost requirements for novel solution development channels practitioner focus on utilising available materials and features over developing completely new processes. Consequently, solutions can arise from reconsideration and creative recombination of existing materials. Therefore, available time and labour are constricting factors in novel solution development.

These constraints mean fixes often use available materials. Blazdell (2022) pragmatically recognises fixes often use materials that are to hand. For example, observing that the production of *The Big Knights* (Astley and Baker, 1999-2000) involved a shot of objects flying through the air, and the implemented solution consisted of drawing the objects on cathode ray tube (CRT) monitors. Likewise, *kit-bashing* can be an accepted part of visual effects and design processes, as usefully illustrated by John Eaves's (2009) designs for multiple space ships from recombining elements of existing models in *Star Trek: Enterprise* (2001-2005). These findings suggest that consideration of available materials informs the design and function of potential solutions, represented in the *Selection Of Workaround To Pursue, If Any* phase of the *Steps In The Theory Of Workarounds* in *Figure 2.2*. It is reasonable to infer that using available materials reduces the time and labour needed in potential modification implementation, and is a response to the conditions of commercial production, as lost time and labour in solution development is limited by avoiding creating new equipment and assets.

The development cost of animation workarounds is considered in terms of the additional time and labour required to design and implement a potential change. Blazdell (2022) highlights implementing features for the sake of it is an inexperienced mistake, instead advocating that potential change viability is determined by calculating: the problem **time** cost against the **time** and **labour** costs in solution development and implementation. Therefore, animation workaround viability is determined by calculating the current problem's cost and scale in terms of time and labour (problem scope *s*, time *t* and labour *l*), against the lost time and labour needed to implement the potential solution:

$$\frac{problem\, time\ (t)\ and\, labour\ (l)}{2(solution\, time\ (t)\ and\, labour\ (l))} = Workaround\, Viability$$

Therefore, animation workaround viability can be calculated by doubling the solution development time and labour cost and subtracting this from the problem time and labour cost. It is consequently possible to hypothesise that the considerations of potential solutions must account for development costs and lost production progress under current arrangements.

DEVELOPMENT AND EXECUTION OF THE WORKAROUND

Stage six in workaround implementation is the *Development and Execution of the Workaround*. Alter calls our attention to the change temporality, stating that workaround development and execution 'can occur in minutes in simple cases where process steps are bypassed or modified slightly, or can take weeks or months if software must be designed and implemented' (Alter, 2014, p.1057). This temporality and scope is key to animation production. This is why the thesis builds upon Alter's model in *The Theory of Animation Workarounds* presented in Chapter *10: Discussions, Conclusions and Contributions* with added *time* and *scope* dimensions. In animation, successful animation workarounds allow production to continue despite obstacles. Research participant Tony Tarantini (2021) highlights that a lot of time is focused on finding animation workarounds to overcome limited budgets while meeting high quality demands. Further illustrating that successful changes are assimilated into the pipeline until a reduction in quality is noticed, such as poor animation and performance for 2D rigged characters. These findings suggest that successful animation workarounds are changes to established processes that allow acceptable quality animation to be completed despite production constraints. It is, therefore, possible that these changes are potentially recorded and integrated into future established assembly methods.

LOCAL AND BROADER CONSEQUENCES

The final stage is the *Local and Broader Consequences* of workaround development. Alter (2014, p.1057) highlights that local advantages can include removing temporary obstacles and improving workflows, while local disadvantages can include failure of the workaround to execute and/or creating other problems, such as distorting information required elsewhere in the work system. Alter (ibid.,) identifies that **local consequences** – include the immediate upsides of: i) removing short-term problems and enhancing workflow executions, with downsides of ii) failure of workaround execution, and iii) distorting information in the work system; while **broader consequences** of workarounds could i) transfer the problem to another unit and/or ii) distort information (ibid.,).

These *local* and *broader consequences* can apply to animation workarounds. In animation, *local consequences* include the immediate upside of reducing time and labour needed in scene construction. The *broader consequences* may be that animation management may observe this swifter production and expect the completion of additional scenes at the same rate without shortcuts. Alter's industry-neutral approach creates ambiguity in context-specific application. As with the previous stage, this thesis' remapped *The Theory of Animation Workarounds* presented in Chapter *10: Discussions, Conclusions and Contributions* expands and defines animation workaround consequences from the *individual* to *department* scales and provides animation industry-specific criteria for change integration. Blazdell (2022) recognises unsuccessful animation workarounds tend to be discarded and forgotten, as practitioners want to avoid advertising their mistakes. Likewise, Tarantini (2021) defines unsuccessful modifications as those that fail to execute as planned and/or produce substandard results. These findings confirm the hypothesis that in animation production, changes that fail to overcome obstacles are often disregarded, only successful changes tend to be recorded. This raises the possibility that unsuccessful modifications may be potentially repeated by different practitioners, as there is no means of knowing – beyond an individual's anecdotal experience – what unsuccessful modifications have been attempted and subsequently discarded and forgotten.

This section has shown that within commercial animation, the intentions, goals and interests of both animation management and animation labourers are broadly aligned, while their methods and focuses differ. These differences can cause problems, often forming the basis of animation workaround development to overcome these while attempting to meet the conditions of commercial production. This development is both informed and inhibited by practitioner knowledge and studio organisational structure. The results have demonstrated that both animation management and animation labourers prioritise familiar solutions and processes when identifying potential resolutions. Likewise, the data shows that available time constrains potential workaround development and selection. Similarly, the section demonstrates that successful animation workaround viability can be calculated by weighing the problem time and labour cost against the time and labour cost of potential solutions. Finally, the section has illustrated that successful animation workarounds are those that allow production to continue despite the impact of potential obstacles, and these are used until a quality reduction is noticed, while unsuccessful changes are discarded and forgotten.

This section's findings are important because they identify the conditions that influence and impact workaround development in contemporary series-making. Thus, this section contributes new understandings to animation scholarship and the study of production processes within *Production Studies*. These results show that organisational structure, practitioner knowledge and animation production resources inform potential animation workaround development and execution. The results presented here demonstrate that workarounds are both generated by a need to meet the conditions of commercial production, but also a need to overcome limitations generated by these conditions in industrial animation-making. The next section discusses the *Effects and Perspectives* of workarounds.

SECTION 4.3

Workaround Effects and Perspectives

This section explores the *Direct Effects and Perspectives of Workarounds* as defined by Alter in the *Theory of Workarounds* (Alter, 2014). This study has condensed the effects and perspective categories proposed by Alter (2014) in this analysis to better reflect the temporal nature of workaround study. This is an especially important aspect for the context of animation production, which is a very time-sensitive industry due to exhibition schedules. Alter's taxonomy suffers from covering similar ground in terms of *effects* and *perspectives*, as these are subjective to potentially differing animation labourer and animation management perspectives in commercial series-making – the focus of the current study. Therefore, this thesis remaps these *effects* and *perspectives* in a framework better suited for commercial production contexts.

These aspects cover three discussion areas: **activity continuation** (including Alter's categories of: *Continuation of Work Despite Obstacles, Mishaps, or Anomalies* and *Workarounds as Necessary Activities in Everyday Life*), **impacts** (consisting of *Workarounds as a Source of Future Improvements*, *Creation of Hazards, Inefficiencies, or Errors*, *Impacts*, *Workarounds as Quick Fixes that Don't Go Away* and *Workarounds as Inefficiencies or Hazards*) and **management expectations** (comprising *Compliance and Resistance*, *Workarounds as a Means for Maintaining Appearances*, *Workarounds as Resistance* and *Workarounds as Distortions or Subterfuge*).

ACTIVITY CONTINUATION

Workarounds allow the *Continuation of Work Despite Obstacles, Mishaps, or Anomalies*. Alter (2014, p.1051) draws our attention to situations with misfits among work practices, hardware and software features and the local environment. These factors often present repeated choices as to performing work efficiently and timely, focusing on the *substance* of what is to be done or whether to perform tasks in compliance with stipulated processes that may appear arbitrary, over-structured and may be counter-productive. Alter (ibid., p.1052) provides a good illustration of how workarounds function in other industries, observing that said participants use workarounds in overcoming obstacles, such as network bandwidth limitations or the limits of *Customer Transaction Systems* in call centre settings. In this example, Alter (ibid.,) highlights that agents *lie* to the system – by inputting inaccurate information to overcome unnecessary structural complications imposed by the system that hinder the achievement of the current task, or when an incorrect or unproductive response is given by the *Customer Relationship Management* (CRM) system. These cases illustrate the broad need for workarounds to overcome operational and structural constraints of systems in other industries. However, Alter fails to account for the rationale of established methods, tools and processes in this part of the framework.

Similarly, Alter (2014, p.1053) observes that workarounds may be viewed as intrinsic to everyday life, social workers may use workarounds when using CRM systems that prevent getting work done. However, in animation, examples of workarounds allowing the continuation of work are provided by animation generalist Mat Dame (2021) and another participant, who both highlight the approval process as a potential production bottleneck. This participant provides a useful illustration of how practitioners work around the limitations imposed by the commercial need to control creative output, by controlling the amount and the type of information provided for approval. In effect, using *shadow* and/or *placeholder* data to overcome potential obstacles caused by operational processes and management constraints. Interviewee and Senior Layout Artist Anye Chen (2022b) illustrates a similar case – that layout artists will use placeholder assets to complete layouts when the required assets are not ready. This is illustrative of the obstacles caused by a control point – an industry-specific means of channelling creative content generation, and the use of practitioner agency in overcoming said obstacles. *Chapter 7* will explore the impact of control points and workarounds in more detail.

It is now understood that placeholder data plays a key role in allowing work to continue despite obstacles. For example, in both contexts – parallel industries and animation production – false or temporary data is entered into the information system to allow the continuation of work. These findings draw our attention to the potential dangers of placeholder data. For example, using said data in a CRM context can potentially breach *General Data Protection Regulations* if inaccurate data is entered into a customer's account in the system. Likewise, using *placeholder assets* in the layout stage may have similar legal and ethical implications, as artists may be credited, or not, for the work that appears on-screen, for instance. Thus, the use of placeholder data allows work to continue with the danger of misrepresenting important system information with the potential to generate ethical and legal problems at a future point in the assembly process. Overall, the data supports the conclusion that practitioners can perceive animation workarounds as a necessary activity to continue production progression despite situational delays and circumstances.

The efficient storage of elements and movements facilitates their use in multiple combinations for the making of animated images. These libraries can be organised so that *pre-prepared* assets can be conveniently found and implemented into the scene at hand. For example, Senior Storyboard Artist and interview participant Kayvon Darabi-Fard (2022) builds personal libraries of storyboard assets, such as backgrounds, for future ease of use on an ad hoc basis. This arrangement of pre-prepared elements ready for use can be termed *animation mise en place*, allowing practitioners to organise their task materials. Mise en place originates from industrial catering. Deena Skolnick Weisberg & McCandliss (2014, p.276) highlight that:

> *Mise en place* refers to the preparations that chefs make before cooking, including physically altering their workspaces so that the necessary ingredients and tools are easily within reach. Although this preparation limits what a chef can make, it also facilitates the process of creating a given dish.
> (Deena Skolnick Weisberg & McCandliss, 2014, p.276).

The creation and organisation of prepared layers and movements within *easy reach* improves the cost-effectiveness of animated image assembly.

This animation mise en place allows practitioners to plan schedules and coordinate activities. Dame (2021) creates his own *procedure lists* and *personal schedules* focused on day-to-day rigging tasks, to maintain his week-to-week schedule, rather than referring to multiple documents and spreadsheets created by the production department, who are concerned with a broader production view. Dame also creates these schedules to keep track of the other members of his team. These meta-instruments prepare and organise pertinent information, such as delivery dates, task procedures and materials, including relevant scenes for the tasks, for instance, ready and nearby when needed for Dame to commence work. These results suggest that time is taken beforehand to plan the animator's workday, considering the time taken for the required tasks and placing materials needed within reach. In this process, *human agency* is used to invest **time** and **labour** in the organisation of personal tasks to reduce future workloads and avoid potential bottlenecks.

This process allows coordination of conception and execution. Daniel Levitin (2015) identifies that:

> Planning and doing require separate parts of the brain. To be both a boss and a worker, one needs to form and maintain multiple, hierarchically organized attentional sets and then bounce back and forth between them. It's the central executive in our brain that notices that the floor is dirty. It forms an *executive* attention set 'mop the floor' and then constructs a worker set for doing the actual mopping. The executive set cares only that the job is done and is done well. It might find the mop, a bucket the mop fits into, the floor cleaning product. Then, the worker set gets down to wetting the mop, starting the job, monitoring the mop head so you know when it's time to put it back in the bucket, moving the head now and then when it gets too dirty....All this shifting, from boss down to worker down to detail worker and back again, is a shifting of the attentional set and it comes with the metabolic costs of multitasking.
> (Levitin, 2015, pp.175-176)

Organising tasks and materials in a *task list* allows Dame to use the *executive set* to plan the required tasks, allowing the *worker set* to focus on quality execution without cognitively draining attention-swapping attempts at multitasking. Therefore, it seems that instruments, such as a *task list*, allow personal and departmental separation and coordination of the *executive* and *worker* sets and their respective concerns in animation assembly.

Similarly, animation workarounds can be perceived as *Creative Acts*. Alter (2014, p.1053) provides useful examples of creativity in the development and execution of workarounds, identifying that workarounds overcoming cumbersome medication systems allow users to live and work with the system without any unrealistic demands. In animation production, practitioners can use software applications in different ways from those originally intended, such as animation director Alex Grigg's (2013) use of Adobe Photoshop like a non-linear editing suite. These results show that practitioners use the software in non-standard ways to produce a creative outcome, altering accepted methods of software use to achieve their aims. In Grigg's example, the practitioner repurposed the program workspace to facilitate the production of moving images, where the program was primarily intended for static images – with some moving image functionality. Here the practitioner has completed some *articulation work*, identifying beneficial program features and organising the workspace to facilitate productive access to these. The program already includes these features, highlighting an interesting distinction and potential contradiction in viewpoints. This workaround is viewed as a *creative act* because the practitioner has only changed their *own* processes and altered the program interface in a manner facilitated by the software developers. If the practitioner were to uncover a beneficial feature in the program code and alter this code, bringing said feature to the foreground, then this change could be perceived as a *best practices* deviation at best, and at worst, a breach of the software license by the software company.

Practitioner role and position influence change perception. This illustration of perspective differences in *best practices* can be observed in the example where interviewee Andy Blazdell (2022) altered the CelAction program code, uncovering a hidden feature and allowing access using a dialog box. The change was viewed as *technical* rather than creative, and most importantly, *sanctioned*, as Blazdell had permission to access and edit the program code. This means that changes to processes and artefacts are seen as creative when they adhere to the guidelines established by the software developer. Having discussed the effects and perspectives of workarounds concerning activity continuation in animation production, the following section explores the impacts of animation workarounds.

IMPACTS

As with the previous section, this chapter part has condensed Alter's effects and perspectives to reflect the temporal nature of commercial series-making better. Furthermore, the current section has grouped hazards as an impact to reflect primary data themes, specifically, the notion that practitioners utilise animation workarounds in the minimisation of potential future errors and reduction in the consumption of animation production resources. The section addresses a failure in Alter's model to address specific industry contexts. Thus the section maps out the effects and perspectives concerning impacts for industrial series-making.

Alter (2014) usefully identifies that workarounds can have *Impacts on Subsequent Activities*, calling attention to the phenomenon that workarounds may affect consequent functions in many ways, irrelevant of whether, or not, the changes have impacted the quality and/or efficiency of work outputs. This effect is related to the *Continuation of Work Despite Obstacles, Mishaps, or Anomalies*. Alter (ibid.,) highlights how workarounds may create inaccurate data which may result in defective products. Likewise, Kmetz (1984) and Jarulaitis Gasparas (2009) provide supporting evidence that workarounds may obscure inefficiencies requiring addressing. In contrast, the subsequent impacts of workarounds in animation production are more *organisational* in nature. Interviewee and Senior Layout Artist Anye Chen (2022c) provides a useful illustration of how production departments take on extra responsibilities to overcome temporary staff shortages, further commenting that:

> These kinds of [organisational, such as departments taking on extra work to compensate for labour shortages,] workarounds should only be temporary, and it should always be the aim to make sure that any workarounds aren't overworking particular departments or causing more problems than they solve.
> (Chen, 2022c)

These comments illustrate perspective and expectation differences between animation management (those who have the authority to design and alter processes at an organisational level) and animation labourers (workers who are assigned tasks and lack decision-making authority in the animation organisation).

Likewise, workarounds can also become *Quick Fixes that Don't Go Away*. Alter (2014, p.1053) usefully highlights that workarounds theoretically act as a temporary measure – a *stop gap* – used to ensure the continuation of work until a more permanent solution can be developed. However, in practice, workaround dependency often develops. Chen (2022c) provides another useful demonstration of how familiarity with successful changes facilitates their potential integration throughout the production:

> Long-term changes that I've observed are continuing to implement the same kind of scripts/shortcuts across productions in a studio, meaning that artists can use these workarounds that they are familiar with.
> (Chen, 2022c)

These results show how practitioners may attempt to integrate solutions which have been locally successful onto a wider basis.

However, such solution development can be problematic when it does not account for the nuances of specific production processes, such as the type of images used in series-making, as Chen elaborates:

> In one studio I worked with, they were very adamant on making shows that worked in vector style or were mostly vector-based to try and make

> the assets more reusable and easier to change. Depending on the style and other requirements of each production, it can be difficult to establish exact processes that work every single time.
> (Chen, 2022c)

Likewise, shortages in production resources can influence ad hoc changes to department and practitioner processes:

> An example of this could be one department taking on additional responsibilities that would typically be under a different role. Whilst a production may ask them to do this temporarily, unfortunately, there are times when the production becomes dependent on them doing these responsibilities instead.
> (Chen, 2022c)

The conditions of commercial production limit the time and budget available for potential solution development. These conditions mean that practitioners seek to implement familiar solutions, those of which they have experience, and as such, can feasibly predict their successful outcome from implementation. This means that familiar solutions are employed more consistently in commercial production.

Workarounds may also be perceived as creating *Inefficiencies or Hazards*. Alter (2014, p.1054) highlights that workarounds may be implemented to reduce errors. For example, delaying the entering of patient information into medical records and storing it on local paper systems when system errors occur. Such delays can cause potentially dangerous consequences as personnel lack access to up-to-date medical information (Boudreau & Robey, 2005, p.17). However, in animation production, practitioners can implement additional processes to reduce potential future errors. A useful example of this is provided by animation director and interviewee David Blanche (2021), who advises practitioners to re-import all the required assets into Adobe Effects and to double-check the composition settings before exporting a project. Pragmatically highlighting the motivation behind such a process: '[t]hen if there's an issue with the footage or delivery, you've checked it and it's the client's fault and not yours. If it's yours, you have to fix it for free' (Blanche, 2021). A pertinent example of the potential of animation workarounds to create errors is provided by Cel Action CEO and interviewee Andy Blazdell (2022), who observes that privileged practitioners and departments can shift work on to less privileged individuals and sectors. This results in wider production delays as the less privileged practitioners have to complete additional work. A final important example of workaround hazards is provided by Chen (2022b), who observes that senior practitioners may attempt to prevent approval bottlenecks by limiting the number of passes, however, highlighting that this can cause additional revisions, as errors and style differences have not been identified. The findings indicate that the potential hazards in animation production are primarily organisational and resource-intensive, in contrast to the dangers associated with medical treatment in the healthcare industry. However, it can be observed that delaying information is a common factor – along with the potential errors this can cause – between these two contexts. Thus, it can conceivably be hypothesised that information control is a key factor in mediating animation labourer and animation management goals and interests in contemporary production.

Alter's model identifies that workarounds can be perceived as *Add-ons, Shadow and Feral Systems*. Alter (2014, p.1053) observes that workarounds to overcome software limitations and functionality may take the form of add-ons or shadow systems. In series assembly, contextual demands such as the lack of a specific department – the visual effects department, for instance – can influence the development of add-ons, shadow systems or feral systems. Research participant Mat Dame (2021) provides a useful illustration of how practitioners can use knowledge of multiple production aspects in combination with specific software expertise in developing shadow systems to overcome demands created by a lack of available personnel:

> On one of the first series I worked on, there was a complex shot where the characters were staring out over a lake at fireworks that were going off and all had to have reflections and ripple effects and lighting on all the characters and background etc. in Layout I had to come up with some complicated work arounds to get the effects to be 'in-scene' rather than via post production. Saving rendering time firstly, but also adding a whole other process in the pipeline that didn't have any comp artists to do it.
> (Dame, 2021)

It can be observed that shadow systems are primarily designed to overcome obstacles, such as a lack of available personnel or equipment. However, their successful development and implementation require time and expertise in the maturation and execution of new processes, separate from established methods. This increases the time, knowledge, expertise and maintenance required to successfully develop and operate a shadow system. The results indicate that these circumstances are generally not considered when practitioners begin to develop the shadow system.

Such phenomena potentially mean interactions between the shadow system and the prime process can cause unforeseen problems, that may be hard to predict if there are unknown elements and processes involved in the shadow system's operation. For example, the use of incompatible file formats, that have the potential to delay the rendering process, hindering successful project delivery. Therefore, the development of shadow systems shares a delicate and paradoxical relationship with established animation production methods. Such systems are designed to facilitate the conditions of commercial production, yet to do so requires the interaction of new processes with potentially unforeseen outcomes, possibly resulting in a scenario where errors may occur when working with shadow systems. These errors can be tempered with appropriate practitioner knowledge.

Workarounds can act as a *Source of Future Improvements*. Alter (2014, p.1053) observes that the integration of workarounds into established and later improved processes moves through four stages: 1) *learning*, 2) *experience*, 3) *diffusion*, and 4) *feedback*. In animation production, transient changes can be a source of future improvements. Interviewee and CEO Andy Blazdell (2022) highlights that efficiency increases as production progresses for a particular season, allowing practitioners to organise their work efficiently. For example, complex tasks are scheduled towards the season's end when practitioners have more proficiency and familiarity with the series production processes. Likewise, Senior Layout Artist and interviewee Anye Chen (2022c) provides a useful illustration of the time allocation required to produce assets throughout animated series production:

> I've found that in the second season of TV productions (or even towards the later half of the first), generally, the production runs a lot smoother because processes are ironed out and problems are solved in the beginning. In the later stages, there are usually a lot of assets that can be reused which saves a lot of time. Many potential problems are recognised early in the project and the solutions are incorporated into subsequent episodes and seasons, likewise, studios can routinise positive changes on a season-to-season basis.
> (Chen, 2022c)

These results demonstrate that early season production time is occupied with new asset generation, allowing production progression towards the season's latter end. The iterative nature of production processes means that planned and unplanned changes can be integrated into the animation work system to improve production efficiency and cost-effectiveness. Changes that meet these conditions are more likely to be integrated into future series-making processes. Until now the discussion has focused on the impacts of animation workarounds, now the section examines the effects and perspectives concerning the compliance and resistance of these potential changes.

COMPLIANCE AND RESISTANCE

This part of the chapter maps out the effects and perspectives concerning the compliance and resistance to workarounds in both animation and parallel industries. It should be acknowledged that this research will not discuss Alter's perspective of workarounds as means of *Lying, Cheating, Stealing for Personal Benefit* as this is a sensitive issue to discuss with practitioners and is not directly related to the focus of the current study. The lack of primary data in Alter's study limits the context and industry-specific nuance that could have strengthened the analysis. The current research addresses this by remapping elements of the *Theory of Workarounds* to directly relate to the context of contemporary series-making. Furthermore, the primary data themes revealed that animation practitioner activity is focused on managing control points and animation management expectations. Therefore, these influences dictated the remapping and discussion in this part of the thesis.

One view of workarounds described in Alter's model is *Compliance or Noncompliance with Management Intentions*. Alter pinpoints that '[w]orkarounds conform with management intentions in many situations, are mildly nonconforming in other situations, and directly undermine management intentions in other situations' (Alter, 2014, p.1052). Stong (1995) provides support for the idea that management approval using workarounds when an organisation's software systems cannot support new current realities, such as, a new set of organisational priorities (ibid.,). In animation production, the approval process can create significant bottlenecks, as artists are unable to complete their work until it has been approved, as by illustrated interviewee and rigger Mat Dame (2021). There are differing ways of approaching this situation in production, with varying degrees of compliance with these control points exerted by capital, such as *personal organisation* and *information control*. Dame (ibid.,) provides a useful example of *personal organisation*, creating a list of actions he can complete without approval that can be quickly changed if need be, thereby, organising his activity to comply with management intentions, a form of *micro-level activity*. *Chapter 5 and Chapter 7* discuss this in more detail. However, Senior Storyboard Artist Rosie Cash (2022) offers an example of *information control*, where artwork *content* and *volume* sent for approval are controlled. These findings suggest the measures to prevent the impact of bottlenecks are widespread in commercial series-making, demanding both organisational and personal approaches. It is also possible to observe *practitioner agency* in contemporary processes, artists take a form of ownership over their tasks and their completion with the potential to complement, or work within the studio's organisational demands. These results suggest that the pervasive impact of production bottlenecks effects personal and organisational processes in their prevention, combined with the *creative agency and ownership* of animation practitioners results in managerial compliance of using animation workarounds in commercial production.

A further view is that of *Workarounds as Resistance*. Alter observes that '[w]orkarounds may entail resistance and intentional noncompliance to authority' Alter (2014, p.1054). Alter (ibid.,) provides a useful illustration, observing that workers may not attend voluntary training sessions, and still use paper forms over *Enterprise Resource Planning* (ERP) systems, with typing being completed at a later date by *power users* as a means of resistance (Boudreau & Robey, 2005). Animation practitioner and historian Tom Sito (2006, p.12) highlights that the industrialised nature of commercial production, with distinctions between conception and execution, has resulted in a paradox where artists see themselves as part of the industrialised system, yet view themselves as individuals. Therefore, the perspective of *Workarounds as Resistance* is related to differences in attitudes between animation management and animation labourers. Animation management may be concerned with the *conception* of the production, such as overhead cost, while animation labourers may focus on the quality of their creative work and the impact of organisational decisions made by animation management on their working processes. Chen (2022c) provides a useful illustration of the interplay between animation labourer and animation management perspectives in commercial production:

> This is a problem that can also occur between the production teams (as in producers, co-ordinators, assistants) and artists. Whilst producers are wonderful in terms of managing and organising schedules etc, in my experience not all of them have had a creative background. Even if they have done so, it is difficult for the production team to know how every single department works and how they do everything in great detail. It is part of the production team's role to ensure that things are running on schedule, so there are occasions where they may suggest ways to speed up processes which do create new problems.
> (Chen, 2022c)

It is possible that such suggestions may not be considered typical *resistance*, but seek mediation between the potentially contrary positions of artists and producers. Animation workarounds therefore only seek to resist animation management intentions when these appear to hinder production progression.

Another perspective is that of *Workarounds as a Means for Maintaining Appearances*. Alter (2014, p.1054) provides a useful illustration, observing that line managers may help salespeople skew data to make themselves look good to senior managers. In animation production, external clients' familiarity with animation production process technicalities can influence their approach to improving creative work. External clients may not fully comprehend the functionality of the artifacts they are reviewing and approving. An interviewee demonstrated overcoming this unfamiliarity by selectively sharing information with external clients. Recalling a particular example where an external client was rejecting particular storyboard panels because the drawn characters did not resemble their original illustrations or model designs. To compensate, the storyboard department avoided sending the client as much information in the early stages of production, thereby controlling the information available for the external client, and smoothing out storyboard generation and their progression and approval throughout the remaining production process. These results show that practitioners utilise *human agency* – decision-making and appropriate *knowledge* of artefact and process functions – in response to organisational constraints, such as the approval process, to prevent potential future delays generated by external client knowledge states. Such processes reveal how practitioners use *synthetic thinking*: considering the potential impacts across the whole assembly process, to anticipate and prevent potential problems. Thus, it can be observed that animation workarounds can be used to overcome or prevent organisational obstacles in contemporary series-making.

Alter's final perspective as that workarounds can act as *Distortions or Subterfuge*. Alter (2014, p.1054) provides a useful illustration, highlighting that rogue traders and fraudsters use workarounds to subvert established processes to acquire information and funds for personal gain. As mentioned before, Alter's approach is limited by a lack of primary industry-specific data used to generate the conclusions. Thus the subjective motivations of this workaround area and their relationship to contextual factors remain unclear. The current study attempts to overcome this shortcoming by considering participant viewpoints and animation-specific contextual factors in workaround analysis.

In animation production, independent filmmakers seeking potential funding may *tailor* information to specific requirements, as filmmaker and animation festival organiser Carla Mackinnon (2021) illustrates:

> [T]he funding application is kind of the original workaround – you see what they are looking for and you tweak your application or idea to fit that, to fall into line with their implicit and explicit priorities. It's the 'by any means possible' approach often with fundraising, I think that is the producers' approach generally.
> (Mackinnon, 2021)

These results show that practitioners may *distort* information when seeking project funding, however, with a lesser degree of dishonesty than the example of the rogue traders and fraudsters. Practitioners seeking funding are reflecting upon their project, drawing out and emphasising those aspects perceived to match the application criteria. Therefore, in animation production, this distortion is closer to a *re-examination* of the potential project, as aspects of it are reconsidered in light of the funding application. There are, of course, other potential instances of information distortion and subterfuge, such as theft and inappropriate personal interactions, that may entail the use of workarounds, but these are beyond this thesis's scope. Thus, in animation production, workarounds are used to navigate the conditions of acquiring project funding.

This section has demonstrated that animation workarounds are an intrinsic part of commercial production processes. It follows, therefore, that practitioners view the creation of both procedures and devices to overcome the inherent constraints in equipment, resources and organisational factors as a necessary part of working in commercial production. Likewise, changes to processes that do not infringe on usage conditions set out by software developers may be viewed as *creative acts*, as only software developers have the authority to make *sanctioned* changes to program code in implementing and uncovering new features. Articulation work is a major part of animation workaround activity. Practitioners perform work that facilitates the production of required tasks. It has been revealed that *shadow systems* have a delicate and paradoxical relationship with established animation production methods: they facilitate the conditions of commercial production by interacting with sanctioned systems in potentially unsanctioned ways to produce approved results. Therefore, animation workarounds are used to maintain appearances with both sanctioned processes and external clients. Likewise, sharing a paradoxical relationship with both, in that, they exist to meet sanctioned goals, but may interact with authorised processes in unsanctioned ways. This section has also demonstrated that parallel information is required to overcome production obstacles, such as approval bottlenecks, with the potential to generate ethical and processual problems further along in the animation process. indexparallel information

Practitioners take ownership of their creative and technical processes within the commercial studio organisation, developing personal and organisational procedures to prevent future mishaps and impacts on subsequent activities. This phenomenon arises from the artist's unique place and perspective within the organisational system. The conditions of commercial production create an organisational system and practitioner agency with the potential to encourage tacitly accepted development and use of workarounds in animation production, potentially distinct from other industries. These findings show the need to address mismatches in the goals and interests of both animation labourers and animation management. Animation workarounds bridge these mismatches, facilitating successful and cost-effective animated series production. These findings suggest that the use of animation workarounds is a tacitly accepted part of working in animation production, motivated by the continual need to ensure cost-efficient production through improving processes and preventing potential future obstacles, another factor that sets animation production apart from other industries. Having examined the effects and perspectives concerning animation workarounds, the next section discusses the *Organisational Challenges and Dilemmas Related to Workarounds* and how they manifest in animation and other industries.

SECTION 4.4

Organisational Challenges and Dilemmas Related to Workarounds

This section of the chapter explores the *Organisational Challenges and Dilemmas Related to Workarounds* as described by Alter (2014), who observes four categories of organisational dilemmas related to workarounds: *Operating Despite Exceptions, Built-in Obstacles, and Incomplete Specifications*; *Balancing Interpretive Flexibility versus Management Control*; *Balancing Personal, Local, and Organisational Interests* and *Permitting and Learning from Emergent Change*.

OPERATING DESPITE EXCEPTIONS, BUILT-IN OBSTACLES, AND INCOMPLETE SPECIFICATIONS

The first sort of dilemma described by Alter is *Operating Despite Exceptions, Built-in Obstacles, and Incomplete Specifications*, distinguishing that '[w]orkarounds make it possible to get work done when conditions get in the way' (Alter, 2014, p.1055), developing this argument by highlighting that:

> [R]egardless of how carefully work is designed or planned, people doing the work need to be able to produce desired results within whatever situations they face, including transient obstacles or anomalies and built-in obstacles within prescribed or established practices.
> (Alter, 2014, p.1055).

Further highlighting that such activities are often part of *articulation work* 'all the coordinating and negotiating necessary to get the work at hand done', as defined by Grinter (2000, p.450).

However, in animation production, practitioners utilise artefacts to continue working despite the impact of potential obstacles, errors and mishaps. Animation storyboard artist Liz Strawbridge (2021) provides a useful demonstration of how storyboard artists use workarounds in overcoming the obstacle of missing or incomplete character designs:

> The use of a character shorthand will be vital for storyboard artists, in breaking down and simplifying the character design into a collection of shapes that would represent the character in a panel. For both the speed needed to quickly draw, discard and redraw the panels as needed, as well as to quickly communicate the character to whoever is using the storyboard panel later in the pipeline.
> (Strawbridge, 2021)

This view of the storyboard as a functional artefact in the production process is supported by animation scholar Paul Ward (in: Honess Roe, 2020, p.155), who highlights that the storyboard is used to plan parts of the production process and is indicative of the future labour of others. Thus storyboards function to plan future work and adapt to changing contextual conditions. *Chapter 8* discusses animation workarounds in the storyboarding process in more detail.

Throughout the animation production pipeline, workarounds often serve as integral and functional components of the overall process. Chen (2022d) provides a useful example of this, highlighting that changing certain aspects of a character model, such as colour and scale, is a regular part of the layout process. It is now clear that artefact changes play a functional role in production processes, being viewed as such by practitioners. This view extends to the use of animation workarounds, which are routine changes that allow work to continue despite the impact of potential obstacles.

This acceptance of process changes may be motivated by the conditions of commercial production, as practitioners need to make continual assessments and changes to ensure cost-efficient production with constantly differing combinations of materials, equipment, personnel and, in this case, artwork. It can therefore be observed that animation workarounds allow practitioners to maintain flexibility in production processes and materials while conserving the required cost-efficiency.

These findings support the argument that animation workarounds are an intrinsic part of commercial production processes. However, it should be acknowledged that appropriate knowledge – of both the production process and the purpose of any changes – is required to ensure artefact functionality and prevent potential errors and delays from inaccurate information being acted upon in the production process. These findings suggest that animation workarounds focus on allowing the continuation of production work, a view shared by practitioners, motivated by the need to make continual efficiency and work assessments during the fabrication process.

BALANCING INTERPRETIVE FLEXIBILITY VERSUS MANAGEMENT CONTROL

The second challenge described by Alter is *Balancing Interpretive Flexibility versus Management Control*, building upon Cherns' (1987) definition of the *minimal critical specification* that 'no more should be specified than what is absolutely essential' (Alter, 2014, p.1055). Further highlighting that 'applying that principle allows work system participants to use common sense and ingenuity in achieving legitimate objectives while also recognizing and honoring necessary controls' (Alter, 2014, p.1055). Additionally, pinpointing that many of the types of workarounds and perspectives demonstrate tensions between inefficient and unsafe variability and counter-productive controls. Contending that these tensions exist when obstacles are first revealed and continue over time as workarounds are extended into organisational routines, contributing to the progression of better practices and products (ibid.). One interview participant has illustrated how practitioners may carefully control the *amount* and *content* of information to prevent potential bottlenecks from the approval process, while Dame (2021) has provided a useful example of how practitioners make easily reversible changes to complete tasks without external clients' approval.

These are both examples of *minimum critical specifications* in animation production. The examples illustrate that only the minimum required information might be sent for approval and that the minimum possible changes are made to artefacts, such as character rigs, in practitioner workload progression. These findings might be explained by practitioners omitting information elements with the potential to generate additional approval alterations to prevent delays and workload additions. These findings demonstrate that practitioners use the *minimum critical specification* to interpret critical information required for management control via the approval process.

As such, interpretive flexibility concerning capital and managerial control is a key factor in organising practitioner tasks in animation production. These examples suggest that flexibility in completing tasks is a priority for animation practitioners at both a personal and organisational level. However, it may be the case that additional information beyond the *minimum critical specification* is required to progress production. This additional information may alter the practitioner's ability to organise tasks in light of managerial control, as more information is required for approval, limiting working process flexibility. This combination of findings provides support for the conceptual premise that practitioners control information and processes to avoid production delays, taking an active role in the organisation of information in animation production.

BALANCING PERSONAL, LOCAL, AND ORGANISATIONAL INTERESTS

Leading on from interpretive flexibility and managerial control, the third organisational dilemma considers *Balancing Personal, Local, and Organisational Interests* of workarounds. Alter emphasises that some workarounds may be motivated by personal interests, organisational goals and other broader organisational interests. Highlighting that '[b]alancing these interests calls for a combination of incentives, knowledge, and monitoring systems that encourage mutual alignment' (Alter, 2014, p.1055). In the organisation and production of animation, two types of activity can be identified: *macro-level activity* – which focuses on the conception of animation activity on a broader level across multiple departments, and *micro-level* *activity* – individual practitioner's organisation of their tasks on a local level. Both *macro-level activity* and *micro-level activity* have the same broader goals: workload reduction and efficient completion of animation tasks. The interplay between these two forms of activity will be explored in more detail in the next chapter.

As discussed, practitioner agency motivates the organisation and completion of animation tasks. The organisation of, and artistic involvement in, making animated content generates a phenomenon where artists possess a sense of individualism and ownership of the task (Sito, 2006, p.12), creating a manufacturing environment where labourers, who are traditionally grouped into the *execution* divide of the detailed division of labour (Jelinek, 1980, pp.66-67) take an active role in *conceptualising* production activity. This is accomplished through the ad hoc re-assessment of tasks and priorities that manifest themselves in *macro-level activity* conducted by animation labourers throughout the production process.

In animation production, it appears that the motivating factors behind *macro-level activity* and *micro-level activity* are broadly aligned – the completion of content with minimum work and time expenditure – but the application and execution of management and practitioner intentions may often not be so congruent. Dame (2021) provides a useful illustration of how these differences may result from different technical knowledge states:

> A Huge obstacle in the pipeline of all the 2D shows I've worked on so far has been to do with the end client. These clients don't necessarily understand the process or why certain considerations have to be made, taking the limitations of the software into account.
> (Dame, 2021)

The comments suggest that working knowledge of the animation process influences external client expectations, generating potential conflict regarding the content and timing of deliverables between external clients and practitioners. In general, therefore, it seems that conflicts balancing local (animation labourer) and broader (animation management) interests result from interactions and gaps between differing knowledge states.

PERMITTING AND LEARNING FROM EMERGENT CHANGE

Finally, Alter describes that workarounds *Permit Learning from Emergent Change*. Pinpointing that aside from one-time fixes to non-recurrent problems, 'many workarounds provide learning that may be an important starting point for emergent change and planned change' (Alter, 2014, p.1055). Developing the model by highlighting that in some examples:

> [T]he learning is that specific workarounds or types of workarounds should not be permitted because they cause subsequent problems. In either case, the learning will be more likely if people have enough knowledge to analyze situations, design possible workarounds, and decide whether and how to implement those workarounds.
> (Alter, 2014, p.1055)

On the other hand, in animation, some studios and practitioners use workarounds as a source for future improvements. Senior Layout Artist and interview participant Anye Chen (2022c) provides a useful demonstration of how some larger studios have formal procedures for change integration into future processes:

> In one of my previous jobs, once we finished the season each department would do a 'post- mortem' (not a name I made up!), but this was basically a questionnaire where we could point out things that went right or wrong throughout the production. This information could then be used going forward into future productions to try and make long-term improvements to each department's processes.
> (Chen, 2022c)

These conditions may be less likely to occur in smaller studios, which may operate mainly on short-term freelance work, such as those in the United Kingdom service sector, as described by John Southall (1997), as these organisations may have less available time, budget, resources and personnel to organise such formal improvement processes.

In contrast, practitioners can integrate changes to their working processes. Chen (2022c) has described how practitioners continue to implement familiar changes – such as integrating vector assets – into studio working processes. These comments show that workarounds allow practitioners to learn from and incorporate emergent change. However, it might be the case that this potential integration is limited by practitioner familiarity, and may limit the scope of any integrated changes. The findings are nonetheless significant, as they show that animation workarounds can be routinely integrated into regular animation processes at both an organisational and personal level. This pervasive acceptance of change integration may be motivated by the conditions of commercial production, as practitioners and studios need to find ways to maintain cost-efficient production continually. The potential for learning from emergent change is facilitated by animation workarounds, allowing practitioners to use familiar process alterations to improve cost-effectiveness in series-making.

This section has reviewed the key organisational challenges of workarounds. Highlighting that in animation production, artefacts and animation workarounds play a functional role in the production process, organising future tasks and labour. Thus allowing work to continue despite the potential impacts of organisational constraints and control points. The section examined how the dynamic between interpretive flexibility and management control is shaped by practitioners' sense of creative ownership and agency in commercial series production. Organisational and personal changes can also be incorporated into future processes, however, possession of relevant working knowledge constrains potential animation workaround integration into future production processes.

These factors imply that both animation labourer and animation management broadly seek to reduce the required production work and cost in project completion. This is driven by profit, if the work is not delivered, the team or the studio risks not receiving payment. This means that in commercial production, pragmatic concerns potentially broadly align the interests and goals of animation labourers and animation management, while these parties' differing knowledge states potentially cause misalignment of their goals and intentions. The conditions of commercial production influence animation management and animation labourer attitudes to animation workarounds, potentially making these accepted ways of dealing with organisational and resource constraints in commercial production. The next section explores and examines the *Phenomena Associated with Workarounds* in animated series-making.

SECTION 4.5

Phenomena Associated with Workarounds

This section of the chapter discusses the *Phenomena Associated with Workarounds*, as outlined by Alter (2014), which consists of eleven groupings: *Obstacles Exceptions, Anomalies, Mishaps, and Structural Constraints*; *Agency*; *Improvisation and Bricolage*; *Routines, Processes and Methods*; *Articulation Work and Loose Coupling*; *Technology Misfits*; *Design Versus Emergence*; *Technology Usage and Adaptation*; *Motives and Control Systems*; *Knowledge* and *Temporality*.

OBSTACLES EXCEPTIONS, ANOMALIES, MISHAPS, AND STRUCTURAL CONSTRAINTS

The first type of phenomenon identified by Alter is *Obstacles, Exceptions, Anomalies, Mishaps, and Structural Constraints*. Alter (2014) defines workarounds

> ...in terms of overcoming conditions such as obstacles, exceptions, anomalies, mishaps, and structural constraints, all of which may be inherent in designed or emergent processes or management intentions, may appear from the external environment, and may occur due to a variety of unanticipated circumstances.
> (Alter, 2014, p.1048)

In animation production, practitioners use alternate processes in overcoming lacking software functionality. For example, Mat Dame (2021) draws on the preview layer in CelAction to prevent the potential loss of vital completed work, due to CelAction's absence of an autosave function. Practitioners also use available software and equipment to overcome organisational obstacles, such as a missing department. As shown by Dame's (2021) designing of a sequence with most of the visual effects created and executed within the composition and animation program (Adobe After Effects, for instance) itself, rather than in postproduction. Thus saving rendering time. Likewise, Dame (ibid.,) provides a useful illustration of the organisational obstacles in production, observing that the end client is a potential obstacle in 2D cut-out animation production. This can be because the client needs help understanding the animation production process and the considerations that must be made for specific hardware and software limitations. Likewise, senior storyboard artist Kayvon Darabi-Fard (2022) highlights that clients dictate production budgets. These results show that there are three types of obstacles in commercial animation production: *equipment-based obstacles*, *resource limitation-based challenges*, and *organisational obstacles*. Therefore, animation workarounds are primarily focused on overcoming these three obstacles.

Equipment-based obstacles include hardware and software – and other materials – functionality and availability required to make animated imagery. Resource limitations may consist of constraints in available personnel, production budget and equipment. There is an overlap between equipment-based constraints and resource limitations, as resources, such as the production budget, dictate the availability and type of equipment used on a project. Organisational-based obstacles can be further divided into organisational training routines, practices, project management expectations and managing the distinct knowledge states of different individuals. Likewise, in commercial animation, the client, such as an external broadcaster, provides the required capital for the project's existence, directly influencing organisational and budgetary constraints. Therefore, animation workarounds exist in a paradoxical relationship with *Obstacles Exceptions, Anomalies, Mishaps, and Structural Constraints*. These constraints are an intrinsic part of the commercial project's existence, practitioners use animation workarounds to simultaneously overcome these constraints and meet the conditions placed upon the project by these constraints.

AGENCY

The second phenomenon is *Agency*. Alter distinguishes that '[w]orkarounds are fundamentally about human agency, the ability of people to make choices related to acting in the world...[reflecting]...human agency within the context of the situations in which workarounds occur' (Alter, 2014, p.1048). For example, the conditions in which participants decide to respond to obstacles, mishaps, expectations and other factors.

In animation, practitioners may use programs in non-standard ways to compensate for lacking personnel or software familiarity, and organise their tasks to prevent approval bottlenecks. Dame (2021) provides a useful illustration, using a preview of a video layer in CelAction to trace over a previous drawing, saving completed work and thought processes when recovering from a program crash. In this instance, the practitioner has used screenshots to overcome the lack of software autosave functionality (which can be interpreted as generating potential mishaps). Likewise, Dame (ibid.,) illustrates another phenomenon impacting animation working practices. To overcome a non-present visual effects department on a project, Dame created an entire animation project solely in Adobe After Effects, the software program he was most familiar with at the time of production. Animation filmmaker Alex Grigg (2013) provides another useful example of the phenomenon of agency impacting working processes, by manipulating the Adobe Photoshop timeline to behave like, and so that it can be controlled similarly to, a non-linear-editing suite, such as Adobe Premier. This is accomplished using three main methods: 1) *layer animation* – setting the system pre-sets to move the playhead forward/back one frame when the right/left arrow keys are pressed respectively; 2) *video-layers* – allowing faster processing for some animations, in addition to layers for clean-up and colour; and 3) *video groups* – for video layer organisation. Moreover, Mat Dame (op cit.,) has developed a method of importing Photoshop artwork into ToonBoom and using specific artwork elements to avoid completely redrawing the asset when transferring an asset between these programs. These are all instances of bricolage. Practitioners have used available materials and equipment to overcome IT functionality and platform-specific hardware and software features, limited animation production resources – production **time**, **budget**, schedule constraints and established practices and training. Therefore, we can observe that animation workarounds are instances of *human agency* in the production process.

IMPROVISATION AND BRICOLAGE

Alter's next phenomenon is *Improvisation and Bricolage*. Alter establishes that '[w]orkarounds are often viewed as instances of bricolage and/or improvisation' (Alter, 2014, p.1049). *Bricolage* involves 'making use of what is to hand' (Levi-Strauss, 1967 in: Alter, 2014, p.1049). Interviewee and Senior Layout Artist Anye Chen (2022b) provides a useful illustration of how practitioners improvise solutions to production problems from available materials, observing that layout artists may use placeholder assets in place of incomplete assets. Likewise, a similar illustration of practitioner ingenuity is provided by Dame (2021), who will often repurpose parts of an existing model for additional shots, such as skewing a hand to become a foot, rather than creating a new asset. Research participant and CelAction CEO Andy Blazdell (2022) provides a potent observation of the changing role of layout artists, observing that the role has shifted from a technical draughtsperson to an asset manipulator. *Chapter 9* discusses the role of layout and the interaction with digital assets in more detail. As discussed earlier in the section, commercial production's organisational, equipment and resource constraints create a dynamic relationship between practitioners, established methods and organisational requirements. Practitioners simultaneously attempt to work within and overcome organisational, equipment and resource constraints. It is therefore possible to hypothesise that practitioners use available materials at any given moment to accomplish both aims. Therefore, instances of improvisation and bricolage are a vital part in the aims, development and execution of successful animation workarounds.

ROUTINES, PROCESSES AND METHODS

The fourth phenomenon of workarounds is that of *Routines, Processes and Methods*. Alter distinguishes that '[w]orkarounds often are viewed as exception handling and/or sanctioned or unsanctioned deviations from routines, processes, and methods' (Alter, 2014, p.1049). For example, management may expect participants to overcome limitations caused by outdated software, or undesirable deviations from *best practices* touted by software developers. Alter (ibid.,) provides a very useful illustration in the relationship between workarounds and ongoing process improvement, identifying that:

> [W]orkarounds have similar relationships with prescribed methods, which may be interpreted either as requirements (you must do the work this way) or as guidelines (in general this is how the work should be done).
> (Alter, 2014, p.1049).

As discussed, the structure of the commercial animation organisation – the studio – is a fundamental part of commercial content. This means that the organisational structure impacts practitioner working processes and individual responsibilities. Animation director David Blanche provides a useful illustration, observing that in smaller production situations '[r]esources are always scarce as there's always a limited budget or [are] short on time...Everyone ends up with a compromise at the end of the day' (Blanche, 2021). Therefore, both resource constraints and organisational conditions directly influence the routines, processes and methods of practitioners working in commercial production.

As observed, there is a dynamic interplay in how practitioners achieve the aims of these influences, by both seeking to meet these and subverting them, when it is perceived to be needed to do so simultaneously. The examples presented here are from instances of small-scale commercial animation production in the United Kingdom, providing a valid insight into the working models of fabrication that are the subject of this research. However, it should be acknowledged that the influencing conditions of organisational, resource and equipment constraints may play different roles in creative or experimental animation, where using different narrative, aesthetic and equipment approaches may be the project's focus. These wider contextual factors do not directly affect the thesis's argument – that animation workarounds are both a fundamental part of, and a result of, the nature and conditions of commercial animation production – but may influence practitioners' attitudes towards the aesthetic, narrative and equipment choices utilised in commercial production. For example, practitioners from a more experimental animation background may consider the aesthetic and narrative choices in commercial animated series to be considered *cheap* and/or *conventional*. Therefore, routines, processes and methods are directly linked to the design and organisation of commercial animation production.

ARTICULATION WORK AND LOOSE COUPLING

The fifth phenomenon in the *Theory of Workarounds* is *Articulation Work and Loose Coupling*. Alter identifies that '[w]orkarounds of obstacles, exceptions, and cumbersome processes often occur when performing articulation work' (Alter, 2014, p.1049), that is: *work that enables other work* (Sawyer & Tapia, 2006). Alter (op cit.,) extends this understanding by highlighting that workarounds address the grey spaces and coordination not described by formal processes, and that are often invisible to formal management systems. Further highlighting that workarounds are essential in 'enacting loose coupling between systems' (Alter, 2014, p.1049). In animation, software developers may allow clients to access hidden program features to overcome specific production issues. Blazdell (2022) provides a useful illustration, observing that the production team behind *Sarah and Duck* wanted to build the zip of Sarah's jacket into the character model, a feature already in the CelAction program code but unable to be accessed by the team. Blazdell created a dialog box allowing feature access, observing that there were brute force aspects to the procedure, as the dialog box's nature constrained added feature development.

Moreover, it is possible that loose coupling can provide functionality for reuse systems, as interviewee Tony Tarantini (2021), a veteran of Canadian series producer Nelvana, provides a useful illustration:

> I have been on projects where there were reuse libraries at the disposal of artists starting with the storyboard artist, layout artist, animator and background painter. If the they all draw from the same library it would offer continuity and a reverse engineering process that would save a lot of money and time...e.g. a storyboard artist would choose an establishing shot that has been used before in another episode, it was finished and filmed. By using it would allow the layout artist to call for a reuse of that background[,] therefore the background artist would not have to paint it...maybe there is new animation...maybe not and the shot can be reused fully completed.
> (Tarantini, 2021)

Such loose coupling provides aesthetic continuity across the production. Like instances of improvisation and bricolage, articulation work and loose coupling in animation production are directly influenced by the resource, equipment and organisational constraints of commercial assembly. The dynamic relationship between these factors creates tension between practitioners and these limitations. Practitioners must sometimes subvert these constraints to achieve the goals of said constraints. Instances of articulation work and loose coupling are an extension of this phenomenon. Practitioners use available features, processes and equipment to overcome problems generated by resource, equipment and organisational limitations, as well as those separate from these influences.

The temporal aspect of commercial production directly affects this decision-making process. For example, when allowing access to a previously hidden CelAction program feature for the *Sarah and Duck* production team, Blazdell (2022) lacked the time to develop an additional feature before the production delivery date. So the solution was articulated by coupling existing program parts hidden from the user into a feature the user could access. Likewise, time is key in developing the studio-wide reuse systems explained by Tarantini (2021). As we can see from the comments, time is invested in earlier production processes to identify, plan and produce assets, such as backgrounds required in multiple shots. Thus demonstrating that additional time is invested in asset generation during earlier production schedules to reduce the time needed to create multiple shots later in the production and post-production stages.

These two examples provide valid insight into the role of articulation work in commercial production by providing illustrations in both smaller-scale and larger instances of animated series production. However, these are both examples of coupling work instigated and sanctioned by animation management, consequently, it should also be acknowledged that individual practitioners can also execute articulation work on an ad hoc basis. For example, both Senior Storyboard Artists Rosie Cash (2022) and Kayvon Darabi-Fard (2022) both create ad hoc reuse systems by taking aspects of storyboard panels, digitally replicating and building these into personal storyboard libraries, to reduce the potential work required later in their working processes. Therefore, both the considered articulation work and ad hoc coupling of materials and processes are a fundamental part of commercial animation production processes, both motivated by and tacitly implemented to meet commercial production conditions.

Likewise, character rigs can act as boundary objects. Etienne Wenger highlights that *boundary objects* bridge different knowledge states – acting as 'artefacts, documents, terms, concepts, and other forms of reification around which communities of practice can organize their interconnections' (Wenger, 2008, p.105). Animation artefacts, such as character rigs, similarly bridge differing artists' priorities and knowledge states. Dame (2021) highlights that designers may prioritise making appealing character designs that match the aesthetic of a series over creating models that are easy to rig and work with. In this instance, the rigger and the rig itself act as *boundary objects* between the differing priorities and focuses of the production department – which is concerned with schedules, approval, and control of project costs – and character designers – who may be primarily concerned with asset aesthetics. Therefore, animation artefacts reify connections between disparate conceptual and pragmatic areas in animation assembly. These enriching examples solidify available time as a key influencing factor in articulating existing material into new solutions in commercial production.

TECHNOLOGY MISFITS

Alter describes the sixth phenomenon as *Technology Misfits*, highlighting that '[m]any workarounds occur because the technology that is used does not fit realities and contingencies of day-to-day work' (Alter, 2014, p.1049). For example, *ERP* (Enterprise Resource Planning) suites may be based on unrealistic management expectations. As such, users may frequently observe a need for workarounds to achieve efficiency, output and customer needs and goals. In animation, practitioners may need to alter working practices when working with proprietary and open-source programs. Blazdell (2022) provides a potent illustration of working with open-source software, highlighting that open-source programs may not be precise in conforming to proprietary file standards, recommending practitioners re-export assets from the prime program to ensure full file compatibility. *Section 5.1* discusses the relationship between open-source software functionality and animation working processes in more detail. It can be observed that software program use influences practitioner processes, as Mat Dame (2021) exemplifies:

> CelAction has quite a primitive set of Effects that you can apply directly in the program. There's a decent amount of them, but they're far from easy to use in comparison to their equivalents in After Effects.
> (Dame, 2021).

Likewise, practitioner familiarity with specific software directly influences their choices of equipment and processes, as Mat Dame (ibid.,) exemplifies:

> I edited a number of development projects from storyboards through to the final version solely in After Effects which is a very weird workflow

> although it did allow me to do all my effects and compositing work all in one project file. This was purely because it's all I knew and didn't know how to use [Adobe] Premier at all.
> (Dame, 2021)

These findings suggest that technology misfits in animation production centre on program functionality, familiarity and ease of use.

Practitioners choose programs and processes they assume will provide them with the desired results. Moreover, they need confidence in using said technology to achieve these results in a feasible time. These temporal constraints are likely to be both personal – a practitioner may have a personal preference as to how long they wish to spend on a specific task or project – and organisational – commercially successful projects need to meet the conditions of commercial production, as identified by Langer (1991, p.5). Such commercial discussions also bring another factor to light: that software choices made by organisations are likely to be dictated, or at least influenced by commercial factors. For example, the price break in securing software for multiple practitioners may channel organisations to choose one specific software program over another. Likewise, such behaviour may generate a second generation of *herd mentality* as organisations and individuals may wish to conform to peer consensus and the practicalities of these working methods. For instance, practitioners may wish to use a particular software program to collaborate with other team members. The pervasive nature of technologies and subsequent solutions creates a phenomenon where practitioners must make continual decisions to mitigate negative consequences from the interactions of potentially misaligned technologies, ensuring that potential production process errors are minimised.

DESIGN VERSUS EMERGENCE

The seventh phenomenon in the model is *Design Versus Emergence*. Alter makes the distinction that '[r]outines or processes bypassed by workarounds may have been designed formally or may have emerged over time through adaptations and improvements, including past workarounds' (Alter, 2014, p.1049). The initial designs of routines, processes and workarounds should allow a suitable amount of secondary design, as participants engage in a process of 'interaction, modification, and embodiment of the system in use' (Mat Germonprez et al., 2011, p.1). Alter (op cit.,) extends the distinction by identifying that workarounds are part of this improvement process. However, in animation production, changes to established working methods can be both formerly designed and arise through intermittent change. Teevan (2011, pp.89-91) provides useful illustrations of designed changes comprising of three primary categories: *generic character rigs*, *geometry-optimised assets* and *parallel workflows*. *Generic character rigs* involve creating multiple character rigs from one primary character rig, replicating and adjusting the rig to create additional character models. *Geometry-optimised assets* look different from different angles, allowing the same asset to be used in different scenes and for different purposes, saving production time compared to creating sufficient assets that look different and rendering these in animation. While *parallel workflows* involve creating a *first run* of scenes to be animated from the assets, such as character and environment models. These are available first while the additional material is being created in parallel (concurrently) in the production schedule. When these additional assets are completed, all the scenes that require these newly created assets are animated. New production processes such as *parallel workflows* and *geometry-optimised assets* that designed to be used in multiple scenes are instances of fashioned changes. These are examples of designed alterations to established methods that occur over a prolonged period.

Changes can emerge from project practicalities and constraints. Strawbridge (2021) provides a useful example of an urgent change in animation production, observing that storyboard artists may break down complex characters into simple shapes to reduce rendering time and allow increased functionality in light of changing character designs through the production process. Likewise, Chen (2022b) highlights that props can be designed after the layout stage to account for new factors that only become apparent after a scene has been constructed. For example, subtle differences in camera angles mean that the angle of a design prop no longer matches the background element of the scene. These findings demonstrate that animation workarounds may be formally designed, or may come about through adaptations and improvements, inclusive of past workarounds.

Moreover, transient changes can be a source of future improvements. Both Blazdell (2022) and Chen (2022c) highlight that many animation production problems are recognised early in the project, and solutions are incorporated into subsequent episodes and series. Chen (2022c) foregrounds that projects are unique and their specific processes can always be improved. Furthermore, observing that production efficiency increases towards the first season's end and the start of the second season, as reusable assets have been created, saving production **time**. Such improvements suggest practitioners acquire experience from identifying and problem-solving potential obstacles as they become apparent. This ad hoc identification results from a specific production instance representing the first time when the assets, schedules and pipelines designed by different practitioners are combined in a working fashion, such as the layout process. This will be discussed in more detail in *Chapter 9*. Therefore, these findings reveal that certain animation production problems and their potential solutions only become visible in the application and execution of animation tasks.

TECHNOLOGY USAGE AND ADAPTATION

Technology Usage and Adaptation is the eighth phenomenon described in the framework. Alter (2014, p.1049) acknowledges that the technology impacts of workarounds are understated in the literature, however, acknowledging that workarounds may overcome technical inabilities to fit the realities and contingencies of day-to-day work. In animation production, practitioners may have to alter their use of technology based on client requirements and available equipment. Interviewee and animation director David Blanche (2021) provides a useful example of how client expectations can influence practitioner processes:

> This mainly happens in relation to exporting for clients with certain specifications (or at least it used to before Apple allowed Adobe to provide pro res to Windows versions of After Effects in 2018). I work on a PC, but have an old Mac from 2011 which can still work with some gentle persuasion and patience but isn't exactly optimal. Some clients have a fascination with Apple products so it's always useful to have the option if required. Some don't like receiving an image sequence, especially editors which is understandable, so pro res with an alpha is often required. I'd often have to switch system towards the end in order to export.
> (Blanche, 2021)

Likewise, Alex Grigg (2013) uses the Adobe Photoshop interface and functionality in a non-standard way to produce short 2D animated films. As discussed, the potential organisational constraints, resource and equipment limitations create conditions where practitioners use and adapt available materials into new solutions to deal with production problems.

The nature of commercial production influences such behaviour. The data demonstrates that practitioners use available resources to achieve both the personal and organisational aims within the boundaries and conditions imposed by both the organisation and the nature of commercial production. The current results show that practitioners adapt available technology and equipment to meet the contextual needs of each specific project. These findings suggest that client expectations have a direct impact on technology choices and processes. Technology use and adaptation are influenced by the nature of commercial production, and practitioners' desire to achieve organisational and personal goals with the organisational, equipment and resource constraints imposed by the conditions of commercial production.

MOTIVES AND CONTROL SYSTEMS

The ninth phenomenon described by Alter is *Motives and Control Systems*. Alter distinguishes that '[r]eward systems that align enterprise and personal interests decrease the likelihood that inappropriate workarounds will be considered' (Alter, 2014, p.1049). Piers Anthony (1988), Beer (1981) and Kaplan & Norton (1992) support the idea that control system quality affects the 'likelihood that inappropriate or personally opportunistic workarounds' (Alter, 2014, p.1049) may be noticed. However, in animation, external clients can delay the production process, as observed by multiple participants. In response, storyboard artists may distort information sent to external clients, maintaining production progression, such behaviour appears to be accepted by management if it facilitates meeting the conditions of commercial production.

Likewise, practitioners may continue working without approval and develop procedures that allow them to make quick alterations if needed without approval (Dame, 2021). A seemingly inappropriate path made with the proviso they can easily reverse any changes if needed. The impact of control points on creative work development will be discussed in *Section 6.2*. As with the relationship between animation workarounds and routines, expectations and processes, there is a dynamic interplay between the goal of control systems, such as the approval process, and how participants seek to meet these goals. In these examples, practitioners decide that the most appropriate way to achieve organisational aims is subverting the control systems in place. The control point is perceived as preventing the completion of personal and organisational goals – the project completion in a timely and cost-effective manner. These findings show that motives and control systems also share a dynamic relationship in commercial animation production. The motives – both the intention of the artists to complete the project in a way which moderates their workload and the desire of animation management to channel the generation of artistic material – are aligned with the conditions of commercial production, both parties wish to control the amount of unnecessary time and labour required in project completion.

However, the tension between these motives becomes conflict-ridden when specific systems to enforce these motives, such as the control of creative work through the approval process, are implemented. This is because the approval process primarily focuses on animation management intentions, whereas potential bottleneck impacts and animation labourer workloads may be less considered. To work around such differences, practitioners *distort* aspects of the very information channelled by the control system. Practitioners make these changes to better control their workloads, mitigating the impacts of potentially one-sided control systems. The commercial nature of studio production means that these instances are inbuilt into the organisational system, appearing to be a tacitly accepted part of working within these by practitioners. However, this research has not sought to excavate any examples of potentially inappropriate workarounds as these are beyond the scope of this study. Nonetheless, it is worth acknowledging that other motives, such as personal gain, or criminal activities may factor in the motives and control systems of individuals in animation production, as they would in any commercial organisation. The presence of such motives does not directly influence the findings of this research. Still, it may be of interest to future studies investigating the motives and working processes of individuals in similar situations. Therefore, the tension between motives and how they are executed can be observed in animation production.

KNOWLEDGE

Knowledge is the tenth phenomenon associated with workarounds. Alter (2014, p.1049) identifies that individuals, groups and organisations possessing the appropriate knowledge required to design and execute workarounds increase the likelihood of appropriate workaround development. In the same vein, workarounds are more likely to generate problems if they are created by participants who lack vital knowledge. For example, workarounds designed by engineering analysts who knew from experience how available programs provided erroneous answers unless they utilised a workaround for inputting temperature coefficients for pipes carrying hot fluids as though intended to operate as if cold (ibid.,). On the other hand, in animation, knowledge is required for pipeline and process alterations to avoid additional work and errors when overcoming staffing shortages. Successful solution development is subject to requisite practitioner knowledge. Senior Layout Artist Anye Chen (2022c) acknowledges that the divergence of styles and requirements of each production can make initiating processes that will work in every situation difficult. For example, recalling how one studio was insistent on using vector-based assets to ensure high reuse and modification. Practitioners use their previous experience of encountered problems to anticipate possible future production problems that only become visible in process execution. Chen recognises that practitioners continue to implement similar 'scripts/shortcuts across productions in a studio, meaning that artists can use these workarounds that they are familiar with' (Chen, 2022c). This suggests practitioners favour applying familiar changes of which they can predict the outcome(s). However, it is only sometimes possible to apply the same shortcuts to multiple productions. The ability to apply similar shortcuts and animation workarounds to multiple productions depends on the unique combination of personnel, visual style, animation media and the individual processes of each studio and production.

TEMPORALITY

The final phenomenon described in the *Theory of Workarounds* is *Temporality*. Alter distinguishes that the 'importance and nature of time are relevant to any broad study of workarounds' (Alter, 2014, p.1050). Further highlighting that some workarounds may be designed and executed very quickly, or arise from extended deliberation, or may only last until an obstacle subsides or a more complex fix is available, while others may become institutionalised within organisational routines for many years (ibid.,). In animation, changes may be made on an ad hoc basis, such as using placeholder assets, overcoming a short-term problem, such as sending distorted *shadow information* for approval, or may be folded into established methods, such as integrating changes through post-season discussions. Studios can also integrate changes on a season-to-season basis. Chen (2022c) reports that *post-mortems* are conducted at the end of a season, with success and error identification through questionnaires. Such data is used to develop changes for department processes in subsequent seasons. Past activities are analysed, and successful changes are integrated into future seasons. *The Animation Work System Lifecycle Model* in *Chapter 10: Discussions, Conclusions and Contributions* shows the adoption of successful animation workarounds into production processes.

Likewise, production teams can become dependent on temporary changes. Chen (2022c) identifies that animation management may temporarily ask individuals and sectors to assume duties of other persons/divisions to account for temporary staff shortages. However, observing that a production can become reliant on these changes over a long period. Consequently, Chen (ibid.,) recommends that such alterations should only be a stopgap measure. This prevents changes from overworking any departments or causing additional problems. These changes to the individual/department duties may go unnoticed by animation management. Chen's comments suggest schedules may be already tight, and the *transient* solution has *temporarily* mitigated the lack of available production staff. This can generate *broader consequences*: the misled animation management expectation that individuals/departments can permanently take on this extra work, and so the transient change becomes folded into future processes. Therefore, small changes to roles and responsibilities can become integrated and even expected from animation management if they appear to facilitate the conditions of commercial production.

The results show that articulation work is a vital part of practitioner activity within the production process. This work mediates mismatches in intentions, goals and interests between animation labourers and animation management, but also mediates mismatches in the organisational, budgetary, equipment and personnel limitations inherent in commercial production. The findings suggest that these constraints arise from the need to control production costs. Therefore, instances of bricolage and workaround temporalities allow practitioner and management flexibility in processes and for animation management to control important aspects of production. This flexible approach to task completion manifests itself at both a local and broader organisational level. In these cases, the intentions, goals and interests of animation management and animation labourers are broadly aligned, and flexibility is used to mediate mismatches between these.

Likewise, this section has demonstrated that both animation management and animation labourers can use formal processes to integrate emergent changes into new future established processes. On the other hand, the findings suggest that external clients, often providers of capital, may not understand the rationale behind these intentions, goals and interests and the flexible approaches to mediating mishaps. Thus, the demands imposed by these external clients potentially generate production bottlenecks and practitioners use animation workarounds to mitigate and circumvent. Therefore, the results generally reveal that animation workarounds are an intrinsic part of commercial production processes. The need for which is created by the resource limitations generated by adhering to the conditions of commercial production and exercised through controlling production costs. Consequently, it seems that animation workarounds have a paradoxical relationship with commercial production. They are a product of resource constraints created by this model, and they allow practitioners and management to mediate these constraints to meet the conditions of commercial production. The final part of the chapter provides conclusions for the application of Alter's (2014) *Theory of Workarounds* to commercial series-making methods.

Conclusions

Thus far, the chapter has shown that animation workarounds function to mitigate differences in approaches between animation labourers and animation management in contemporary production organisations in the UK. Likewise, the results have shown that the use of *parallel information* is a key aspect of this mediation process, and that using animation workarounds is implicitly accepted in contemporary series-making. In this chapter, it has been established that animation workarounds are an intrinsic part of the production process, allowing cost-effective animated content production, while simultaneously creating the need to control manufacture costs in meeting the conditions of commercial production. The results have revealed that animation workarounds play a functional role in the production process, helping to organise future labour in commercial series-making. The chapter has also shown that the principles of mass-production are embedded in commercial assembly processes.

An explanation for these findings might be that animation workarounds play a vital role in performing *articulation work*, work allowing the completion of other work required for project completion, such as overcoming equipment limitations in commercial production. Likewise, another explanation for the findings presented here may be that animation workarounds result from mediating the differing intentions, goals and interests of animation labourers and animation management inherent to the commercial organisation of contemporary production.

This chapter has extended Alter's (2014) models from the study of IT-reliant organisations to creative organisations. These findings illustrate how animation workarounds mediate differences in animation management and animation labourer organisational approaches, and in doing so, are particularly relevant to the growing study of animation production processes within *Production Studies* and animation scholarship.

This is the first study that has used Alter's (2014) *Theory of Workarounds* in the analysis of activity involved in making contemporary animated series. Therefore, this research extends our knowledge of the motivations and consequences of animation workarounds in contemporary series-making. A major strength of this study is the use of in-depth relevant data, analysed through appropriate frameworks to generate new understandings.

Nonetheless, further work is needed to understand the quantitive impacts of animation workarounds, such as the **labour hours**, and **time** costs of shifted work. Likewise, further research might explore the impacts of animation workarounds at other points in the production process, besides the use of animation workarounds in animated feature production. The next chapter moves on to examine the integration of digital production processes and their impacts on series-making working methods.

Part II

Animation Workarounds in Practice

CHAPTER 5

Mass-Production In Studio Animation Production

This chapter analyses the integration of digital production tools, such as digital computer workstations and software, into animation processes, and their impact on organisational and practitioner working methods. The extent to which the integration of digital processes influences the development and implementation of animation workarounds in contemporary production processes still needs to be better understood. The chapter addresses this gap by providing one of the first investigations to assess the relationship between animation workarounds and digital production processes in contemporary UK series-making. This chapter consists of three sections. The first: *Digital Mass-Production*, looks at the implications of working with digital files and processes in animation production. *Digital Asset Libraries* addresses the functionality of digital asset libraries in modern series-making. Finally, *Digital Reuse Systems* investigates the relationship between reuse systems and animation workarounds in contemporary production.

SECTION 5.1

Digital Mass-Production In Animated Series

The making of animated series makes extensive use of digital production tools, such as Adobe Animate, ToonBoom, and CelAction, as pertinently recognised by Teevan (2011), Tarantini (2011) and reported by interviewee Andy Blazdell (2022). *Chapter 2: Research Context* discussed the integration of digital production tools into established animation production processes. Janet Staiger (in: Bordwell et al., 1985, pp.90-92) proposes three principles for understanding mass-production: assembly, standardisation and interchangeability. These are crucial for understanding industrial live-action production, as Staiger (ibid.,) observes that live-action fiction films are suited to these mass-production techniques. However, this model fails to account for digital production process integration. This is a significant limitation resulting from Staiger's (ibid.,) focus on the development of the *Classical Hollywood Cinema* production mode until the 1960s, before the mass implementation of digital production tools.

To overcome these limitations, the current study proposes that Staiger's mass-production principles can be extended to account for the use of digital tools in contemporary series-making. This extension generates the new terms of: digital-replicability, digital-assembly, digital-standardisation and digital-interchangeability. This chapter subsequently proposes that asset creation activity, production scheduling, and reuse systems in contemporary series-making are based on applying these digital mass-production principles. Such new terms are justified because the production of 2D cut-out series occurs primarily within a digital pipeline. These concepts may also work in other animation media that use digital production tools, such as 2D drawn and 3D stop-motion animation. Likewise, other media might use these principles in combination with physical processes, such as 3D printing. Therefore, the implications of these same principles can still apply. Consequently, most contemporary series-making uses digital tools for production and exhibition, making the digital extension of this theory a valid framework for understanding specific processes and conditions for digital production.

The principle of digital-replicability distinguishes digital mass-production from mass-production. The binary nature of digital data allows the creation of exact copies of files, such as assets or project files, allowing the iteration of files and assets, including the generation of *child assets* from *parent assets*, which will be discussed later in the chapter. This allows *non-destructive* changes. For example, copies of files can be made, and changes can be made to these files without altering the original. These considerations and working practices are part of the practical process involved with digital files. Digital tools are based on the binary system. Data is represented as either 1 or 0, allowing easy information replication, such as text documents or pictures. Digital mass-production refers to digital tools, such as animation software, not organisational systems like the detailed division of labour. These aspects are nonetheless relevant because of the prevalence of digital production tools in contemporary production in the United Kingdom. This section will examine these considerations and conditions of working with digital mass-production principles.

> **Original Contribution to Knowledge: Digital Production Principles**
> *This research contributes the principles of digital mass-production in understanding animation assembly. These principles comprise of digital-standardisation: digital standardised file formats, digital-replicability: the ability to make 1-to-1 copies of files, allowing digital-interchangeability: combinations of separately made elements to be combined in digital-assembly: new digital content constructed from these constituent parts.*

This early chapter portion discusses the conditions of working with digital files in contemporary series-making. Digital-replicability functionality means digital files can be easily overwritten. Interviewee and CelAction CEO Andy Blazdell (2022) provides a practical example, identifying that this is especially true when using automated rolling backups. For example, when an user has a folder with an image of Barack Obama with the filename "*president.png*", and another newer image file containing an image of Donald Trump – also named "*president.png*" – and this file is backed-up automatically in the rolling back-up: the image of Barack Obama will be overwritten with the image of Donald Trump. And the original image is lost. These factors need consideration to avoid lost work and additional expense in **time** and **labour** required to meet the project delivery date. The example is pertinent to physical backup media, such as local hard disk drives. It should be acknowledged that backing up data on separate hard drives, stored in three separate locations, is an established part of *digital housekeeping*. Meaning that digital best practices already involve using multiple hard drives, somewhat mitigating any potential impact of overwriting files in rolling back-ups, assuming these *best practices* **are** followed.

Nonetheless, large and small-scale productions may use cloud storage solutions, where multiple practitioners use the same file set. If a practitioner changes a specific file, then said file is changed for all working with the file. The mass use of digital assets in contemporary series-making means this point is still key.

Periodically archiving working files overcomes the potential for overwriting these files in rolling backups. Blazdell (2022) recommends archiving important project files by taking a snapshot, by backing up the entire hard drive/server to a different external hard drive periodically – every week or month, for example. Making the case that, should one drive fail, become lost, or overwritten, no more than **1 period** of work is lost. This demonstrates the factors that need consideration when working with automatic backup systems to maintain access to important files. The loss of access to critical assets in animation assembly can cost production **time**, **labour**, and **equipment** to re-create the required files by the project delivery date. This change can be categorised as *Augmenting New Routines Without Developing New Resources* in the *Theory of Workarounds*. As Blazdell argues for a slight *addition* to existing animation production processes to prevent the potential loss of costly animation work through the execution of traditional methods, such as the established rolling back-up. Hence, it can be hypothesised that practitioners might use animation workarounds to change *aspects* of established processes to prevent losing completed work.

Likewise, the archiving of completed work is key to preventing the potential loss of said work. Using periodic snapshots to overcome the impacts of overwriting files when using a rolling backup system can be also categorised as *Overcoming IT Functionality* in the *Theory of Workarounds*. This case illustrates that rolling backups are a workaround that is implemented to overcome the obstacle of accidental animation asset and data loss while performing a routine backup, with the *Direct Effect* of allowing the *Continuation Of Work Despite Obstacles, Mishaps, Or Anomalies*. Therefore, these results reveal that operating differences in animation hardware, such as computer workstations, and software, can be integrated into practitioners' working practices in making commercial animated series.

This example is a useful illustration of using digital assets to overcome obstacles inherent to digital production tools and processes in making 2D digital cut-out animation. It should be acknowledged that archiving physical animation media in the same way could be problematic, as physical assets require physical space and materials. These may be more difficult to store requiring constant appropriate physical storage space, conditions and maintenance to store, While digital files require minimal physical storage space, archiving them requires addressing physical considerations like shielding from magnetic fields and temperature control. Levitin (2015, p.321) usefully illustrates the requirements for storing and accessing physical and digital data. Highlighting that 90% of the total data in the world is stored on magnetic disks vulnerable to magnetic fields, temperature changes and radiation while observing that the probability of a hard drive failing within 5 years is over 50%. However, this analysis was written before 2014, since this time, the use of *solid-state storage devices* (SSDs) for personal data storage has increased. Nonetheless, large-scale and archived data storage may utilise magnetic devices. These factors need consideration in maintaining access to digital backups. These findings are nonetheless relevant because of the pervasive conditions of working with digital technology in contemporary series production.

Broadcasters may wish to re-commoditise existing material. Blazdell (2022) provides a pertinent demonstration, highlighting that the distributor for *Peppa Pig* (2004 - present) wished to release a high-definition version of the first season on Blu-ray. This process required the re-rendering and exporting of the entire first series of 52 episodes in a high-definition format. This re-render needed to be completed over a single weekend. This point is illustrative of animation management expectations and goals creating a grey space addressed with local practitioner agency. These results suggest that the capability to re-render in a higher resolution output format, and subsequently make additions to the shows, was made possible by digital mass-production principles. The principle of digital-standardisation may have provided appropriate export criteria for high-definition video and broadcast (for example, using the codec: H.264 1920 x 1080 at 25 frames a second) allowing CelAction to reference the vector files of the character and environment models. This process refers to a completely digital pipeline, it might be the case that these conditions for re-commoditisation would be difficult to emulate with physical media, as the original animation assets would need to be stored and accessed in accessible formats.

Likewise, even in a completely digital pipeline, there are implications for working with older digital files. Levitin (2015, p.323) usefully examines the key factors for preserving access to older digital files, underscoring how rapid software advancements can quickly render files obsolete. This issue is exacerbated by the financial incentives for hardware and software makers to produce faster products, creating incompatibilities with older systems. Furthermore, software manufacturers may introduce forms of *forced obsolescence*, thus limiting access to files and features, such as Adobe's switch to a subscription model for Creative Suite applications. A move which uses both proprietary file formats and a monthly subscription model to incentivise customers into subscribing, without which practitioners may lose access to important project files. Likewise, Perry R. Cook, Professor of Computer Science at Princeton University, advises that it is beneficial if the file formats are open-source, as Microsoft and Adobe files are very fragile, whereas, plain text files can be opened by almost any computer (ibid., pp.323-325). Therefore, this re-commoditisation creates a scenario where multiple versions of the same content can coexist, such as different versions of films, some with extra scenes not present in the theatrical release. Often, these *para-versions* are motivated by the prospect of increased monetisation. Access to original digital files and the ability to make non-destructive changes allows additional content re-commoditisation without extra production costs. This is vital for continually commercially successful series-making.

Likewise, digital mass-production principles allow additional content inclusion in the re-render of *Peppa Pig*. In an interview, CEO of CelAction, Andy Blazdell (2022) demonstrated how additional content, such as seatbelts, was added to car scenes during the high-definition re-rendering process. This highlights the gap between animation management's goals and the practical execution of tasks by animation labourers. Practitioners utilise the conceptualisation of process functionality to address practical gaps in organisational goals. The principles of digital-standardisation, digital-assembly, and digital-interchangeability allow for the addition of new content. Digital-assembly and digital-interchangeability facilitate breaking down the animated sequence into discrete parts, allowing additional elements, such as the seatbelts, to be added while leaving others, such as the car and background, unchanged in the high-definition render.

Blazdell (ibid.,) provides a constructive illustration of digital tool functionality and digital mass-production principles in CelAction series re-commoditisation. Illustrating that digital mass-production allows series content created by smaller production teams to be re-released for exhibition. However, as the CEO of CelAction, Blazdell had the authority to implement a process change for an in-progress production. Likewise, such changes are more difficult to implement with physical media during production. The US/Hollywood and UK series production models demonstrate a prevalent desire to generate additional revenue from the same creative content. These processes risk creating multiple versions of the same project, which requires additional consideration, though this is beyond the scope of this thesis discussion. Nonetheless, these file access considerations have further implications for series-making. Access and manipulation of animation assets, such as referenced character models, is needed for rendering animated sequences and episodes for (re-)exhibition. Thus, it can be reasonably hypothesised that digital mass-production principles allow practitioners to alter existing material to facilitate potential re-commoditisation processes.

This end part of the section explores the relationship of software functionality with aspects of practitioner working processes in contemporary series-making. Different software programs may have dissimilar internal constructions and processes. Research participant Andy Blazdell (2022) demonstrates that software applications lack universal features. Data cannot always be transferred from one application to another. For example, a client wished to import camera movements developed in Adobe After Effects into a scene in CelAction. Blazdell pragmatically observes that Adobe After Effects and CelAction store and operate data differently. Therefore, commands cannot be interchangeably transferred from one program to another. These comments focus on software development rather than practitioner working processes. Although the visual content may appear similar, file format content can vary significantly across different software programs. For example, the same image can be saved in both Adobe Photoshop and Illustrator, however, both programs store and operate the image in different ways. Photoshop primarily operates with bitmap images, while Illustrator manipulates vector-based images. It should be noted that this example only applies to animation and visual design software, however, it is logical to assume other applications function similarly.

File format functionality manifest practical considerations. According to Levitin (2015, pp.323-324), basic file formats are essential for preserving access to digital files over time. These findings show that data needs to be stored in the most basic format, such as a plain .txt file in the case of written documents, or a .csv file for table-based documents, for instance, ensuring maximum compatibility and transferability between different software versions, as software versions can become outdated through forced obsolescence and operating system progression. For example, LaTeX is an operating system (OS) independent typesetting software. Likewise, .xml files can be used by both Apple Final Cut Pro and Adobe Premier. Practitioners need continued access to the important working files in production. Hence, applications process information in distinct ways, and practitioners need to consider this functionality in modern series-making.

Likewise, programs using similar data process said information in different ways.

Blazdell (2022) makes the important point that vector graphics function differently in ToonBoom compared to Adobe Illustrator. These production factors need consideration, as information cannot be instantly shared between two programs, even though they may look similar to practitioners. Animation teams must consider these internal operating differences when using digital tools to create and edit files and assets. Vectors are a file format specifically used in the 2D cut-out animation production process, making them a productive illustration of this discussion. However, other software and areas allow basic to complex functionality in software applications. Plain text files (.txt) can be opened in almost any text editor or word processor running on any operating system. Therefore, it is in practitioners' interest to have open-source file formats that anyone can edit. Adobe pursues a commercial strategy whereby practitioners' and studios' subscriptions are required for access and storage of proprietary files on Adobe Creative Cloud. Thus, software makers can potentially exploit specific functions. Lower-budget productions may need to use alternative software due to the high cost of subscription-based models.

The source code of *open-source* applications can be modified and redistributed freely. According to research participant Andy Blazdell (2022), proprietary file formats like Adobe Illustrator's .ai files tend to be more stable when created using the original proprietary software, such as Adobe Illustrator, rather than open-source alternatives like Inkscape. This suggests that open-source software may not adhere as precisely to file format standards, potentially causing compatibility issues when sharing files with other programs. For instance, creating vector artwork in Inkscape and importing that file into CelAction may result in issues, as CelAction may need to properly read the open-source Adobe Illustrator (.ai) file format. These findings suggest that proprietary file types are more stable when created with original programs, rather than open-source versions. Blazdell (ibid.,), CEO of CelAction, provides an advantageous example of a software developer's perspective on open-source software and file formats. CelAction is a software application used throughout UK series-making. A factor which makes this a valid source for the discussion, but also a vested interest in proprietary animation software, which potentially influences animation production processes. In general, therefore, the findings suggest that proprietary file types, such as Microsoft Word .docx files, are more complex, and as such, are more stable when opened and edited in prime programs, a factor that brings long-term access considerations.

There are procedures for overcoming these issues with proprietary file types. Blazdell (2022) pragmatically recommends converting files through the prime program. For example, converting Inkscape files through Adobe Illustrator before importing or referencing the .ai files in CelAction, thus overcoming any potential open-source standardisation issues. Likewise, animation director and interviewee David Blanche (2021) recognises that some clients are predisposed to Apple products and do not like to receive image sequences. To accommodate this, Blanche (2021) switches computer systems to an old Mac to export the completed content in an Apple ProRes codec in a QuickTime (.mov) file. These findings demonstrate that deviations from standardised formats must maintain relative conformity to be accepted in production processes and integrated into future assembly activities. Practitioners need to consider this when creating and working with proprietary file formats. These changes can be categorised as *Overcoming IT Functionality* in the *Theory of Workarounds*. Practitioners are using animation workarounds – shifting workstation formats – to overcome the limitations of proprietary information processing of different machines. It should be acknowledged that Blazdell is a valid source, possessing relevant expertise in developing software solutions for UK production teams.

On the other hand, software developer Donald Norman (1999, p.51) acknowledges a shortcoming in the commercial model of software manufacture – that software is created by many people working in different contexts. This distributed development process presents challenges for ensuring consistency and cohesion in the final product. A factor that increases the potential of shortcomings in making programs comply with proprietary file formats. Therefore, practitioners must carefully select tools, balance function and outcome, and adapt to the unique contextual factors of each project. This is nonetheless relevant, as larger studios are more likely to use unified standard systems. Smaller studios and teams may have more opportunity and necessity to use bricolage in completing projects under resource and budgetary constraints. Animation director David Blanche observes '[i]t just means doing it yourself or doing it again on your own time' (Blanche, 2021). Consequently, appropriate knowledge and decision-making are essential for navigating file format challenges in digital production.

It is important to acknowledge that open-source software can offer fluid integration and workflows. For example, the integration between LaTeX[1] (a typesetting

[1] The writing process of this thesis shifted from Microsoft Word to LaTeX – an open-source typesetting program, which brought advantages and disadvantages. LaTeX's use of plain text files allowed editing of this thesis in multiple programs, leveraging the advantages of each. Likewise, the LaTeX editing process separates form and content. The author is not distracted by formatting concerns during writing, LaTeX automatically organises headings, spacing and figures. In addition, integration allows hyperlinked references and vector graphics in LaTeX documents. However, LaTeX is only suit-

application), BibDesk (a reference manager) and Inkscape (an image manipulation program). LaTeX (and TeX programs generally) create documents from plain text files. The file can be opened and edited on almost any computer without the need to pay for specialist software to access and edit files. Likewise, plain text files[2] are less susceptible to file corruption, unlike Microsoft Word and other proprietary file types, as recognised by Levitin (2015, p.323). These conditions allow practitioners to overcome access barriers to digital files that plague proprietary formats. For example, changing file standards, such as Microsoft's switch from .doc to .docx files, means older versions of Microsoft Word cannot access files created by more recent software versions. Likewise, proprietary file standards are used to incentivise consumption. Adobe encourages creative consumers to utilise Adobe file formats and cloud storage to maintain subscription income, as consumers risk losing access to work if they cancel. It is therefore possible that open-source software[3] and plain text files mitigate these access issues.

This section identified key concepts in film scholarship, namely, how the understanding of mass-production can be extended in accounting for the pervasive use of digital production tools in contemporary series-making. Likewise, this section has shown and explored the implications of digital working processes and their, until recently, under-documented role in influencing practitioner and organisational working processes. This part of the thesis has explored the implications of proprietary and open-source software and file management on practitioners working in contemporary production. These findings are important to the expanding study of animation assembly activities within *Production Studies*, excavating previously under-observed aspects of working with digital tools that impact on series-making methods. The analysis of these processes has presented new knowledge and understandings of influencing aspects of UK series-making working processes. These

able for longer documents with longer manuscript set-up times compared to Microsoft Word with the additional learning curve of understanding mark-up language.

[2]Plain text is a possible exception to this rule. The versatility of these files allows them to be opened and edited using a diverse array of software, making them a highly robust file type. However, even then, the encoding format of the text (Unicode or ASCII, for instance) must be considered when copying and pasting plain text between programs to avoid character substitution and potential lost work in this process.

[3]In the wider context, the development and use of open-source software, software wrappers that allow older software(s) to be used on newer operating systems and game modifications, in any field can be considered a workaround, and a topic of debate. For example, the importance of open-source software in facilitating practitioner agency in smaller and individual productions is particularly relevant in light of Varoufakis's (2024) argument concerning IT ecosystem-platform control and monopoly. Open-source programs and platforms offer functionality without being subject to platform conditions, control and forced obsolescence, though debates and the development of such approaches begin to diverge from this thesis discussion.

findings demonstrate that animation workarounds are a necessary and intrinsic part of commercial production, showing how digital mass-production principles, originally a deviation from established processes, now dictate animation production activity. The next section considers the use and implications of digital asset libraries and reuse systems in contemporary series-making.

SECTION 5.2

Digital Asset Libraries

This section extends Alla Gadassik's (2015) understanding of assembled archives of movements into digital production methods. Gadassik (ibid., p.276) argues asset libraries in commercial production use stored archives of assets and animation – including movement data and animated movements via frame-by-frame progression – that can be archived, drawn upon and replicated for different sequences. It is conceivable to hypothesise that breaking the animated image into constituent parts facilitates using mass-production principles and the detailed division of labour in cost-effective animated image assembly. The main weakness of this theory is that Gadassik ignores digital assembly manufacturing functionality.

The current study overcomes this limitation by applying the principles of digital mass-production (discussed in the previous section) to contemporary production analysis. Therefore, this thesis discussion highlights how digital assets, such as environment and character models, can be archived in asset libraries for future use. This creation is facilitated by the principle of digital-replicability, allowing 1-to-1 copies of assets to be stored in digital asset libraries. This example works in the case of digital production processes, such as those used by contemporary 2D cut-out series. The key distinction is that digital archives are based on the principle of digital-replicability. The extension of Gadassik's framework is suited to digital forms of animation production, such as 2D drawn – with digital extensions – and 3D CGI media, rather than physical formats, such as stop-motion animation. Thus the present study raises the possibility that digital archive extension is relevant for understanding the processes involved in contemporary UK series-making.

This early part of the section examines digitally iterated file functionality and conditions in series-making. Using digital production tools allows iterative asset creation. Matthew Teevan (2011, pp.86-89) provides a pertinent demonstration, recalling the production of *9* (Shane Acker, 2009), which was organised so scenes featuring completed characters were animated first, while simultaneously constructing additional character models (*child assets*) in parallel; highlighting that *parallel workflows* is a process that uses asset libraries to generate *child assets* from *parent assets* (ibid.,). As mentioned in *Chapter 2: Research Context*, Teevan's analysis is largely superficial as no baseline process to judge activity improvements is provided, likewise ignoring the **time** and **labour** development cost of the documented changes. Nonetheless, the example is illustrative of animation management-driven digital process changes in contemporary assembly. This organisation aims to reduce total production time. Digital iteration allows the swift generation of additional characters. A 1-to-1 copy of the *parent* is generated, and changes are applied to these *child* versions. Likewise, the principle of digital-replicability allows non-destructive asset changes. For example, a *parent* asset is replicated, and the change, such as altering the colours of the character's clothes, is applied to the *child asset*, leaving the *parent* asset unaltered. Moreover, digital-interchangeability allows character parts to be used non-destructively in creating subsequent or additional models (digital-assembly), such as copying a hat from one model for use on another. Stored assets can be created and used in this manner. Thus reducing resource expenditure, by focusing on early process asset creation aimed at reducing later resource cost across the production process. It should be acknowledged that Teevan (2011) has decision-making authority to design new processes across multiple studio departments.

A major problem with these changes is their limited applicability to physical production processes. Similar changes may be more difficult in 3D stop-motion production, using 3D printed character rigs and other model elements to allow a *first run* of models, allowing the production of key scenes concurrent to the generation of the *second run* of asset assembly costs additional physical resources to construct and store. The key difference between the two mediums is the space required to store physical and digital puppets for production. Thus, the cost of process changes – in terms of **time**, **budget** and **personnel** – require consideration when implementing digital copies into altered production processes. Hence, it can be hypothesised that digital-replicability allows the creation, storage and iteration of digital asset libraries.

Likewise, these assets can then be designed for multiple scenes and sequences. Teevan's (2011) *geometry optimised assets* reduce the required production **time** and **labour** in building the equivalent multiple assets. Thus asset creation labour is channelled into multi-use artefacts. This functionality is provided by the principle of digital-replicability. Thus allowing production teams to design labour-saving processes based on archived movements and assets, these are planned, created, stored, standardised and replicated for different sequences. Therefore, the principle of digital-replicability allows a single asset to be used in multiple scenes with minimal additional **time** and **labour** expenditure. Teevan's extensive experience in managing 3D CGI animation production makes this a relevant and credible source. However, an additional factor for consideration is that 3D assets can be viewed from multiple angles, whereas flat 2D assets cannot. As such, only scale, orientation and colour modifications can be made to these assets. Therefore digital-replicability enables the non-destructive reuse of assets across multiple scenes in digital series production.

The generation of new assets from re-iterating current assets creates a *parent-child* relationship between the *original* asset (the *parent*) and the *iterated copy* of the asset (the *child* asset). However, this *parent-child* relationship means that the conditions and problems with *parent* assets are inherited by *child* iterations. An interesting demonstration of this case is made by Teevan (2011, p.86) who practically highlights that the characters in *9* (Shane Acker, 2009) were comprised of a net, which presented problems when the puppets were moved. In the film's production, the team compromised by identifying movements that would not break the puppet and creating a pose chart of 15-20 poses to ensure consistent animation across scenes and sequences. Thus practitioners alter established processes to address artefact functionality. Such behaviour is sanctioned by animation management as Teevan instigated the changes and expected practitioners to utilise agency in executing the new process. It seems possible that these results are because of the inherited conditions from *parent* assets that need consideration when generating workflows and animated movements. Furthermore, these results suggest that the principle of digital-replicability means errors and conditions are easily replicated and can proliferate throughout a pipeline.

It should be acknowledged that 3D models are generally more complex than their 2D counterparts. However, this is only sometimes the case, as illustrated by interviewee and Senior Storyboard Artist Rosie Cash (2022), who notes that some CelAction models can be incredibly complex. It is also possible that reused layouts (an aspect which will be discussed in more detail in *Chapter 9*) may inherit functions and errors from their prime versions, such as passed on workarounds and ad hoc changes and incompatibilities with other assets and processes.

On the other hand, reusing specific layouts may be a very efficient and effective method of generating specific scenes. For example, reusing the layout of an outside shot with specific weather conditions for another similar shot. Therefore, practitioners need to consider the function and outcome when reusing layouts to prevent *parent-child* errors from being present in multiple scenes. When reusing a layout, practitioners should also consider the assets embedded within it. For example, when a layout containing an asset with an error which needs to be corrected by a rigger is replicated for reuse in another scene, the error within the character rig is replicated as well. The need for the error to be corrected is also replicated, thus increasing the **time** and **labour** required to fix the iterated error(s). Potentially creating a scenario where both iterations of this model are sent for revision to correct the same error that has been re-iterated through digital-replicability.

It can conceivably be hypothesised that within the *Theory of Workarounds*, *parent-child relationships* might generate *local consequences*, such as the ability to reduce required production **labour** and **time**, with the *broader consequences* of replicating problems further along in the production process. Hence, consideration of the potential work required in rectifying these errors must be weighed against the benefits of easier *child* asset generation in digital production.

> **Original Contribution to Knowledge: *Parent-Child* Asset Relationships**
> *In digital production, the principle of digital-replicability means parent asset conditions, limitations and errors are replicated in child assets, such as digital character models, and these may require additional **labour** and **time** to correct later in the process.*

The early identification of these potential problems provides opportunities for solution generation. Teevan (2011, p.86) makes the case that the puppets for *9* were originally designed for a short film, acknowledging that animated features generally have a higher technical standard. Consequently, additional work was required to improve puppet skeletons for feature use, including identifying poses that would not break the net and including these in a pose chart. These pose charts facilitated consistent animation and gestures across all scenes in the feature (ibid.,). Teevan (ibid.,) observes the animation for *generic character rigs* had to 'achieve a lot through body language and key poses, and a great deal through what could be suggested through the eyes and mouth' (Teevan, 2011, p.86). The limitations of the character models pushed practitioners to utilise the principles of *limited animation*. Wells (1998, p.64) identifies that *limited animation* involves making animation more economically viable by using fewer and less-detailed drawings, fewer animated movements, repeating cycles of movement, and accentuating sound over action in animated storytelling. These conditions – limited movement without breaking said model – were inherited from the models used in the original film. These results suggest that early identification of asset limitations allowed the team to identify methods, such as the limited animation principles, that could be used to tell the story with these inherited model constraints. Thus animation management expectations influence accepted local practitioner agency. Hence, it could be hypothesised that these conditions mean that both *macro-level* (organisational level) and *micro-level* (practitioner level) coordination activity consider animation principles while evaluating production cost control in reducing total resource expenditure in meeting the conditions of commercial production.

Such solutions are examples of *ecumenical and eclectic* self-theorising. Teevan (2011, p.83) recalls that the small budget and short timespan of *9* (Shane Acker, 2009) necessitated inventive and novel approaches to avoid compromising quality. Here Teevan presents changes to accepted processes as pragmatic solutions to production constraints and conditions. This is a useful illustration of the conditions of series-making, as also identified by Tarantini (2021) in an interview for this research, who constructively observes that series production budgets are always constrained. Teevan's (ibid.,) project leveraged existing materials from the initiation phase, which may have led management to believe that minimal additional production time was required in this case. Consequently, the time and budget required to develop new processes are always limited by the conditions of commercial production. Therefore, in general, practitioners use ecumenical thinking to generate solutions to solve problems created by resource limitations.

This latter chapter portion explores the different types of decisions both animation management and animation labourers can make within studio organisations, and how these respective agencies can be utilised to overcome potential obstacles in contemporary series-making. It has been discussed and established that only animation management can allocate resources and activity across studio processes. For example, Teevan was Head of Production during the project. As such, he was able to allocate animation production resources, such as **equipment**, and **labour**, and design new processes across the studio. Therefore, it can be observed that Teevan has decision-making authority in the studio, and can coordinate and allocate workloads across the studio, a form of *Department Strategy* in the *Work System Framework*. Thus Teevan's changes may have limited applicability to physical and 2D vector production media. Nonetheless, this is a fruitful illustration that shows how changes are designed and implemented within larger studio organisations and processes. However, it should be acknowledged that the current example is a *studio for hire*. Processes may differ from other larger and smaller studios, which may have a more *free-form* approach to designing and implementing changes. It might also be the case that smaller studios may have a more balanced interrelationship between individuals who have and those who do not possess decision-making authority. A factor potentially resulting in an *organic* design and implementation process of changes to established methods. Therefore, it seems that such *macro-level* coordination requires decision-making authority to organise labour across the project. The findings indicate this *micro-level* activity focuses on conceptualising animation assembly.

Likewise, practitioners without decision-making power can still organise their own tasks effectively. Animation rigger and research participant Mat Dame (2021) uses a *procedure list* – that includes specific production details and methods of naming conventions and rig structures, for instance – when adapting to specific team processes, ensuring tasks and details are not missed at new project commencement. This list allows Dame to externalise the details of new technical processes, often specific to individual productions. Hence, we can infer that artists use agency to organise and coordinate their tasks and processes on a *micro-level*. Such activities are motivated by practitioners needing to organise their labour efficiently, preventing errors and potential missed deadlines.

This valid source helpfully illustrates the *day-to-day* application of *micro-level* activity, because Dame (2021) is a freelance practitioner. Therefore, freelancers may find it more challenging to adapt to a new studio's workflows compared to a full-time employee. Consequently, the *procedure list* may be focused on this assimilation process over managing practitioner workload. However, workload management may remain a key function of the artefact. Therefore, these findings indicate that practitioners organise activities to manage workloads concerning specific organisational contexts. Hence, it could conceivably be hypothesised that practitioners (animation labourers), who lack decision-making authority in resource allocation, can use animation workarounds to coordinate local activity efficiently, such as workload completion.

Moreover, practitioners can utilise *micro-level activity* in creating their digital asset libraries. Storyboards can facilitate the planning and development of these asset libraries. For example, Senior Storyboard Artist and interview participant Rosie Cash (2022) creates ad hoc background archives, copying and pasting background swatches and other aspects from storyboards. A process facilitated by digital-replicability, allowing practitioners – animation labourers – to design and implement asset libraries on a local level, increasing production efficiency. Likewise, Senior Storyboard Artist and interviewee Kayvon Darabi-Fard (2022) uses specific storyboard parts to create a high-resolution image library for organising references and assets, such as designating reuseable material and locations and supplying character design references. Thus practitioners use local agency to increase individual process efficiency. This data might be explained by *micro-level* activity facilitating the creation of libraries of reusable materials from already constructed elements. A process that eliminates the potential effort needed when creating an archive outright.

This is a beneficial illustration of *micro-level* activity in larger animation studios, showing the distinction between studio and individual practitioner processes. Digital-replicability and using flat layers may facilitate easier ad hoc asset library creation from 2D digital assets. Material, space and storage requirement differences may make this process difficult in physical production media, such as 3D stop-motion. The organisational system and influencing principles that define ad hoc reuse systems are created *on-the-fly* as the asset library is generated by practitioners when conducting other tasks. Such *on the fly* criteria may lack the structural cohesion of planned *macro-level* organisational systems. These need to coordinate the activities of multiple artists across the organisation, as effectively identified by research participant, Tony Tarantini (2021). Hence, it is conceivable that the storyboard serves as a means of externalising ideas for the organisation of potential asset libraries for reuse systems *before* investing time and labour in asset library creation. A process conducted to avoid unnecessary expenditure of production resources.

Generating ad-hoc asset libraries can be categorised as *Designing and Implementing New Resources* in the *Theory of Workarounds*. The library may be created to prevent losing access to background assets constructed throughout the season. An explanation for this might be that such a process is a change to established methods that potentially generates the *local consequence* of taking extra time to log and create copies of every background. These may bring the *broader consequence* of reducing the time needed for future storyboard creation, as artists can pick elements from the library rather than creating new ones.

A further possible explanation for this might be that such ad hoc activities are instances of *human agency*. Artists are using initiative to implement procedures: to create inventions that can be used to reduce their potential workload at a future point in the process. These findings suggest that the *macro-level* ad hoc nature of library creation means they are suited to specific project conditions. These libraries account for contextual factors that arise in production, such as emerging asset designs. These factors may not have been considered if the asset library had been designed earlier in the production process. Hence, it is reasonable to hypothesise that ad hoc asset libraries, an instance of bricolage, are a context-specific case of *practitioner agency* in animation assembly.

Likewise, it is possible to infer that both *macro* and *micro-level* activities focus on workload reduction and task coordination. It has been established that both *macro-level* and *micro-level* goals seek workload reduction. In commercial production, both animation labourers and animation management seek to organise tasks efficiently. A possible explanation might be that animation labourers lack decision-making authority to organise production activity on a *macro-level*. Instead, they can employ similar decision-making processes in coordinating and organising their animation activity within their place in the studio hierarchy. It is conceivable to hypothesise that these goals are motivated by the conditions of commercial production. Practitioners coordinate their animation activity to minimise and organise their workflow and tasks, reducing required **time** and **labour** for workload completion.

This section has shown that a key understanding of asset libraries, as proposed by Gadassik (2015), can be extended to account for the use of digital tools in contemporary series-making. This inquiry has highlighted how digital functionality impacts the creation of animated material, and how the working conditions of digital assets can be used to increase production efficiency and easily replicate problems when iterated assets are used pervasively throughout production to reduce the expenditure of animation production resources. Likewise, the section has demonstrated how digital tools allow practitioners agency in their working processes, and how animation management can use digital functionality to coordinate multiple practitioners' and departments' labour to achieve cost-effective production.

These results are important as they add to the expanding field of studying animation production processes, highlighting new understandings of the impact of digital asset libraries on practitioner and organisational working processes in contemporary series-making. Furthermore, this work contributes to existing knowledge of Gadassik's (2015) understanding of asset libraries by providing new insights concerning the use of digital archives in contemporary UK animation production. These understandings demonstrate that the workaround category of *Overcoming IT Functionality* directly dictates established production practices. Digital asset libraries have been adopted for commercial reasons. This is a deviation-adaptation to conventional practices which now dictates established production activities. Thus illustrating that animation workarounds are embedded into the nature of commercial production processes, and are a key requirement for meeting the conditions of commercial production. The next section discusses digital reuse systems in contemporary series-making.

SECTION 5.3

Digital Reuse Systems

Digital reuse systems are built on the principles of digital mass-production. For example, the previous section demonstrated that digital mass-production facilitates efficient organisation of production activity, illustrated by Teevan's *parallel workflows*. Likewise, the previous section discussed how digital asset libraries, and changes to these, function in series production. Digital asset libraries are the foundation of reuse systems – stored archives of assets and movements that can be used in multiple sequences in production. This section explores digital reuse systems' functions, changes, coordination and limitations in series assembly.

Interviewee Tony Tarantini, Professor of Animation at Sheridan College defines reuse systems:

> A workaround that can be very useful is reuse systems. This is the process whereby assets (artwork - e.g. layouts and/or animation) are reused in various scenes and sequences. With proper planning during the storyboard and layout stages, there could be quite a bit of reuse in a film and certainly in a series.
> (Tarantini, 2021).

These comments suggest reuse systems are methods of planning, creating and organising assets, such as a character model, for use across multiple scenes, negating the need to create additional assets, which potentially reduces required assembly production **time**, **budget** and **labour**. This example is a fruitful illustration of reuse systems in Canadian series-making. Likewise, Tarantini (2021) possesses numerous years of experience in this specific animation industry, justifying this source's validity and context. Byrne (1999, p.60) recognises that material reuse is more accepted in series-making. However, it should be acknowledged that Tarantini (2021) classes reuse systems as a workaround, and yet, material reuse appears to be an accepted part of commercial series-making, illustrated by Tarantini's acknowledgement that re-using material entails the work of multiple practitioners across many studio departments. This paradox may be explained by the relationship with *production value* and reuse systems. In that, animation management may perceive the overuse of reuse as lowering production value, shifting the perspective of a sanctioned process to an unsanctioned one. Likewise, such a definition of high production value may come from the origins of commercial narrative animation production. Processes that make heavy use of reused material may have been perceived as deviating from the *then* innovative methods implemented by the Disney studio in the 1920-40s, which have resulted in the prevalent form of narrative animation based on a naturalistic interpretation of the physical world, identified by Wells (1998, pp.19-24) as *hyper real* animation. Likewise, Tarantini (2011, p.261) has usefully identified that these traditional production processes remained unchanged from the 1950s to the mid-1990s, before the integration of digital production tools. Therefore, it seems that reuse systems are a change to accepted production methods that have become integrated into established methods sharing a paradoxical relationship with animation management intentions, possibly based on the distinctions and motivations of the prevalent commercial animation development models generated by Disney.

Original Contribution to Knowledge: Digital Reuse Systems
Digital reuse systems are a system and process of creating, organising and using digital assets, such as character and environment models, multiple times across a project without requiring additional fabrication, as multiple digital assets can be copied using the principle of digital-replicability, allowing non-destructive alteration and digital-assembly in many sequences.

Reuse systems can be analysed through the *Work System Framework*. The process of reuse in song sequences is facilitated by the *Technologies* – digital storyboarding software – of the work system. These *Technologies* allow *Participants* to utilise digital mass-production principles in creating ad hoc asset libraries, storyboards for song sequences and the sequences themselves. Hence, it could be hypothesised that standardised file formats allow opening and editing of model data within an image-editing program (digital-standardisation and digital-interchangeability), in which 1-to-1 copies of selected aspects of the character model can be made (digital-replicability). This iteration can be opened and assembled in the animation program (digital-assembly). Consequently, mass-production principles coordinate the complex activity involved in digital animation. Complex calculations are concealed by modern computers' graphical user interface (GUI) and the practitioner's discourse.

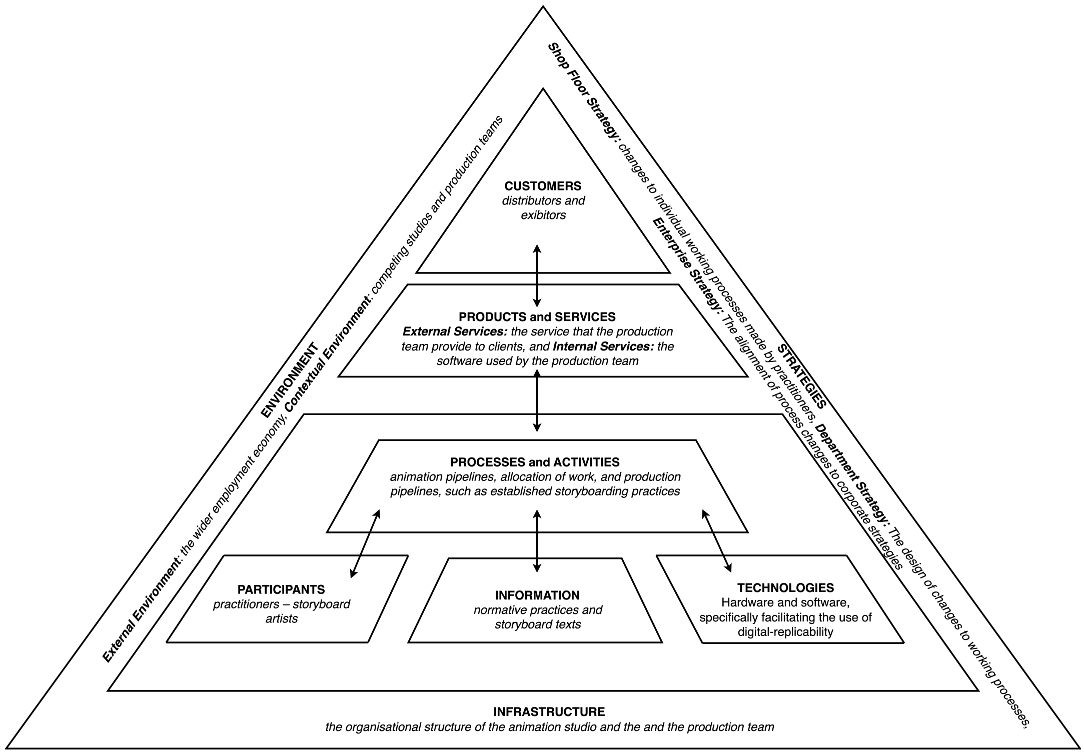

Figure 5.1: The Work System Framework applied to the application of Reuse Systems in Animated Series Content.

This chapter part discusses the functionality of reuse systems in contemporary series-making. Both interviewee Tony Tarantini (2021) and layout artist and author Mark T. Byrne (1999, p.66) highlight that animated series often reuse a large number of assets, such as character models and environments. This is a key distinguishing factor between feature and series animation. However, Byrne (1999, p.60) also acknowledges that large amounts of reuse on a project can be seen as limiting production value. However, Byrne's argument relies too heavily on larger studio cel processes, ignoring the contextual factors of limited budget, smaller production teams and swifter production deadlines which may influence reuse perception. According to these data, we can infer that broadcasters, distributors and producers wish to maintain animated content production value, which costs **time** and **labour**, requiring the selective use of reused material. These sources provide serviceable and relevant examples of the relationship between reuse systems and project production value.

Production context influences material reuse perception. As established earlier in the section, the Disney *hyper real* aesthetic and assembly model may have influenced perceptions of *high production value*. This means production value definitions may differ in other animation assembly models worldwide, though such discussions are beyond the scope of this thesis. Hence, it may be the case that only *visible* aspects of re-using material impact production value. The reuse of a single male character model in *Open Season* (Roger Allers, Jill Culton and Anthony Stacchi, 2006) was disguised by covering the model with different combinations of hats and beards (Roger Allers & Stacchi, 2007). It should be acknowledged that animated rolling series delivery deadlines mean practitioners may have less production time to hide the reuse of elements in series contexts than animated feature development cycles. Therefore, the visible reuse of material is a potential distinguishing feature of series animation.

The storyboarding process facilitates the selection of reused material. Research participant and storyboard artist Liz Strawbridge (2021) constructively reports that storyboard drawings inform the planning of reuse systems and posing. For example, 2D rigged puppet construction informs pose libraries used by riggers and animators. Etienne Wenger (2008, p.105) identifies *boundary objects* as artefacts or concepts that interconnect distinct knowledge states. Hence, it is possible to infer that storyboards act as *boundary objects*, bridging the expertise, roles and objectives of board artists, riggers and animators, thus providing a basis for posing and animation in the storyboard. Ward (in: Honess Roe, 2020, p.156) beneficially identifies that storyboards are used as a production management tool at Aardman Animations, informing the selection of shots. These findings suggest that the production management functionality of storyboards can be extended to reuse systems. Storyboards inform animated material construction for shots and sequences. In general, storyboard reuse and selection decisions are a complex synthesis of interdisciplinary practical considerations and the reification of story and characterisation concepts.

Song sequences are a unique factor of animated series[4] that allow narrative and assembly shortcuts. Interviewee and Senior Storyboard Artist Rosie Cash (2022) highlights that songs may be in every episode of a series, and that storyboard artists can become quickly adept at constructing song sequences; however, pragmatically highlighting that characters cannot move too slowly in these sequences. Further

[4]While songs are used in animated features, these sequences may include special character models and sets that have been designed especially for the sequence, whereas song sequences in animated series use character models and sets that have been used in previous episodes, as identified by Cash (2022).

arguing that slow movements can reveal the construction of character models, and complex CelAction layer orders prevent characters from being layered on top of other character puppets. However, there needs to be more consistency with this argument. Series have different uses of songs, and some have none. Nonetheless, these results indicate that song sequences also allow shortcut use. Song sequence elements are not required to conform to the established episode continuity. Characters can appear in sequential shots wearing different outfits and the audience will not question the change. These shortcuts can be instrumental in overcoming the constraints of particular sequences. For instance, overcoming said inability to obscure one character with another by cutting to a different shot without re-establishing continuity.

This is a productive illustration of sequence articulation in larger studios. It should be acknowledged that not every animated series will include songs. In terms of pacing and tone, the intended series demographic influences song use and type. Thus, it is reasonable to infer that song sequences, and their production and storyboarding processes, are influenced by the intended demographic, as observed by Jean Wright (2005). Hence, it can conceivably be hypothesised that practitioners improve their processes and gain specialisation in the mechanics and constraints of particular sequences as projects progress.

The data shows that storyboard artists' ability to board song sequences improves with experience. This improving adeptness of board artists in song sequences can be understood as *Augmenting Existing Routines Without Developing New Resources* in the *Theory of Workarounds*. A possible explanation might be that storyboard artists' proficiency in boarding song sequences improves as they develop an increased understanding of narrative mechanics and practical considerations of character models involved in particular song sequences. This is a practical illustration of storyboarding processes in larger studios. Likewise, both research participants Andy Blazdell (2022) and Anye Chen (2022c) beneficially assert that proficiency increases throughout a season. Practitioners become more familiar and experienced with specific working processes, being able to complete more difficult shots and sequences towards the end of a season. So, as the season progresses, organisational and practitioner processes become more experienced and adept. Consequently, it can be hypothesised that an awareness of these factors is improved through testing, evaluation and practical application in contemporary series-making.

Likewise, we can infer that reuse systems coordinate the standardisation and interchangeability of the constituent material. Interviewee Tony Tarantini (2021) observes that artists using a shared asset library enables continuity and allows for reverse engineering. For instance, a storyboard artist can reuse a previous establishing shot, so the background artist does not need to create a new background. A weakness of this argument is that it assumes a context: that storyboard artists can choose to reuse material, and that senior staff or clients will not intervene in these decisions. Nonetheless, these comments explain that this choice eliminates the **labour**, **time** and **budget** required to create an original background. Digital mass-production principles facilitate this functionality. For example, digital-standardisation provides file formats for opening and editing within multiple image-editing and animation software programs. Therefore, digital functionality shapes and constrains the creative material used for reuse in modern series production.

Moreover, this reusable material influences the coordination of animation activity. The principles of standardisation and interchangeability allow the creation of further assets based on the originals. For example, *geometry-optimised assets*, documented by Teevan (2011), organise and coordinate the activities of asset (character and environment) designers and modellers in creating further assets for use in additional shots and sequences across the production. A possible explanation might be that these changes to established processes are focused on coordinating and organising digital mass-production on a higher conceptual level. Such conception organises multiple practitioners and departments in sequence completion, to meet the conditions of commercial production in contemporary series-making.

This latter section part discusses factors that constrain material reuse in contemporary series-making. Interviewee Rosie Cash (2022) pragmatically observes that complicated CelAction layer orders can prevent the reuse of complex character models. For example, highlighting that reusing a character's back complicates the scene's layer orders. Therefore, Cash avoids any action that adds complexity to these layer orders. While these explanations may be accurate, they may fail to consider that some practitioners prefer the layer orders and other CelAction functionality. The practitioner's ability to repurpose parts of already created character models depends on model complexity, construction mechanics and software. Nonetheless, this is a profitable illustration of CelAction model complexity influencing practitioner decisions in UK series-making. It should be acknowledged that such processes may differ from other forms of animation media, such as 3D stop-motion models. However, the complexity involved in changing model aspects may limit potential reuse, whereas building reusability into the accessible bitmap files may increase both the potential model reuse and its complexity in placing and operation in an animated scene. From these observations, we can infer that reuse functionality needs to be independent of software applications to maintain maximum flexibility. Therefore, practitioners are likely to take parts of available models that can be reused relatively quickly (*kitbashing*). Thus avoiding the expenditure of animation production resources, such as **time** and **labour**, on model changes, when said **time** and **labour** could be spent on new asset creation. Hence, it is reasonable to hypothesise character model construction limits the magnitude of asset reuse in sequences.

Likewise, material ease of use and availability can affect element reuse decisions. Cash (2022) fruitfully details that asset availability and technical considerations are discussed in the workbook stage. For example, pragmatically highlighting that props, such as a plate of spaghetti, may be included by the storyboard artist in a panel and changed in the workbook stage to use available and technically workable props, such as a turkey leg instead, for instance. However, Cash's observation does not account for narratively important props that may be harder to change. Nonetheless, decisions on whether to use a certain asset may depend on asset availability and functionality, in additiona to the workload and practices of storyboard and layout artist(s). Furthermore, these decisions may be made on an ad hoc basis during the workbook stage for every episode. Hence, these decisions accumulate throughout a season, informing future episodes and seasons, and providing an example of change integration into subsequent production processes. Therefore, the ease of using the material likely influences decisions about reusing elements.

Supervisory personnel incursions may impact material reuse. Cash (2022) productively highlighted in an interview that particular broadcasters perceive that material reuse cheapens animation aesthetics they have invested in. Moreover, observing that ambitious directors may wish to showcase their talent by requesting shots and assets that are not easily reused. Byrne (1999, p.60) usefully highlights that large amounts of reused material limit perceived production value. However, this argument needs to be more consistent, as some studios may favour reuse as an aesthetic choice. A possible explanation for these results might be that resistance to reuse is based on perceived value and creative ambition. For example, capital providers may want to ensure a good return on their investment. Meanwhile, ambitious staff must prove their skills for promotions and future jobs. These observations support the hypothesis that perceived value and creative ambition influence and limit reuse in series-making.

This influence brings both *local* and *broader consequences*. *Local consequences* may include planned storyboards featuring reused content possibly being discarded, requiring fabrication of additional storyboards, work and assets. Potentially bringing *broader consequences*: the extra work involved in designing and creating additional assets and sequences, consuming additional production **time** and animation production resources. This may be compounded by distributors seeking additional approval for the revised sequences. These factors potentially cause future production bottlenecks, as artists must await approval to begin work. *Chapter 6* explores this subject in more detail. Hence, capital demands and expectations limit material reuse.

This section demonstrated that digital reuse systems have become embedded into contemporary series-making processes, exerting an influence on animated material production, in turn, reuse systems can be influenced by other animation processes and artefacts, such as the storyboarding process. These findings show how practitioners' activities adapt and evolve, efficiently working with digital processes, and organisational and practical constraints to re-using material in contemporary series-making.

These findings are important because they add to the expanding field of studying animation manufacture within *Production Studies* and animation scholarship by highlighting the impacts and relationship of digital reuse systems on practitioner and organisational working processes in modern UK series-making. This section has contributed new understandings of change integration in modern series assembly, confirming that animation workarounds which facilitate the principles of digital mass-production become integrated into commercial production processes. Digital reuse systems are an example of a new process formalised into established animation methods, representing a change that now informs practitioner and organisational working processes in modern production. The final chapter portion provides conclusions to these findings.

Conclusions

This part of the study has examined the role of digital files and process functionality on the working methods of practitioners and organisations in contemporary 2D cut-out series production. The chapter has identified that asset libraries and reuse systems are based on mass-production and digital mass-production principles. The findings indicate that reuse systems can organise and coordinate efficient production activity. The results of the investigation show that the development of asset libraries and material reuse can occur on a *micro* and *macro level*. *Micro level* asset libraries tend to be constructed on an ad hoc basis by individual artists, whereas, *macro level* developments coordinate the labour of multiple artists and departments. The findings demonstrate supervisors and distributors constrain the amount of reused material based on production value considerations, asset construction, and software functionality. The research has also shown that the pervasive use of digital tools means digital housekeeping conditions are tacit considerations of assembly functionality and distribution.

A possible explanation for these findings might be that animation management and animation labourers share similar broad goals, but differ in focus. Likewise, these relationships may be explained by practitioners seeking to organise their workload to facilitate efficient task completion. These results might also be explained by studios and distributors focusing on production value, aesthetic control and enterprise organisation, and these differences influence material reuse and digital process organisation.

The lack of research into workarounds used in studio processes has created a knowledge gap. These results shed new light on the understanding of digital assembly processes in contemporary production, extending Gadassik's (2015) modelling of asset libraries into digital production. In addition, the chapter extends Staiger's (in: Bordwell et al. (1985)) principles for understanding mass-production in two ways. Firstly, the study extends Staiger's (ibid.,) model from examining live-action processes to animation assembly; secondly adding the principle of digital-replicability to account for digital functionality utilised in these processes. This study enhances our understanding of *digital housekeeping* – a critical aspect of digital working processes vital to the modern series industry.

Being limited to focusing on digital 2D cut-out series production, this study does not investigate other animation media that may use digital processes, such as the integration of 3D printing and rapid prototyping in 3D stop-motion animation. This study is also limited by the absence of textual analysis of digital storyboards, layouts and assets, which have the potential to further some of the findings regarding digital functionality presented here.

Further research might examine digital artefacts, such as assets and layouts using textual analysis to generate a more comprehensive understanding of digital mass-production. For example, further studies should be conducted regarding iterative asset development concerning physical processes. Ongoing research could provide deeper insights into the iterative development of 3D-printed models and other physical assets. The next chapter examines the relationship between animation workarounds and the organisation of production studios, teams and personnel.

CHAPTER 6

Organising and Coordinating Production Activity

The chapter examines how labour is organised, controlled and altered in modern series-making. To date, there has been little research into the design and implementation of animation workarounds in contemporary animation production processes. This is the first study to investigate changes to established series-making methods in the United Kingdom. As such, this chapter contributes an examination and understanding of the organisation and coordination of studio activity and labour on practitioner working processes to animation scholarship and *Production Studies*. The chapter shows how organisational changes function and can be integrated into future 2D cut-out series-making processes. The *Organising Teams and Personnel* section examines how studio labour is organised and discusses the power balance among individuals and departments in commercial studios, while the *Control Points* section discusses the impact of control points on animation production activity and working processes.

SECTION 6.1

Organising Teams and Personnel

This early part of the section examines the conditions that influence the organisational structure of animation studios and production teams in the United Kingdom. The hierarchical structure of animation studios has the potential to influence practitioner and organisational working processes. An important demonstration of organisational structures is provided by Levitin (2015, p.272) who highlights that organisations may have either a deep (with multiple levels) or flat (with fewer levels) structure. Further elaborating that flat (horizontal) hierarchies with fewer layers of hierarchical organisation have increased crossover in roles and responsibilities, whereas workers in multi-layered (deep/vertical) structures may suffer from *silolisation*, where they may have little knowledge of the work their co-workers are completing. *Figure 6.1* illustrates deep and horizontal organisational structures.

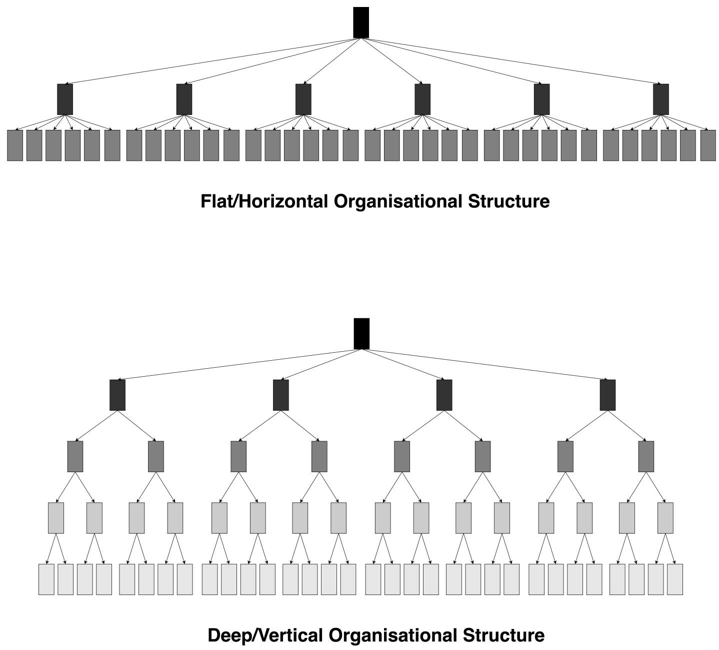

Figure 6.1: Flat and Deep Organisational Structures (Levitin, 2015, p.273).

When applying these findings to animation production, it can be justifiably hypothesised that in smaller studios and production teams, these flatter hierarchical structures support participants working together and employing their talents outside the formal organisational structure. However, in such structures, only one person may have decision-making authority, which might result in one person being required to make many time-consuming decisions. Such a process would take the evaluation of multiple sources of additional information to help in making cost-effective decisions in this context. However, working processes in deeper structures, such as larger animation studios, may suffer increased silolisation where workers may not know what others are doing. *Chapter 9* discusses the impacts of silolisation on practitioner working processes in more detail. The hierarchical structure and size of production teams influence the communication and organisation of tasks within teams and studios, and those hierarchical structures with blurred responsibilities allow practitioners leeway to implement their own solutions to overcome potential production obstacles.

These findings regarding the influence of team size and organisational structure can be applied in analysing series animation production in the United Kingdom. A useful illustration of the organisation and size of production teams in the UK is provided by John Southall (1997), who foregrounds that the UK animation industry is composed of small units 'that expand and contract depending upon levels of production' (Southall, 1997, p.45). Further observing that within this system, production schedules can be rapid and 'production teams often are assembled only for the lifetime of the project' (Southall, 1997, p.45). However, a key limitation of Southall's observations is that they ignore digital tool integration and influence on subsequent processes. Nonetheless, the findings suggest that the UK service sector's production teams and organisational structures are adaptable, expanding and contracting to meet current project demands. These smaller units likely have flatter, less hierarchical structures. The results also raise the implication that in this sector, there is likely to be a higher degree of crossover in the roles and responsibilities of production workers when compared to the original US/Hollywood model, which may feature a higher number of personnel with a more pronounced utilisation of the detailed division of labour. Thus smaller production teams in the UK service animation sector may be more likely to alter established processes and integrate those changes into future productions.

Animation production has moved on since Southall's study was written in 1997. These limitations may be overcome through incorporating Tarantini's (2011) findings that observe the use of digital production tools in the mid to late 1990s has now become pervasive. Therefore, it is possible to hypothesise that the crossover in roles and responsibilities in this sector has increased. The UK service sector exhibits a greater crossover between practitioner roles and responsibilities compared to the US/Hollywood model. This may be because of smaller team sizes in the UK sector. These factors, such as decreasing production budgets, as usefully highlighted by Tarantini (2011, p.250), and increasing responsibility overlap, potentially increase practitioner workaround development in overcoming conditional factors of commercially successful UK series-making. (The impacts of digital production tools on practitioner roles and processes will be discussed in more detail later in the section.) For example, animation director and interviewee David Blanche (2021) identifies that he primarily operates in small teams with no fixed methods. The comments presented here support the idea that these factors can be seen in the prevalence of one-person and smaller animation teams working with digital production tools observed in the primary research data. Therefore, these findings suggest a relationship between contextual conditions and practitioner processes, in that, organisational structures and practitioner roles adapt to fit localised conditions.

Building on Southall's (1997) model, it is possible to distinguish between *core* and *periphery* personnel within UK series-making. *Core* practitioners might be permanently employed, while *periphery* animation labourers may be hired as the project requires, and these workers are likely to be freelancers. For example, freelance artist and research participant Mat Dame practically highlights that he uses *procedure lists* (detailed listings of specific production procedures) in orientating himself to particular project working practices when hired as a freelancer. These findings pertinently illustrate how freelance practitioners use artefacts to orientate themselves into the specific working practices of a particular animation team while working mercenarily in the UK service animation model. It should also be acknowledged that Dame (2021) may also work for other larger studios, and as such, would have to learn how to integrate into their specific working processes. As discussed earlier in the section, these working processes are likely to be more rigid than smaller working teams. Nonetheless, the source is a valid example of using animation workarounds to integrate into the making of contemporary series. This source's relevance makes this a pertinent example of personnel organisation and responsibilities in UK production. According to this data, we can infer that periphery animation labourers use tools and artefacts to orientate themselves and assimilate into the working processes of established production teams.

Related to the relationship of *core* and *periphery* workers is the concept of the organisation's *memory system*. Levitin (2015, p.273) argues that corporations can be considered *transactive memory systems*. Illustrating that new employees assimilate into the organisation through understanding which individuals hold specific knowledge, as no one individual in the organisation holds all the required knowledge and no one may even know who has the required knowledge to keep the enterprise running in a large organisation (ibid.,). Animation studios and production teams may function as transactive memory systems, where the collective knowledge and expertise of the group exceeds that of any individual member. Dame (2021) provides a useful illustration, using a *procedure list*, a list of instructions detailing studio-specific processes, such as step-by-step instructions in colour palette alteration of shared assets in ToonBoom, to assimilate into new processes and avoid errors when working at a new studio. These comments support the idea of *transactive memory* within studio organisations. Dame uses the *procedure list* to integrate into the specific organisational processes and record key knowledge required to complete the necessary work. This example suggests that studios are transactive memory systems, the knowledge stored within them is tacit until overtly requested within working practices. This is a useful illustration of how practitioners integrate into bespoke technical and social organisational production contexts.

Knowledge can also be transferred among organisations. Langer (1991, p.6) usefully observed that practitioners took knowledge from production to production. Pertinently observing that Bray's top employees left the Bray studio after its reorganisation, taking the knowledge of the detailed division of labour and pyramidal organisational structure and founding their own studios based on these principles. Thus developing the now established US studio system. This knowledge transfer helped proliferate the now pervasive pyramidal model of studio organisation. Thus, in animation, knowledge transfer *between* and *within* organisations is key to process development and execution. These comments further support the idea of studios and teams storing and transferring knowledge of working processes and methods between studios, causing knowledge to disseminate and change throughout animation organisations.

The dissemination of new knowledge can alter work processes as information is incorporated and adjusted to fit evolving circumstances. For example, a practitioner may take knowledge acquired from a previous role and utilise it to overcome a problem while working in a new role, possibly in a manner not considered by current management. Such a change could be considered an animation workaround. In the UK model, many practitioners work as freelance, contract-based employees, moving between studios. This allows them to gain broad knowledge of diverse processes and adaptations. These practitioners transfer their expertise, knowledge and animation workarounds between workplaces, potentially increasing the overall utilisation of animation workarounds within the UK service sector.

The UK service sector can be interpreted through the *Work System Framework*, which can be observed in *Figure 6.2*. This research overcomes the industry-neutral limitations of Alter's (2013) framework, extending the *Work System Framework* model specifically for animation production by creating the additional layer of *Shop Floor Strategy*, which refers to practitioner activities within the *work system*. These activities focus on pragmatic choices and articulation work conducted by practitioners, such as workarounds that make it possible to complete the animated project despite contextual conditions and limitations. For example, Dame's (2021) *procedure list*, which lists project-specific processes, allowing Dame to integrate into a production team's specific methods and contribute to the successful project completion. It can be observed that the flexible size of production teams creates overlaps between the *Work System Framework* and *Shop Floor Strategy*. These overlaps represent practitioners taking on additional responsibilities in smaller production teams compared to larger organisations, which feature bigger teams with an additional detailed division of labour. For example, interviewee Andy Blazdell (2022), CEO of CelAction, usefully illustrates that within smaller CelAction production teams, animation management may ask practitioners and departments to take on extra responsibilities, such as asking storyboard artists to assemble layouts. In this context, *Shop Floor Strategy* may involve the processes practitioners use in task completion, also known as articulation work within these conditions, such as creating one *parent* layout and iterating this to produce multiple layouts in less time. Therefore, these findings illustrate that *Shop Floor Strategy* focuses on project completion despite contextual conditions created by *Department Strategy* and *Enterprise Strategy*. Thus overcoming a lack of industry-specific contextual awareness in Alter's original model.

External clients often provide project budgets for animated content production, such as a broadcaster funding an animated series. These budget proportions influence resource allocation within the production organisation. An important illustration of this is provided by Senior Storyboard Artist and interviewee Kayvon Darabi-Fard (2022), who highlights that production budgets are dictated by clients, who determine project deadlines and personnel, equipment (number of available workstations and production space, for instance) allocation. These comments lack specificity concerning *how* the budget is allocated. Such decisions are probably made by the department head, whose decisions are likely influenced by the available budget. These findings suggest that capital, such as external clients, potentially determine macro project conditions, such as completion timeline, and purchasable

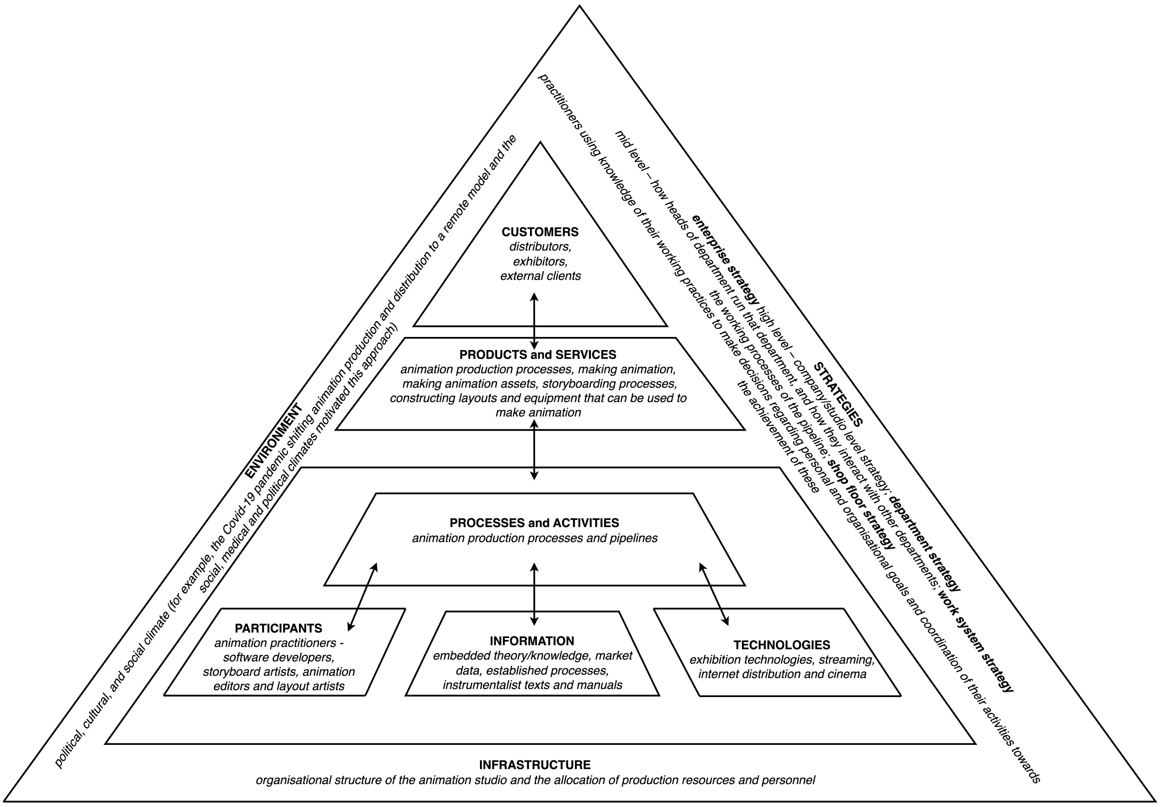

Figure 6.2: The Animation Work System Framework.

and affordable equipment choice. In this organisation, senior team members organise available resources at a department level to meet the conditions of commercial production through cost-efficient resource allocation. These are key observations regarding the storyboarding process, which is the focus of this research, making this source of critical relevance to the study.

However, Darabi-Fard (2022) also notes that senior storyboard artists may not handle budgets and other nuances. The detailed division of labour within studio organisational structures suggests that artists are not required to consider the specifics of budget allocation. This commercial production organisation allows artists to focus on artistic tasks. Therefore, these findings suggest that artists must orientate themselves within these conditions, as observed by Sito (2006, p.12), who practically highlights that artists see themselves as individuals and yet are part of an industrial system. Such orientation may take the form of articulation work, such as Dame's *procedure list* and animation workarounds, to complete tasks within the limited conditions exerted by the constrained funds in commercial production.

> **Original Contribution to Knowledge: Increased Process Variation in UK Production Teams**
> *The predominance of smaller team sizes, flatter organisational hierarchies and increased use of digital production tools increase the potential for process variation in UK animation teams.*

This latter portion of the section examines the impacts of digital tool integration on production team size, roles and responsibilities in contemporary series-making. To understand team organisation in the UK service model, it is necessary to synthesise a wider understanding of the evolution of production processes. *Chapter 2* established that digital production tools have been widely integrated into established processes. This *digital shift* has reduced the size of production teams. Tarantini's (2011, p.260) empirical observation of contemporary processes and discussions with all research participants demonstrate that digital tools are now an established part of contemporary production processes. These data suggest that the influence of digital production tools and the conditions of the UK service sector have blurred role boundaries and responsibilities. Therefore, we can infer that requirements to meet the conditions of commercial production, specific and changing production requirements, motivate digital tool adoption into contemporary series pipelines.

The integration of digital tools, originally intended to reduce labour and time requirements, has instead contributed to increased skill and job role overlap within production teams, creating conditions that foster the generation of workarounds. Practitioners use knowledge to overcome resource limitations and perform articulation work on integrating technology differences into working processes. Research participant and animation director David Blanche (2021) practically demonstrates this articulation work, using an older MacBook to export projects with an Apple ProRes codec for clients. The overlap of responsibilities, integration of digital tools, and increasing technicality, heighten the potential for generating animation workarounds. Such changes are needed to articulate differences in these factors in project completion in the UK service sector.

Likewise, these influences can be observed in the prevalence of smaller teams and single practitioners in the primary data. For example, Blanche (2021) usefully identifies that he primarily operates in small teams where there are no fixed methods. These comments illustrate that the conditions of the UK service sector result in smaller production teams, which expand and contract as project needs dictate. The findings suggest that within these smaller teams, there are fewer workers to complete the animation tasks, traditionally completed by multiple specialised workers in the industrial studio production model. However, other small teams may operate differently, potentially creating numerous undocumented process variations in the UK production model. Production constraints, including varying delivery dates and budgets, may influence these potentialities differently. Variations and combinations of production constraints influence animation assembly methods. Hence, it could be hypothesised that these fewer workers have additional crossover in roles and responsibilities.

Animation practitioners use knowledge to compensate for resource limitations. Alter (2014, p.1049) usefully identifies that appropriate workarounds are likely to be developed when practitioners possess relevant knowledge. When working in a smaller studio that lacked a visual effects department, animation generalist and research participant Mat Dame (2021) developed a process to animate the visual effects for a scene within the Adobe After Effects project file, instead of using a visual effects team which were unavailable at the time of production. Thus practitioners may be expected to utilise local agency to overcome resource limitations in achieving wider project goals. These changes to established processes can be categorised as *Substituting Unavailable Or Inadequate Resources* in overcoming the obstacle: a deficit in available production personnel. In this example Dame utilised multidisciplinary knowledge and agency within the organisation to design a cost-effective solution to overcome project conditions. The process change was most likely sanctioned by animation management. The proposed new process allowed the project to meet the conditions of commercial production without significant expenditure in animation production resources. This example worked in this context because Dame (2021) had the requisite knowledge of visual effects procedures and software. Likewise, animation management allowed Dame (2021) to design and schedule a new process. Marrying this observation with that of Alter (2014, p.1049), we can hypothesise that knowledge is a requirement for successfully designing animation workarounds to compensate for limitations in animation production resources. Therefore, the findings suggest that practitioner knowledge, agency and suitable conditions, such as enough time, equipment and willing animation management, are needed to create effective solutions for overcoming production constraints. This knowledge appears to be a crucial factor in successfully developing animation workarounds, just as it is in other industries, according to the findings of Alter (2014).

Alter pertinently highlights that: '[w]orkarounds are fundamentally about human agency, the ability of people to make choices related to acting in the world' (Alter, 2014, p.1048). These alterations to established processes are instances of human agency in response to production and resource constraints in commercial series-making. For example, in the illustration described above, Dame (2021) utilised *local* agency afforded within the organisation to alter established procedures to overcome contextual obstacles, including a lack of available production personnel. As noted earlier, Dame (2021) was on a production team that allowed such suggestions and changes, however, not all teams may be willing to accommodate solutions. This may be for personal reasons, such as not wishing to hear unfamiliar suggestions, as observed by interviewee and Senior Layout Artist Anye Chen (2022c), or for organisational reasons. For example, larger studios may have specific processes which require adherence to ensure operational compatibility. Likewise, contextual reasons, such as time limitations in solution development, limit change adoption, as observed by research participant and CelAction CEO, Andy Blazdell (2022). Therefore, personal, organisational, and contextual factors constrain practitioner agency.

Dame's illustration is an example of bricolage – practitioners making use of available materials. Blazdell (2022) highlights that most animation workarounds are not developed due to time and budgetary constraints. Such comments only focus on wider resource-intensive device and process developments, ignoring local practitioner agency. Therefore, it can be hypothesised that most potential instances of bricolage are not developed and the underlying idea is not documented. These factors may limit potential changes to *micro-level* activity. Alterations that can be swiftly actioned with the available materials and equipment in executing normal practitioner tasks are pursued first. Therefore, increased instances of *Improvisations And Bricolage* should be expected and planned for with variable-sized teams and limited animation production resources.

Smaller teams may generate their own processual impacts. This *local consequence* of smaller-sized teams with increased role crossover generates potential *broader consequences* of increased instances of *improvisations and bricolage*, as practitioners must use limited available materials and animation production resources. Variable-sized teams may generate the *local consequences* of shorter and less expensive short-term production. However, the *broader consequences* may include a lack of personnel, time and labour to complete all required work and decision-making, potentially creating future bottlenecks. Likewise, a smaller team's ability to complete a single project with limited personnel, time and budget – a *local consequence* – may lead to animation management assuming that teams can complete increasingly ambitious projects with similarly limited resources. This leads to the *broader consequence* of studios controlling production costs by employing fewer team members and these reduced team sizes becoming a new standard.

The findings have shown that the UK service sector is predominantly made up of smaller teams and studios. These act as transactive memory systems containing specific production team and process knowledge. *Peripheral* practitioners use artefacts and processes to integrate into these teams. Likewise, the section has demonstrated that increased use of digital production tools, motivated by a desire to utilise the benefits of decreased production time and costs, has reduced team size and increased role and responsibility crossover in the UK production sector. The section has also illustrated that practitioners utilise agency and knowledge to overcome limitations in animation production resources within UK service sector assembly. indexdigital production tools

These findings mean practitioner knowledge and agency are key in adapting to changing production conditions. This specialised knowledge, agency and adaptability are key in successfully integrating multiple teams' working processes, as well as generating solutions from available materials to resource limitations. These findings demonstrate that animation workarounds used to overcome organisational limits have become integrated into newly established methods. The next section examines how content generation is controlled in commercial production, how such control is achieved, and the impacts on practitioner working processes.

SECTION 6.2

Choke Points in Animation Production

This section first examines the traditional control over creative content generation in commercial animation production, before exploring how this control is maintained through the approval process for creative work in contemporary series-making. The control of animation labour requires the consideration of both commercial and creative factors. A classic observation of labour organisation is provided by Langer (1991), who observes that '[e]very industry has its traditional paths by which authority is exercised, and that within commercial animation production, the control of creativity equals control of authority' (Langer, 1991, p.12). Therefore, controlling animation labour is quite different from other organisations (ibid.,). These comments suggest that this control is exercised through the approval process, in which supervisory personnel approve creative work for the project; thereby, creativity is controlled: only approved work is used in the project.

There are two traditional choke points in animation: the story department, and the initial layout of the film and characters by the director and/or lead animator (Harvey Deneroff in: Langer 1991, p.12). Thus creative content control is built into commercial assembly processes. The findings indicate that animation management directs and channels the ideas that artists are permitted to explore and develop. In this process, a senior production team member, such as a director, or senior storyboard artist, approves a batch of completed work to ensure it conforms to project requirements. This process prevents the creation of work that does not meet the project requirements and, as such, potentially increases the cost in animation production resources in generating redundant creative work. The evidence presented here supports the idea that such choke points theoretically allow artistic autonomy and the control of creative content, and so are used to control animation labour in commercial studios.

To gain a nuanced understanding of how creative content may be controlled, it is important to acknowledge the shift in the control of processes and content before returning to the discussion on choke points. Langer's example works in the context of the 1910s production model, when the principles of *Scientific Management* were heavily imposed on animation labourers (Gowanlock, 2020, p.64). However, integrating these principles has been observed to create tension in the Disney and Pixar animation organisations. As a response, animation management now also uses non-linear tools that perform manual tasks, freeing practitioners to focus on creative aspects of their workload, as a means of labour control (ibid., pp.66-77). Stahl (2010, p.272) highlights that animation shares institutional dependencies with other forms of creative production: requiring zones of autonomy for artists to generate novel content, the control of artists by animation management through the power to hire and fire employees, and the control of created content through copyright ownership (ibid.,). These factors highlight a tension between control of creative work and creativity. Gowanlock's (2020) observations show that the methods of controlling creative content have shifted from rigid organisational structures and choke points to a focus on reducing the time and effort animation labourers expend in the execution of manual tasks.

This control shift represents a more subtle and flexible manner of controlling and influencing practitioners' creative output and activity. This influence has been observed by research participant, and CelAction CEO, Andy Blazdell (2022), who usefully highlights that practitioners ask him to find ways of eliminating manual tasks that occupy a comparatively small amount of time, such as reducing loading and rendering times, to which Blazdell (2022) recommends they use the time to conduct a concurrent task instead. Likewise, Blazdell pertinently identifies that animation workarounds are only effective if they eliminate a significant amount of human interaction consistently from the workload. Therefore, it is possible to observe that the control of generated creative content is manifested through this process, the reduction of manual tasks perceived as mundane and time-consuming.

However, the efficacy of task automation is limited. While aspects of the generation of creative content by practitioners can be increasingly automated, the approval process requires animation management to visually inspect and approve work, limiting the amount of possible automation. Senior Layout Artist and research participant Anye Chen (2022b) practically demonstrates that the approval of novel content is usually conducted by one or two supervisory personnel. Thus illustrating hierarchy in content control. These comments suggest that each decision must be calculated and solved in sequence in approval decision-making. The amount of content that any one individual can process is therefore limited. These findings suggest that the ability to reduce the time required for these tasks is therefore limited, as the entirety of the information – the creative work – must be inspected to avoid shortchanging the process. It should be acknowledged that this example works in larger studio contexts, such as Brown Bag Films, and it might be the case that this example may be less applicable to smaller animation studios and smaller production teams, who may not have available additional personnel to assist in creative work approval. Larger studios are likely to produce higher volumes of creative work for approval, all of which must be checked, making this method of overcoming the impact of choke points a long process. These findings suggest that the control of creative content depends on human interaction, meaning the process has the potential to take a long time while taking time away from other processes. This has the potential to create delays in other areas of the production. Therefore, this change requires a balanced judgement, weighing the value of time spent on the approval of other animation tasks. Consequently, there are limited ways to reduce the amount of required human interaction time and its impact on tasks in the production process.

Creative work approval can impact on other tasks, thus hindering production progress. According to Senior Layout Artist Anye Chen (2022b), supervisory personnel are often too occupied with other responsibilities to review and approve layouts within the allotted approval timeframe. This potential choke point bottleneck manifests because a senior production team member must approve all necessary work. One person must evaluate a large work volume, such as character designs, models, storyboards, animatics and layouts. Thus limiting the amount of information that can be processed. Consequently, hierarchical control creates a void in *conception-based* control decision-making. This grey space is addressed with local practitioner agency, which may be tacitly accepted within the organisation if it meets wider project completion goals. Here Chen (2022b) provides a fruitful and vital illustration of the operation and consequences of control points in larger animation studios in the United Kingdom.

However, the impact of particular processes may be easier to observe in smaller production teams and organisations, such as those serviced by CelAction and interviewee Andy Blazdell (2022), who relevantly considers the time impact of any proposed process changes, foregrounding that as any impact, such as an increase in production time or workload, might be easily observable in a smaller production team. These findings suggest that in larger studios, any impact of a specific process may only become visible when a large enough problem occurs, as the detailed division of labour in play means that artists are likely to be primarily focused on their own tasks. The approval process can divert practitioner time from other tasks, potentially causing production bottlenecks. This impact may be more pronounced in smaller organisations than in larger studios, where the detailed division of labour helps mitigate potential effects.

The type of work for approval takes multiple forms, including scripts, storyboards, animatics and designs, for instance. Senior Storyboard Artist and interviewee Rosie Cash (2022) usefully highlights that the director's review of animatics can be a bottleneck and that the approval of storyboards may progress faster than that of animatics. This is because storyboard artists can produce storyboards at a faster rate compared to that of animatics. These findings suggest that artefacts which can be produced and altered swiftly can compound bottleneck impact, as work for approval builds up. Thus the pace of content creation contributes to potential bottlenecks. This is probably not considered in the *conception* of content control measures as it requires specific process knowledge gained from the experience of task *execution*. Thus the *conception/execution* divide contributes to approval bottlenecks in commercial assembly. Here Cash (2022) provides a beneficial illustration of the director's review process of animatics in a larger animation studio.

In this example, it is reasonable to infer that artists have appropriate knowledge of the required animation materials and the time needed to construct, design and understand the changes made to artefacts and processes. It should be acknowledged that storyboards may be viewed as disposable artefacts, as observed by Ward (in: Honess Roe, 2020, p.160), who highlights that storyboards are an iterative mode of developing the animated narrative in an inexpensive disposable medium before expensive mistakes are made in the production phase. These findings suggest that different work types are perceived differently – they are given different weights – animatics may be viewed as more *concrete* than storyboards, as more storyboards have been produced through iterative narrative exploration. Another possibility is that the perceived value of artefacts and creative work might create bottlenecks. Work perceived as more *concrete* might be prioritised for approval above more *abstract* – less defined and finished work. Thus the type of animation required for approval influences production bottleneck severity.

It has been established that the approval of work requires practitioner **time**. Interviewee and rigger Mat Dame (2021) constructively demonstrates how the limited window of approval time can cause additional delays:

> The [approval] system worked by having a small window every day where the director would review any designs that were waiting to be given the go-ahead. This sounds fine in theory, but when a design is

> finished, gets reviewed and given feedback, gets fixed by the designer (usually really quickly) but now needs to wait until the next day to get looked at again, this can add up to days where I'm unable to start a rig because the design is stuck in this daily loop. Many times the design will have to go through this daily loop 2 or three times before it gets approved which can be frustrating. Especially because deadlines aren't usually taking this sort of thing into account and my rigging deadlines don't move around because design is delaying things etc. Obviously, production staff understand this and realistically aren't rigidly sticking to these schedules in these cases, but when the whole production is organised using these schedules, it's always going to create some issues and discrepancies somewhere down the line.
> (Dame, 2021)

Thus illustrating the *conception* and *execution* perceptive differences in production. *Conception* control measures ignore granular task practicality. These comments illustrate that limited approval time and repeated intervals generate a scenario where created work is not approved and delays compound, creating additional problems further and later on in the production process. This illustration provides a useful and relevant understanding of the balance between creativity and the commercial aspects of industrial production. According to this data, we can infer that the available time allotted for the approval of created work can compound potential delays to individual tasks and practitioner work progression.

Up to now, this section has discussed the conditions and impacts of the approval process, now this closing part of the section explores the methods practitioners use to overcome and prevent the impact of potential production delays caused by control points. Alter proactively acknowledges that '[w]orkarounds are fundamentally about human agency, the ability of people to make choices related to acting in the world' (Alter, 2014, p.1049). Animation practitioners can use this agency to make their own choices about how to respond to the conditions and impacts of the approval process. Dame (2021) illustrates his response to the compounded delays to his work caused by the approval process:

> In that example [(discussed above)], I needed to come up with a workaround to somehow bypass this roadblock as I literally couldn't just wait for things to get finalised or I would be too far behind/sat doing nothing etc. So I started my own process of identifying the 'safe to start' rigs, which were designs that had minor notes that I could ei-

> ther fix quite easily later down the line such as notes purely to do with the colour of things etc[.], rather than the actual shapes and design of things, as colours are incredibly easy to change in Toonboom.
> (Dame, 2021)

Thus illustrating that local practitioner agency addresses the grey space between *conception* and granular task-specific *execution* practicalities. These findings suggest that practitioners can create devices and procedures to mitigate the impact of delays on their workloads. Moreover, these comments fruitfully illustrate that practitioners can use human agency to overcome the potential impacts of compounded delays caused by the approval process.

Alter (2014) also usefully highlights the importance of knowledge in workaround development, foregrounding that: '[a]ppropriate workarounds are more likely to occur if the individuals or groups in organizations have the knowledge needed to design and execute a workaround' (Alter, 2014, p.1049). Turning back to the animation example, it can be observed that knowledge is a key component of this process, as Dame can prevent potential problems by exercising situational and contextual knowledge to inform the selection of which tasks to complete without approval and assess their potential impact on the production process and practitioner's workload. Therefore, the findings reported here suggest that agency and appropriate knowledge are vital in making *micro-level* decisions to mitigate the impact of potential approval bottlenecks, thus preventing additional problems later in the production process.

Until now, the discussion has focused on examples where the approval of creative work has occurred *within* the animation studio or production team. However, the nature of commercial production means that funding, and therefore, a degree of creative control may come from *external* clients, such as broadcasters and those who have created the original work from which a project may have been based, such as illustrators. These external clients can present additional challenges in the approval process. One interviewee, working in a larger studio production, advantageously recalls a project based on a book adaptation, in which the original illustrator reviewed 5-month-old animatics followed by more recent storyboards, reporting that the original illustrator was not able to recognise the characters from their book in the storyboard panels. In effect, the external client could not recognise work they had previously approved. This situation may not reflect all instances of client review but is nonetheless relevant for understanding client familiarity in production contexts.

These findings indicate that external clients frequently lack an understanding of the animation production process and the substantial time and effort required to create the necessary materials. This lack of familiarity can cause additional problems when repeating approval, potentially creating a vicious cycle of delays, as practitioners cannot action any required revisions. Such data reminds us of Alter's (2014, p.1049) observation that knowledge is a requisite of successful workaround development, though now we can see that knowledge is also key in understanding the *function* of animation processes and artefacts, irrelevant of workaround development. This effectively illustrates the impact of external clients on practitioner processes in larger animation studios in the United Kingdom.

Likewise, Senior Storyboard Srtist and research participant Kayvon Darabi-Fard (2022), pragmatically acknowledges that external clients seldom compromise during approval, observing that uncompromising quotas and restrictions compel artists to focus on generating creative options and efficient methods, rather than designing and developing potential workarounds. These findings suggest that internal departments can accommodate each other to prevent approval bottlenecks *within* the animation organisation, whereas this accommodation is not possible with external clients who dictate the production budget and delivery date. Many projects rely on investment from external clients to exist and succeed. The data suggests that external clients need more flexibility when approving created work.

It has been established that Alter (2014, p.1049) highlights that workarounds are about human agency and the ability of people to make choices. Therefore, practitioners can coordinate their local activities to meet the conditions dictated by clients. Practitioners can use animation workarounds to mitigate the impact of capital control points. One participant practically identifies that broadcasters may not understand the specifics of animation production and that these particulars may need to be made clear to broadcasters, observing that distributors can be pedantic when series makers are selling an idea. For example, attempting to control storyboarding stage activity. Thus, *local* agency allows immediate task completion despite capital and organisational control constraints. Limited knowledge among animation management and investors can inhibit production progress when makers seek approval for designed sequences and assets. A further explanation for these findings is that to overcome the problems of external client approval delays and flexibility, producers limit the *flow* and *content* of information to be approved, creating a separate set of *parallel information*.

Using *parallel information* is not unique to animation production and can be observed in live-action commercial projects. For instance, during the preproduction of *Kingdom of Heaven* (Ridley Scott, 2005), 20th Century Fox pushed for an action-adventure film similar to that of *Gladiator* (Ridley Scott, 1999). 20th Century Fox requested reductions to the film script, including losing several integral plot details and subplots to focus on the central character's story arc. To receive a green light for production, director Ridley Scott and screenwriter William Monahan developed two scripts for the film. The first was a shorter script which left out key subplots and the second was a longer script containing these key subplots, such as the euthanasia of King Baldwin V, providing resolution of supporting character arcs. 20th Century Fox pushed for the shorter script's production, while Scott and the production team organised production for, and filmed, the longer script. Scott agreed the theatrical release would mirror the shorter script on the condition that an extended director's cut of the film could be released later, which contained the euthanasia subplot among other character arcs omitted from the theatrical version. The critical reaction to the theatrical cut was mixed, while the extended version of the film received a more positive critical reappraisal (de Lauzirika, 2006). Thus *local* agency facilitates task completion in parallel industries and is utilised by practitioners with decision-making authority. These data suggest that practitioners use *parallel information* – tailored artefacts – to gain approval and bypass studio funding choke points and proceed with the completion of creative tasks in a manner different from approval expectations, as their original intentions may not have acquired acceptance from the approval process and capital. Therefore, practitioners leverage their agency and knowledge to design and implement alternative information when approval impedes completing their creative goals.

So far, the discussion has focused on methods to control information for external client approval, now the final portion of the section will explore procedures used to work around internal approval processes. Earlier in the section research participant and Senior Layout Artist Anye Chen (2022b) usefully identified that one or two supervisory personnel traditionally conduct work approval. Chen (ibid.,) further identifies that if these supervisors are too busy for reviews, then additional personnel, such as an experienced senior artist, can be promoted to a lead role and review work, similarly, the number of approval passes can be limited, however, observing that this can result in additional revisions. Chen (ibid.,) also indicated that supervisors can provide succinct notes in the earliest instance to limit further revisions. Likewise, observing that supervisors and art directors can review separately, however, highlighting that this may prolong the approval process. Thus content control is treated in an assembly-line fashion to prevent bottlenecks. An explanation for these findings might be that these procedures limit potential bottleneck impact by constraining the processing time for each piece of information, restricting feedback, and reviewing in parallel. Therefore, practitioners control approval information to mitigate choke point impacts.

> **Original Contribution to Knowledge: Controlling Approval Information**
> *Practitioners control the amount, content and flow of information – animation work, such as artwork and assets – sent to animation management and external clients to prevent potential approval process delays.*

Likewise, one interviewee practically highlights that limiting work volume and sending work later in the process can also prevent animatic approval bottlenecks and that limited selections of work can be approved at key points to ensure progression. This comment mirrors interviewee Andy Blazdell's (2022) observation that pipelines require a constant information flow to prevent bottlenecks, illustrating that practitioners conceptualise production processes, thus conducting *conception* work in the course of daily tasks. These sources align with Alter's (2014) positing of a worker who conceptualises work system functions and is focused on process efficiency. Therefore, an individual needs to process information for approval in the production pipeline. This decision-making process takes time. Practitioners control information quantity and timing to prevent potential approval process bottlenecks.

The findings reported here suggest that practitioners use *human agency* to circumvent approval process constraints, and in doing so, avoid unproductive periods where animation labourers cannot action and complete required work. Research participant Kayvon Darabi-Fard (2022) provides a counterpoint, practically arguing that choke points are symptomatic of flawed pipelines and schedules, which can be remediated through department cooperation for achievable results from the assigned artists. Therefore, it is conceivable that *human agency* organises information to meet the conditions of commercial production despite contextual circumstances.

This section has built on Stahl's (2010) observation that controlling animation labour and content generation is different from other media, requiring areas of autonomy and output control. This chapter has demonstrated that methods of controlling animation labour have shifted from *Scientific Management* principles to minimalising manual tasks. However, the approval process remains a means of evaluating and channelling the direction of creative content. As such, the section has reviewed how limited numbers of personnel with constricted available time for work reviews usually conduct the approval process. These factors, along with work type and limited external client flexibility, potentially create delays in created work approval. To compensate for this, practitioners use relevant agency and knowledge to alter their processes and workloads, while senior members of the production team may alter the *amount* and *content* of created work.

These findings are important because they suggest that changes designed to mitigate approval process impacts can occur on the *micro* and *macro-level*. Animation management may tacitly accept such key information alterations to minimise production costs to avoid additional further delays. Raising the argument that animation workarounds are necessary for producing commercially viable animation and overcoming capital control constraints. For example, capital control points can create production bottlenecks. The chapter has demonstrated that animation workarounds are required to overcome these potential impacts, avoiding costly delays to completed animation work. This section has demonstrated that animation workarounds are an intrinsic part of meeting the conditions of commercial production in light of organisational constraints. The final part of the chapter presents conclusions and evaluations of the findings presented here.

Conclusions

The chapter findings show that the influences of both the UK service-based animation sector and the pervasiveness of digital production tools have increased crossover in practitioner job roles. This study has identified that practitioners use *human agency* to work within these conditions and to overcome resource limitations and potential control point impacts. The findings show that animation studios act as *information systems* – archives of information – in which distinct personnel possess specialist and often unique knowledge. The research has also shown that practitioners use *human agency* to control information in preventing approval bottlenecks arising from choke points.

One possible explanation for these results might be that animation assembly relies on a flow of information. Calculation delays and incomplete calculations mean vital information is needed further along in the process. Consequently, additional

time and **labour** are expended *processing* this information to allow production to continue. This leads to a further interpretation of the findings, that human interaction is required to complete and approve work and action approval changes. The findings may also be explained by the conditions of commercial production influencing how this information moves through the production process. Capital, budget and distributors attempt to control the process. This impacts how information moves through the process; often delaying or preventing requisite calculations, resulting in method and asset changes, such as storyboard and asset revisions. Therefore, incorrect information alteration can cost additional animation production resources, as further human interaction is used to (re-)process said information so production can move to the subsequent stage.

As such, the results of this study contribute new understandings of animation assembly as an *information process*, extending Alter's (2013) and (2014) models from the field of *Information Systems* (IS) to commercial creative assembly. The findings reported here shed new light on how information is manipulated to allow production progression and avoid bottlenecks. These findings foreground tacit industry understandings for commercial production analysis and implementation.

This study has examined UK series animation to understand the transnational US/Hollywood production model. However, the prevalence of smaller production teams in the UK service sector may limit finding generalisability to processes in larger animation studios and teams in the US/Hollywood production model, as this research examines data from freelance practitioners and personnel working in smaller teams, rather than larger studios. The study finds the approval process may be a bottleneck. However, it lacks textual analysis, ethnographic and in-person observational data on this critical step. Similarly, the findings are limited by a lack of in-person observation of approval and work review meetings.

As such, future studies can conduct in-depth investigations into practitioner workloads concerning the approval process. Such study can be conducted in both larger and smaller animation studios. Likewise, further research might explore the impact of the approval process using data from larger US-based and *studios for hire*. Further study could use in-person observation data from approval meetings to assess the impact of control points and their relation to information systems and processes within commercial production. The next chapter moves on to explore the relationship between animation workarounds and animation production resources in contemporary series-making.

CHAPTER 7

Animation Production Resources

This chapter analyses the impact of animation production resources on designing and implementing animation workarounds in contemporary series-making processes. To date, there has been little definitive research that has used *Work System Theory* (Alter, 2013) or the *Theory of Workarounds* (Alter, 2014) to examine production activity in contemporary series-making, representing a gap in present knowledge. The current study seeks to address this gap by enhancing our understanding of workarounds in contemporary production by analysing the impact of animation production resources on practitioner and organisational working processes. The chapter contains two key sections. The first – *Production Resources and Activity* – examines the relationship between animation production resources and working activities, and the second – *Power Balance in Studios* – discusses the power balance in studio organisations.

Before this chapter begins, it is important to define some key terms which will be used throughout. Animation production resources comprise of **animation labour** (the amount of practitioner interaction required for completion); **time** (time needed to complete projects); **personnel** (number of practitioners required for completion); and **equipment** (instruments needed to complete work, such as computer workstations, animation desks, and studio space, for instance). Typically, animation management allocate these animation production resources. However, practitioners can use procedural modifications to use these resources more efficiently and to compensate for insufficient resources.

SECTION 7.1

Production Resources and Activity

This early portion of the chapter examines the impact and influence of production budgets and other production resources on the organisation of activity in contemporary series-making. Budget limitations have the potential to influence the availability of other animation production resources in contemporary series-making. Canadian series-making veteran and interviewee Tony Tarantini (2021) recognises that series consistently have limited budgets and high-quality demands, resulting in a continual search for ways to meet these demands with limited animation production resources. These need careful allocation to maximise effectiveness, as budget conditions dictate other resource – **personnel**, **time**, **labour** and **equipment** – availability. Tarantini has 20 years of experience in Canadian series production, specifically in 2D drawn and digital series animation and the demands and nuances of cost-effective series-making, making this a valid and reliable source for the thesis discussion. However, it should be acknowledged that Tarantini's point might be limited to Canadian series production. Likewise, Tarantini's comments reflect a pragmatic production viewpoint, ignoring the potential change impacts in individual artists processes and perspectives. Gowanlock (2020, p.66) usefully identifies that animation studio Pixar designs, implements and markets new technologies for each feature film produced. It is, therefore likely that said features may have higher budgets and development times compared to animated series. Consequently, the limited budget and faster turnaround times are key for solution development in animated series.

The availability of animation production resources can impact animation manufacturing activity. Senior Storyboard Artist and interviewee Kayvon Darabi-Fard

(2022) highlights that budget limitations fundamentally define production conditions, including prescribing the amount of time allotted for artists to work, which may vary from *Pay As You Earn* (PAYE) and freelance daily rates and accommodations for over-time in project completion. The available **budget** dictates employment conditions, and the allotted **time** – labour hours – to complete work. Darabi-Fard has ten years of experience working in series production in the United Kingdom, such experience makes this a valid and relevant source for this research discussion. Darabi-Fard offers an alternative artist-centric viewpoint to Tarantini's comments, showing an artist and producer perspective alignment on the issue. In general, therefore, it seems that resource limits constrain required activities, and the production budget defines the conditions of a specific project.

The preproduction phase focuses on investing animation production resources early to reduce future expenditure. Wells (2007, p.15) recognises that the labour-intensive process of making animation means that the precise intricate devising of material is pivotal in enacting the project intentions in the most time and cost-efficient manner. This decision-making requires practitioner **time** and **labour**. Production activity expedites these resources earlier in the process to limit resource expenditure in production and postproduction. Wells is a distinguished scholar. It should be acknowledged that this example applies to orthodox narrative animation, such as the Disney model of production (*Chapter 4* discusses this) and the US/Hollywood model of animation production. It should be considered that other geographic locations/production models, such as Africa (Bendazzi, 2017, p.291), Latin America (ibid., p.311), may have different hierarchical structures, along with examples of experimental animation production, which have not been discussed. However, these wider examples are not the focus of this thesis's argument and discussion. Therefore, early time in the commercial production process is used to plan the efficient use of material and labour later in the process to help control the project costs and meet the conditions of commercial production.

As such, resource limitations influence the coordination of animation assembly activity. For example, Darabi-Fard (2022) practically highlights that limited time in the storyboarding phase may result in rougher drawings, less refined compositions and incomplete storyboards and edits. Further emphasising that the project delivery date dictates production schedules, highlighting that timelines work back from this date and that a shorter delivery time can limit decision-making at any point. These comments illustrate a *shop floor* perspective on granular task practicalities. Incomplete consideration results in additional refinements, as the missing decision-making is noticed and completed as revisions. These alterations cost additional time in the schedule. However, a key consideration is that these comments ignore decision-making elsewhere in the process and may seek to compensate for limited storyboarding time. These findings suggest that this preproduction activity focuses on eliminating errors and efficiently using animation production resources across the future production process.

This middle part of the section discusses the impacts of limited production resources on practitioners' working processes and their responses to mitigate these potential effects. In this early organisation of personnel and resources, supervisory personnel play a key role in planning commercial production. Layout Supervisor and interviewee Antonia Gancheva (2022) explains that in feature production, the Technical Director and Heads of Department collaborate in establishing the overall production process. In this holistic discussion, every role is considered against project requirements, the Art/Director's visual style and the available budget. These considerations determine production constraints and liberties. One question that needs to be asked, however, is whether the same level of preplanning occurs in smaller production teams or series-making contexts. Nonetheless, the findings suggest that the design of the process moves from high level to local department-specific considerations, in which supervisors consider department organisation at a local level, a procedure that facilitates the efficient use of limited animation production resources. Gancheva's (2022) comments focus on feature production, a context with a 3 to 5-year development cycle, with time available to set up the project pipeline and processes, whereas series production hires freelancers on an ad hoc basis when they are required. Therefore, in commercial production, supervisory personnel coordinate activities early to minimise wasted resources.

Likewise, the process should consider the practical impacts of resource limitations early. Research respondent and Senior Layout Artist Anye Chen (2022d) usefully advises that during the script stage, it is useful to consider time and budget restrictions, by limiting the number of new locations and characters in each episode. Further observing that, within this process, department supervisors review animatics to identify potential issues; while animation and rigging departments may highlight difficult action that current rigs cannot achieve; and layout and background supervisors identify new locations, suggesting new angles of existing environments to use instead. Likewise, Senior Storyboard Artist and participant Kayvon Darabi-Fard effectively illustrates the impacts of limitations in animation production resources at this process stage:

> The outcome of time constraints could be that the storytelling, script and ideas are less considered and not at their greatest potential...Constraints in budgets will therefore usually dictate how much time the artists themselves can spend on the work.
> (Darabi-Fard, 2022).

This is an example of the parallel decision-making that might be used to compensate for the limited storyboarding time discussed in the previous paragraphs. These observations support the hypothesis that within commercial production organisations, the technical expertise of each department is employed to identify potential problems before **time** and **labour** consuming work begins. This example is a useful illustration of the contextual conditions of animated series, with limited **time** and **budgets**. Likewise, Chen is an experienced layout practitioner, demonstrating a pragmatic viewpoint. Therefore, departments streamline potential future activity during the preproduction phase of commercial assembly.

It has been established that preproduction stage organisation and planning reduces resource expenditure, however, such practical consideration may also reduce the potentiality of future mishaps. Interviewee Anye Chen (2022d), observed that assets generally do not experience glitches during the layout stage. However, observing that character rigs can sometimes break down in the animation stage. When this occurs, the rig must be sent to the rigging department for repair. If repairs are impossible, the animation department must devise its own workarounds to address the issue (ibid.,). These comments support the idea that glitches are treated like other temporary obstacles. A serious glitch is more likely to be sent for revision than a minor one. This example works when production processes for a particular project have been established, as research participant and CEO of CelAction, Andy Blazdell (2022) highlights, tougher tasks tend to be left towards the end of the project or season when the production runs smoother. In this example, the studio, and most likely Chen, are working on an established production.

The situation may be different if the team were using new – or different – media or a combination of techniques. In addition, it should be acknowledged that sending rigs for repair does not add additional work for layout artists and departments. Riggers and the rigging department conduct rig repairs. Repairing rigs increases the workload for design practitioners and departments. Layout completion is merely pushed back to accommodate this potential delay. It can thus be suggested that layout artists/departments view these glitches as temporary obstacles since they are not responsible for asset repairs. These findings suggest that early planning, testing and organisation reduce problem and glitch potentiality in the storyboard-layout transition. Likewise, these findings suggest glitches are viewed and treated as temporary obstacles. However, other factors may influence these views, such as a practitioner's position in the organisation and familiarity with the tools and processes. It can thus be suggested that such early consideration allows practitioners to utilise *agency* and *knowledge* in preventing potentially costly future mistakes later. This process is open to perspective and temporal influences that may affect practitioner decision-making.

It has been established that a practitioner's team role influences their perspective regarding responsibility for repairing glitches. A practitioner's job role may also influence their approach to creating assets. For example, riggers and animators may tacitly understand and feel responsible for repairing minor issues as they arise, as discussed in the previous example and confirmed by freelance rigger and interviewee Mat Dame (2021). The artist may feel some responsibility for causing the glitch on a model they have created. Dame's example is based on freelance activity, which, as established earlier in the thesis, involves moving from studio to studio and integrating into these diverse teams and practices. One of the main difficulties with this line of reasoning is that the data comes from a freelance context and *in-house* riggers may feel differently concerning role responsibilities. Nevertheless, according to these findings, we can infer that the animation artist (the animation rigger, or the animator, for instance) attempts to repair minor glitches as they occur.

Hierarchical organisation and privilege allocation may influence practitioner responsibility perceptions. One participant usefully identifies that riggers may be the least privileged animation labourer type within studio hierarchies, as such, may feel obligated to take on repair work. Likewise, these findings suggest riggers may wish to prevent possible glitches and repairs to avert future time-costly revisions. It should be acknowledged that these of the views of specific practitioners in distinct contexts, with consequent potential limited applicability to wider production situations. Privilege and practical concerns in series production may contribute to developing optimal working practices. The present study raises the possibility that preventing potential future problems for fellow practitioners is considered part of *best working practices*. For example, animation riggers might adapt their processes to prevent future workload problems. The next portion will discuss the implications of privilege on practitioner and organisational working processes in more detail.

The previous discussions have highlighted that *knowledge* and *agency* are requisites for developing and implementing **successful** changes. However, up until now, one important aspect has only been implicitly discussed: **human interaction**. The next few points discuss the importance of human interaction to both animation workaround development and production processes.

Research respondent and CelAction CEO Andy Blazdell (2022) practically highlights that practitioner labour hours are the most important production resource. Referring to an occasion when a broadcaster changed their minds on previously locked character and environment designs four episodes into a show's production run with a 2-month rolling delivery schedule. As a solution, the broadcaster advocated changing individual frames to update the designs, a process intended to be conducted by an intern, believing the cost of animation labour to be low. Blazdell (2022) argued that the labour-intensive manual updating of individual asset layers across selected frames was impractical. Instead, Blazdell advised using Adobe Photoshop scripts to automate the process. This method, Blazdell emphasised, allowed the broadcaster to define a generic set of rules for changes, which could then be applied before exporting the final sequence. One of the limitations of this explanation is that it does not elaborate on how such decisions may be made in the studio, as Blazdell is acting as an external CelAction advisor in this context. The findings could shed light on the potential differences in perspective between broadcasters and producers. Broadcasters may perceive the surface level of production – the final outputted sequence – whereas producers may have increased awareness of *under the bonnet* aspects of the proposed changes, and understand the differences which might result from these.

> **Original Contribution to Knowledge: Human Interaction Time**
> *The data shows practitioner labour hours are the most important production resource. Changes that use this resource inefficiently often result in additional expenditure in* ***time***, ***labour*** *and* ***budget*** *in rectifying these decisions.*

Building on observations made in *Chapter 5* regarding series re-commoditisation through the release of high-definition versions, it should be acknowledged that Blazdell's solution presented here limits the potential re-exporting of the series in a higher-resolution. This is because the high-definition re-release utilised the original assets in producing a high-definition render. In the solution presented above, new character drawings are limited to the resolution and aspect ratio of the created sequence, making it difficult to generate higher-definition versions, as the additional pixel data required is not present and cannot be generated. Hence, these findings suggest that both *present* and *future* human interaction time need consideration when designing and implementing solutions.

Likewise, the organisational context of Blazdell's solution requires consideration. CelAction primarily works with smaller teams, offering bespoke software solutions, as such, Blazdell as CEO of the company has more authority to influence client processes. As such, this argument has a potential inconsistency, as larger productions may require more capital control and choose to re-produce and export the episodes with the requested changes. Such a potential approach may mirror that of large-scale software manufacturing. Software designer Donald A. Norman (1999, p.51) usefully identifies that management perceives that additional labour allows work to be completed faster. However, coordinating a larger workforce requires more time and effort to manage the labour of these additional workers effectively. Therefore, these results highlight that human interaction is a vital resource, revealing a need to consider the labour cost of any changes to maintain effective use of animation production resources. Animation workarounds should consider this vital labour cost in implementation, to maximise output quality and resource expenditure.

The importance of human labour hours as a resource means interaction time requires careful consideration to minimise human labour wastage in series-making. Blazdell (2022) practically recognises a balance of robustness and stability in workaround viability calculations, emphasising that forcing individuals to complete time-consuming manual work generates knock-on effects when delivering episodes for approval, as departments frequently rely on work produced by other teams within the organisation. For example, a character model is necessary for an animation department to commence work. These comments support the idea that human interaction is a cost-intensive resource requiring careful consideration in production activity coordination.

The present CelAction examples are based on smaller production team experiences, where observation of *where* and *when* work is shifted *to* and *from* is possible. Blazdell's position as a CelAction consultant and advisor offers an advantageous perspective on smaller studio politics. There are limits to how far this concept can be taken. These phenomena may be harder to observe in larger productions, as they will probably contain additional labourers and tasks working within a structural hierarchy. This potentially increases the difficulty in observing the impacts of changes to individual practitioner working processes. It is reasonable to infer that it may be easier to make and track smaller changes in smaller production hierarchies, as the detailed division of labour increases the difficulty of doing so in larger animation organisations. Consequently, it seems that **labour** in smaller organisations is more limited, therefore; it is more important to manage labour changes to maintain cost-effective use of animation production resources. This means that we can conclude that workaround viability calculations require a balance of robustness and stability in using animation production resources efficiently.

Human interaction time and labour are also required to design and implement new resources. Blazdell (2022) recommends analysing the amount of **time** and **labour** implementing a new process will save against the **time** and **labour** required in the original task(s). For example, eliminating tasks that require little overall human interaction time – such as devising a solution to eliminate a task requiring two labour hours every month (like renaming 100 files, for instance), or for other background tasks – are not necessary or cost-effective. These findings suggest that an analytical view is required when considering implementing new resources in the development and execution of animation workarounds.

These balance calculations occur in the *Intentions, Goals and Interests* stage of the *Steps in the Theory Of Workarounds*. The animation workaround designer needs to consider problem severity compared with solution development cost. The change cost may expend more animation production resources than the original problem, nullifying workaround effectiveness.

As mentioned before, these CelAction examples are based on smaller production teams, in which, the labour supply is limited compared to larger organisations, as such, changes may be easier to track, which may be useful as practitioner time is lost on new resource development. Gowanlock (2020, p.63) constructively identifies that larger studios, such as Pixar, utilise separate departments to develop new resources, meaning that time is not taken away from production in the development of new technologies and procedures. Further emphasising that this marketed technological development is part of Pixar's corporate strategy. These observations support the hypothesis that small companies need to consider their limited labour pool when developing new resources, yet also consider the need to innovate to keep up with commercial innovations and marketing processes of larger studios. Gowanlock's analysis does not take account of the potential for information dissemination in smaller production teams, like those in the UK service sector. It can therefore be hypothesised that a high amount of consistent human interaction and a net labour payoff are required to develop a successful procedural change and that animation workarounds are more effective in small and medium productions when they eliminate human interaction.

Chapter 4 established that the detailed division of labour has been a key component of commercial animation organisation since the re-organisation of the Bray studio. Interviewee Andy Blazdell (2022) profitably highlights that having one person who understands a particular task better than anyone else and can complete this task for everyone in the team increases production efficiency. Blazdell's comments reflect a managerial perspective, ignoring the potential benefit of multiple task experiences for individual workers. Nonetheless, these results suggest that it is beneficial in terms of the efficient use of practitioner **time** and **labour** to have practitioners who specialise in specific tasks. This approach utilises the principle of specialisation, detailed knowledge of a task possessed by a practitioner, and the work entailed is focused only on that one task. The specialisation of tasks in animation production results from integrating the detailed division of labour, instigated by Bray's re-organisation of the Bray studio. Therefore, these results support the idea that effectively using practitioner specialisation is key to efficiently utilising animation production resources in maximising output quality while meeting the conditions of commercial production.

Likewise, specialised animation labour can be utilised to increase effectiveness and efficiency in animation production organisations. Research participant and interviewee Rosie Cash (2022) fruitfully observes that storyboard artists and editors understand that the storyboard and animatic articulate the animation narrative in distinct and complementary ways. Arguing for a clear division in the pipeline between editors and storyboard artists, observing that the storyboard excels in detailing poses and dialogue, while animatics excel at visualising song sequences. These comments ignore the need for practitioners to take on extra tasks in smaller teams or other contextual factors, such as staff shortages or project demands. An explanation for these comments might be that with a single practitioner assigned to both tasks, work must be conducted in sequence, and the practitioner may lack time and expertise to complete work at the required quality, whereas, multiple practitioners with distinct specialisms allow parallel working and task specialisation.

This case has shown how specialisation might work in larger-scale narrative series production with the schedule and budget for separate storyboard and animatic manufacture. The US/Hollywood system of production facilitates these budgetary conditions. However, it might be the case that smaller production teams, such as those within the United Kingdom service model, may not have the **budget** and

time for both storyboard artists and editors. This can create increased crossover in practitioner roles and responsibilities. In addition, budgets in this sector may only allow for some of the personnel required, as such, producers and animation management may need to prioritise which staff are required. It is possible, therefore, that smaller productions may not have the **time**, **budget** and **personnel** required to develop both storyboards and animatics. These findings suggest that the sector, narrative and production team size influence the ability to develop a narrative using both the storyboard and the animatic.

It is also possible for these specialised practitioners to work in complementary ways. Storyboard artist and research participant Liz Strawbridge (2021) constructively identifies collaborative working practices existing between storyboard artists and editors in animated feature assembly. Further elaborating that editors have a high-level view of the narrative, helping create cohesion when combining sequences created by different artists. For example, some studios ask storyboard artists to pitch their sequences to editors, who provide feedback on timing and shot choices. However, this argument needs more consistency, as production team size and workload may limit possible interactions and force practitioners to take on extra responsibilities. Nonetheless, these findings suggest that storyboard artists and editors can also work collaboratively. Supporting the hypothesis that editors' high-level overview and narrative expertise complements storyboard artists' practical specific-level view and knowledge of posing and staging. These distinct specialisms and sequence views are synthesised, maximising output quality.

However, it should be acknowledged that feature manufacturing cycles allow additional time for narrative development compared to series rolling delivery. These additional considerations may limit the time available for storyboarding, and an editor could also request extra shots during the episode-making process. Furthermore, series episodes might have tighter deadlines. As such, collaborative processes are driven by the necessity imposed by rolling production deadlines in series-making. Likewise, in smaller production team contexts, there may only be one storyboard artist, reducing collaborative potentiality, however, increased role crossover might offset this. It is probable, therefore, that in series-making, storyboard artists and editors collaborate to meet the conditions and demands imposed by rolling delivery dates.

So far, the thesis has emphasised the significance of animation labour, but it has yet to address the cost of this crucial resource. Interviewee Rosie Cash (2022) argues that not all storyboard artists are proficient at editing and that asking them to create animatics undermines skilled editors who specialise in that process. Cash (ibid.,) maintains this can reduce quality and negate any potential cost savings. These comments fail to account for personal or staff training and increasing task experience and efficiency. Nonetheless, these findings support the idea that animation management controls production costs by reducing overhead expenses. Likewise, these data highlight that the perspectives of studios and artists differ. Animation management seek production cost curtailment through overhead reduction, while animation labourers value practitioner skill and ability in task execution.

It is important to acknowledge that Cash's example is from a larger animation studio with multiple personnel for each process stage and requisite task. In this context, animation management may look to reduce staff numbers rather than actual roles, as maintaining the detailed division of labour may still meet their objective of cost-effective production. These observations suggest that reducing available project staff requires animation labourers to take on additional work to compensate for reduced personnel and the parallel tasks they would have completed. Likewise, conditions such as potential staff shortages may require personnel to take on extra duties, as beneficially identified by Chen. Thus, to meet the conditions of commercial production, it is necessary to consider the resource cost, the artist's specialisation, and the output quality of any task or personnel alteration.

> **Original Contribution to Knowledge: Management Overhead Reductions**
> *Animation management attempts to reduce overhead costs redistribute the same remaining work volume among fewer animation labourers, increasing individual workloads and potentially causing wider production delays and revisions, as practitioners may short-change processes to maintain the production schedule.*

Likewise, attempting to reduce labour costs through a combination of specialised roles generates additional production process consequences. Reducing overhead cost through role amalgamation results in a short-term reduction in assembly cost (a *local consequence*). However, the reduced team size results in practitioners completing work outside their expertise, reducing quality and increasing the **time** required. This is because of limited parallel working (a *broader consequence*). Therefore, reducing production costs through constraining the amount of **animation labour** brings significant *local and broader consequences*, that potentially inhibit meeting the conditions of commercial production. *Figure 7.1* illustrates the *local and broader consequences* of attempting to reduce overhead costs.

Figure 7.1: Attempts to lower the cost of production through the reduction of animation labourers analysed through the *Theory of Workarounds*.

Thus far, this chapter has argued that animation production resources are limited in contemporary series-making, and that these limitations influence the traditional organisation of animation assembly processes in controlling manufacture costs to meet the conditions of commercial production. This section has demonstrated that these established methods of controlling production costs can be over-zealously used by animation management, resulting in situations where work needs revising, costing additional **time** and **labour**. Such occurrences result from only considering the impact from a single angle, such as the labour cost. Therefore, the findings suggest that a holistic and analytical view is required when making resource decisions that best utilise practitioner working processes and collaboration. In this organisation, practitioners view preventing downstream errors as a *best practice*.

These findings are important because they suggest that the organisation of animation production resources is a delicate balance between finance, artistic and working factors. All of which need consideration when making effective management decisions regarding the effective utilisation of animation production resources to meet the conditions of commercial production. These results show that animation workarounds are essential to surmount resource limitations and effectively manage manufacture costs and are consequently indispensable for commercially viable animation assembly. The next section focuses on considering the power balance in studio organisations.

SECTION 7.2

Power Balance in Studio Organisations

The opening of this section presents the essential concepts needed to comprehend how privilege is distributed within the hierarchical framework of modern animation studios. *Chapter 5* established that studio animation production is organised into both deep and flat hierarchical structures, with animation labourers (such as animation artists) performing work and reporting to animation management (senior personnel and department leaders, for instance). Likewise, this study established that this separation of animation labour and management mirrors the influence of the conception/execution divide which pervades management thought, as established by Jelinek (1980, pp.66-67). However, Jelinek overlooks 20$^{\text{th}}$ Century management concepts like *Kanban*, *Just in Time production*, and *Total Quality Management* (TQM), but accurately summarises management thought for this discussion. It is possible for animation labourers within this organisation to be differentiated. Matt Stahl (2010, p.55) provides a classic in-depth example of the significance of stratification within animation studio organisational structure and practices. Stahl (ibid.,) proposes a strata-based model of cultural labour, in which copyright and stratification – *the line* between creative and technical employees – separate authors and non-authors of animated content making. This analysis suggests that practitioners with higher status or privilege within the studio hierarchy wield greater influence over studio processes and workloads compared to their less privileged team members.

It should be acknowledged that Stahl examines the working processes of larger studios in the United States, such as DreamWorks. Such larger organisations usually implement a detailed division of labour and deeper organisational structures.

These facilitate the separation between conception and execution tasks in commercial animation production. Such examples are useful for this research discussion, as they allow the identification of important concepts such as privilege allocation and their potential impact on practitioner working processes. However, it should also be noted that production conditions in the United Kingdom service sector may be different. Many of the present study's research participants work in this context. Teams in this context might possess fewer team members, which generates the conditions for increased crossover in practitioner roles and responsibilities. *Chapter 5* and the previous section discussed this. Such conditions may mean increased difficulty in privilege allocation and process influence in smaller teams. Therefore, it seems that animation labourers exist in a privilege hierarchy in commercial production organisations.

Situational contexts may influence animation hierarchies. Contextual factors also influence the amount of privilege granted to practitioners. Research participants Rosie Cash (2022) and Andy Blazdell (2022) both pragmatically argue that animators often constitute the largest part of a project workforce, while projects often suffer from a lack of designers, who are expected to complete additional work with fewer personnel. These comments suggest tasks other than animation may be considered ancillary. An implication of this is the possibility that less privileged departments and individuals, such as designers and the design department, are expected to complete their allotted tasks with fewer staff. It is possible, therefore, that department size and visibility within the commercial animation organisation contribute to privilege allocation. This is a valuable illustration of processes in larger animation studios that utilise the detailed division of labour.

Animation management perceptions influence privilege allocation. However, it is important to consider that external clients often dictate production budgets. Likewise, a producer's knowledge of production methods may affect hiring processes. For example, producers may hire more animators as they may be less familiar with the specifics of tasks and assume that these personnel can complete many requisite tasks, rather than hiring *riggers*. External factors, like capital demands, can affect privilege allocation, as can internal ones, like animation management's knowledge and expertise. More visible production aspects, such as character animation, have a greater impact on decision-making, the coordination of production activity and the allocation of animation production resources. Hence, it can be hypothesised that department size and visibility influence the privilege awarded.

Performed tasks could impact privilege allocation within the production hierarchy.

Practitioners conduct different types of work within animated series-making, such as animation, storyboarding and character model construction. Blazdell (2022) constructively recognises that there are often fewer riggers than animators in production teams, which can create bottlenecks. Insightfully and pragmatically observing that puppets are technically demanding, often involving complex engineering considerations to achieve the desired results. It can thus be suggested that technical animation aspects and processes involve more human interaction to operate and maintain, especially when problems arise.

In digital production, producers may assume character rigs can be created through a *copy and paste* process[1], whereas animating these models may be perceived as taking place over a longer term and requiring more work and, hence, more staff. Blazdell (ibid.,) productively identifies that rigging is a specialist task and that animation production teams typically contain more animators than riggers. The comments suggest that practitioners must overcome these conditions created by animation management perceptions and actions. These findings suggest that practitioners must use practical task knowledge to avoid potential bottlenecks. Resource constraints and technical demands on less privileged workers can create bottlenecks, as these animation labourers have limited **time** and **labour** to work on complex tasks. It can thus be hypothesised that the nature of assigned work influences awarded privilege in commercial animation hierarchies.

The first part of this section discussed the influences of awarded privilege on practitioners and departments. The remainder of this section explores the impacts of privilege and privileged individuals and departments exert on working processes in contemporary series-making. The awarding of privilege potentially affects the allocation of animation production resources in commercial series-making. One participant constructively maintains that design department budgets are consistently restricted, often with no option to complete work during overtime. Likewise, observing that riggers are among the least privileged practitioners who are expected to solve problems with character puppets passed on to them from the layout department. However, such explanations overlook how different studios may have differing privilege hierarchies. Nevertheless, these comments suggest that technical – and perceived less creative aspects of animation assembly – are prioritised lower than creative and visible ones. An explanation for this might be that these tasks may be seen as unglamorous, uncreative and tedious. These findings

[1]This process is facilitated by the principle of digital-replicability. *Chapter 4* discussed the implications of this process.

provide a valuable illustration of resource development in larger animation studios that can utilise the detailed division of labour.

An important consideration is the impact on smaller production teams. Animation director and interviewee David Blanche (2021) constructively observes, that in such contexts, practitioners may have to complete work in their own time to make up for unavailable resources, such as a shortage of production personnel. These comments reflect a pragmatic, responsible and task-focused perspective, but fail to consider other practitioners' potential perspectives regarding agency and responsibility in production contexts. Nonetheless, these findings suggest that the detailed division of labour enhances potential privilege allocation. If no other practitioners are available, work cannot be shifted onto them, as might be the case in smaller animation organisations. Privilege tends to shape the distribution of resources within commercial production hierarchies. Therefore, less privileged sectors/individuals may have limited resources in these organisational situations.

The detailed division of labour requires multiple workers to perform tasks simultaneously and in parallel, thus, reducing available workers constrains parallel task capacity, creating a potential production bottleneck. Research respondent Andy Blazdell (2022) has previously demonstrated that there are often fewer riggers than animators in contemporary production teams. This can create bottlenecks, as puppets are technically demanding, often involving complex engineering considerations to achieve the desired results. However, such explanations overlook how rigging occupies less time compared to animation in the total course of production. These findings indicate that technical animation assets and processes may require more human oversight and intervention, particularly when issues or problems occur.

This is a fruitful illustration of processes in smaller production teams. For example, CelAction riggers may predominantly be freelance workers, employed *as and when* they are required in production, such as the case with interviewee Mat Dame. In this context, creating character rigs in software, such as CelAction involves complex engineering. Freelance riggers, such as Dame, may specialise in specific software, creating practitioner specialisation that may create bottlenecks. As the only practitioners who can solve rigging problems may not be available due to working on another CelAction project. Hence, it can be conceivably hypothesised that practitioner specialism in bespoke processes influences potential bottleneck occurrence. It is possible, therefore, that resource constraints and technical demands of less privileged workers can create bottlenecks, as these animation labourers have limited **time** and **labour** for completing complex tasks. According to this data, we can infer that the reduced team size of less-visible sectors increases the potential of production bottlenecks in commercial series-making. There are fewer specialised individuals to complete technically challenging tasks, such as rigging, especially when unscheduled problems and mishaps occur.

> **Original Contribution to Knowledge: Studio Privilege Allocation**
> *Practitioner and department privilege is influenced by the type of work conducted: creative or technical, department size and visibility. Privileged practitioners and departments can shift work, such as mundane technical tasks, onto less privileged individuals and sectors.*

This section has examined how privilege affects resource distribution. Now the section explores the impacts of privilege on working processes in contemporary series-making. One participant, working in a larger studio, highlights that storyboard artists and departments are often privileged, although acknowledges that this can vary among studios, emphasising that ambitious directors may ask storyboard artists to create complex sequences. However, the comments overlook how privilege is distributed in other studio settings and smaller production environments. Nonetheless, these findings support the idea that senior personnel and directors are granted autonomy for decisions that increase perceived series production value. Even though these decisions create additional work for other departments and individuals, such as the design department. This is a constructive illustration of storyboarding processes in larger studios.

However, it might be the case that the director may not be able to change sequences after the shot has been animated, as this would require additional approval for the extra animation production resources required to execute these changes. It can thus be suggested that such sequence changes are made in the context of production practicalities. A possible explanation might be that leeway may be determined by production practicalities and that limits are imposed by capital and broadcaster release schedule(s). Therefore, work perceived to have a higher production value potentially increases privilege allocation and the ability to make *filmic* and *directive* choices. It is reasonable to hypothesise that visibly creative sectors have more leeway in the decision-making process.

The potential to influence working processes is not limited to senior production team members. Interviewee and CEO of CelAction, Blazdell (2022) insightfully highlights power often rests with editors and animators rather than the producers, who are the theoretical practitioners with decision-making authority. Further observing that it is common for animators to complain about, and seek solutions for, eliminating technical and tedious tasks, such as waiting for a sequence to render and export; contending that generating solutions to these tasks does not increase efficiency. Instead arguing it is more efficient for artists to take a break during exports than to invest costly time and labour in additional solution development. These pragmatic and observant comments provide a useful studio-neutral perspective. As such, these findings support the idea that privilege allocation ignores traditional hierarchy. Vocal individuals who conduct creative tasks can exert more influence than animation management (producers), who traditionally coordinate resources and workloads. This example provides a valuable illustration of the overlap in practitioner processes and the closer relationship practitioners may have with producers in smaller production teams, such as those facilitated by CelAction. In this context, **time** and **budget** limitations may make it harder to recruit new staff, and therefore, animation management make do with available personnel. In general, it can therefore be hypothesised that privileged vocal and creative workers can alter and influence procedures despite their position in the organisational hierarchy in contemporary series-making.

Likewise, practitioner personality can influence both the awarding of privilege and working processes. Blazdell (2022) pragmatically recognises that production teams are usually led by one or two charismatic people who lead the consensus and who may complain about conducting perceived trivial and time-consuming tasks. Further highlighting that it is 'the shy people who come up with genius ideas, the good and weird ideas, those that are not taken to the mob' (Blazdell, 2022). The comments reported here suggest that such shy practitioners may refrain from suggesting changes perceived as outlandish. This is a constructive illustration of personal characteristics influencing practitioner processes in smaller CelAction production teams.

However, it is possible to hypothesise that process changes led by vocal practitioners are limited by hierarchical and formal process constraints in larger studio contexts. Such constraints might consist of formal descriptions of working processes and job roles. Peer pressure can constrain the development and implementation of potential improvement ideas. The data suggests that charismatic individuals can sway consensus, which may constrain the development of potential solutions, including animation workarounds, in modern-series making.

The thesis has discussed how privilege allocation allows team members to influence and change established processes. The next part of the discussion explores the costs of these process changes. Blazdell (2022) highlights adding extra work onto individuals and departments – such as the shifting of work onto less privileged practitioners – *doubles* the amount of **time** required due to the original work being delayed by the *additional* shifted work. An explanation for these comments might be that these tasks cannot be completed in parallel without additional **personnel**, meaning extra **time** is required to complete both the original and additional tasks. Blazdell (ibid.,) has provided a fruitful illustration of the implications of changing established processes, specifically illustrating how team consensus influences potential animation workaround development in smaller CelAction production teams.

However, it is reasonable to assume that tracking such process changes is difficult in larger studio contexts, as said tracking is done through an individual's informal observation of production processes. Such theorising raises the possibility these effects might be mitigated in larger studios where shifted work is completed by many animation labourers, or in instances where the change is completed outside allotted production time. Moreover, it should be acknowledged that doubling the required **time** and **personnel** costs is conceptual, and applies to in-progress productions, though it is pertinently relevant for series with rolling delivery deadlines. Shifting work onto other individuals/departments relieves the workload of some practitioners, but increases the work of others and the amount of **time** required to complete the project. In general, changing established procedures in this way incurs additional labour costs.

Shifting work also impacts the wider production team and project progression. Interviewee Andy Blazdell (2022) productively recognises that a continual flow of information is needed in production to prevent bottlenecks. Pertinently highlighting that the primary challenge is tracking and anticipating potential problems down the line, to ensure information – animation work – continually flows through the production process. However, such explanations overlook aspects of episodes that may be produced in parallel in series-making contexts. Nonetheless, a possible explanation for these comments might be that shifting tasks can create bottlenecks. The originally planned work is postponed to prioritise the shifted assigned tasks. This original work is needed for subsequent tasks. For example, animators need completed character models to commence animation, and these rigs may be delayed if riggers have to complete additional shifted tasks. This efficaciously illustrates the effect of compounded additional work from shifted tasks in small-scale production teams, such as those serviced by CelAction.

However, the comments overlook the decision-making involved in broader studio contexts and processes, such as animated feature production. Research participant and Lead Layout Artist Antonia Gancheva (2022) provides a fruitful demonstration of pipeline development in feature production, elaborating that the director and technical director design the pipeline beforehand. These findings support the idea that, in features, the information flow is planned. As such, personnel may be reluctant to change these designed processes due to the time and budget investment involved in the process design. It is possible, consequently, that task shifting has a greater impact when there are fewer personnel and is more likely to occur in smaller production team contexts. Thus shifting tasks can reduce individual workloads, but it may also lead to wider delays in the production schedule.

Likewise, shifting workloads and tasks onto other practitioners has local and wider impacts. *Local consequences* of shifting work may include technical departments having to complete additional work with fewer staff members, as such, tasks may be delayed depending on approval. Likewise, shifting technical tasks removes temporary problems for privileged practitioners, however, less privileged individuals/departments – whom the work is shifted onto – are forced to complete additional work on top of their allocated duties. This may generate the *broader consequences* of potentially delaying other tasks requiring input from the aforementioned workers. Similarly, depending on the nature of the shifted work and the skills required, those allocated extra tasks may not know how to complete these properly. A factor that could cause problems if tasks are completed incorrectly. It is possible, therefore, that privileged individuals/departments are most likely to shift perceived technical and unpleasant tasks. Shifting workloads may focus on an individual's tasks, but the broader impact on overall production is often overlooked. The next part of the section discusses individual and department privilege allocation in contemporary animation production.

> **Original Contribution to Knowledge: Task Shifting**
> *Shifting tasks onto less privileged practitioners and departments benefits the individual, reducing their workload, but costs those whose workloads have increased, and as a result, the wider production, as crucial work originally scheduled may now be delayed.*

It has been established that designers and riggers are among the *least* privileged practitioners/departments in contemporary studio organisational hierarchies. One interviewee subjectively claimed the layout department is privileged due to the availability of guides and assets accessible in layout creation, further observing that some layout departments over-vocalise their workloads, blaming errors on the design department and shifting work onto designers. However, this dynamic may vary among different studios and team members. Nevertheless, this argument relies too heavily on the personal opinions of layout tasks. These comments suggest that layout departments can shift technical tasks onto design departments, potentially through sending revisions and additional work, for example, requesting difficult asset revisions. This is a helpful illustration of privilege allocation in larger studios. These larger organisations are structured into distinct departments with clearly defined practitioner roles and responsibilities. Nevertheless, it must be acknowledged that these are the subjective views of one participant. The detailed division of labour contributes to and influences privilege within contemporary animation production.

Likewise, awarded privilege may vary among departments and practitioners. Research respondent and Senior Storyboard Artist Rosie Cash (2022) practically observes that some studios are less strict regarding asset reuse, creating work for the design departments who must create additional assets to facilitate this increased reuse. Likewise, emphasising that production team ambitions increase as the season progresses, potentially increasing design department workloads. These comments illustrate a useful and pragmatic *shop floor perspective*. The findings support the idea that animation management, storyboard and layout artists make decisions concerning asset reuse. The design department must implement these decisions, which must complete work conceptualised by more privileged individuals and departments. This is a fruitful illustration of privilege allocation in larger animation studio contexts. In general, therefore, the design department is observed to be the least privileged sector in contemporary series-making.

This strata of privilege can be understood through the *Work System Framework*. Privilege allocation allows privileged individuals/departments to influence these elements of the *Work System*, existing within the animation studio itself. Privileged practitioners/sectors reduce aspects of their workload deemed undesirable, offloading these onto other individuals or departments. The shifting of work from privileged practitioners/sectors to less privileged individuals/departments can bring the *local consequence* of increased workloads for less privileged individuals/departments. Thus, bringing about the *broader consequences* of less privileged workers/areas missing their scheduled deadlines and potentially the delivery date for the project itself. Therefore, animation management must consider the *local and broader consequences* of privileged practitioners/sectors attempting to shift work in the studio organisation, potentially inhibiting the entire production team from meeting the conditions of commercial production. *Figure 7.2* illustrates the allocation of privilege in studio organisations.

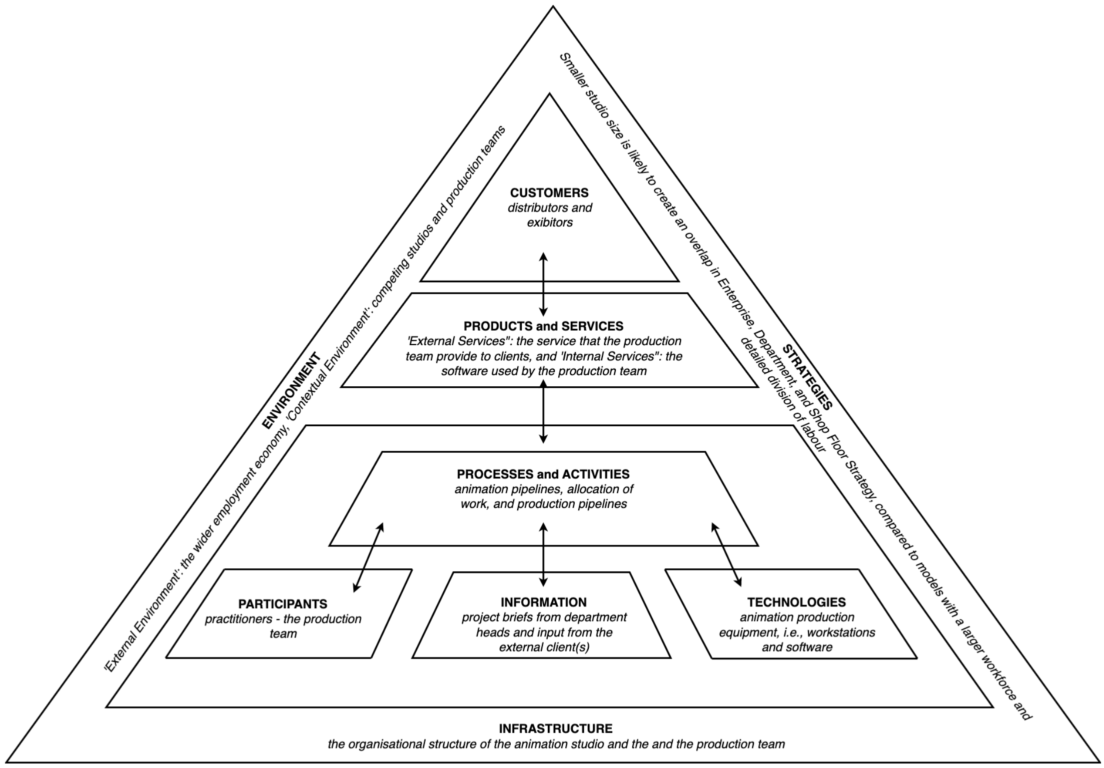

Figure 7.2: The Work System Framework applied to Power Balance in Animation Studios.

Thus far, the section has illustrated that animation labour exists within a hierarchy of privilege, in which department size, visibility and work type influence awarded privilege. The section illustrates that awarded privilege allows vocal and charismatic team members to influence established processes by shifting work and tasks onto meeker individuals and departments. The findings suggest that this influence restricts the development of animation workarounds. Privilege also creates a consensus that practitioners with novel ideas may feel reticent in challenging. These findings also highlight the importance of awareness of privileged individuals' and departments' ability to shift work. Shifting work responsibilities can lead to increased workloads for individual team members, potentially causing production delays across the entire project. These organisational and resource conditions mean that animation workarounds can be used for ill – the reduction of personal workloads – by animation labourers, disrupting commercial production. The final section of the chapter provides conclusions on the relationship between animation workarounds, production resources and privilege relationships in contemporary series-making.

Conclusions

The current chapter has identified that cost-effective production is organised early to maximise efficient use of animation production resources. This appears commonsensical, however, resource limits delay and reduce this decision-making, consequently limiting the available time for other production tasks, including planning, execution and review, manifesting additional revisions. The second major finding presented in the chapter was that workaround designers need to consider the scope of any proposed change. In general, it seems that the **time** and **labour** required in solution design and implementation must be weighed against the problem costs in terms of animation production resources.

The investigation found that privileged practitioners influence and alter established processes. Furthermore, a major finding was that these alterations are motivated by personal gain – individual and departmental workload reduction – and potentially cause wider production delays. It can therefore be hypothesised that awarded privilege is influenced by creative visibility, department size, work type and personal qualities.

Processes including conception, resource allocation, execution, control and method alterations all require human interaction. This manipulates information – through decision-making and work – ready for the next production stage. Artificially accelerating the production process by skipping ahead to the next stage bypasses critical manipulation steps. This forces the activity to regress to complete the necessary prerequisite calculations. Therefore, privilege-influenced process alterations require additional human interaction to change methods. This removes human interaction time from originally planned work, which can cause potential production delays.

The chapter has provided a deeper insight into the relationship of process changes concerning animation production resources by expanding Alter's (2013) and (2014) models from the field of *Information Systems* (IS) to animation production. Specifically, this chapter contributes to the idea of animation production as an *information system*. This understanding is relevant for the animation industry, allowing new knowledge of the impacts of privileged practitioner process alterations. This contribution is made by foregrounding tacit knowledge – the vital importance of human interaction time and studio power balance.

Likewise, the chapter contributes to the understanding of labour in commercial production. Extending Stahl's (2010) hierarchy of cultural production into UK series animation, providing new understandings of how privileged practitioners and departments can influence established production processes.

It should be acknowledged that a lack of quantitative data limits this current study. While the chapter recognises practitioner labour hours as a critical resource, it lacks a quantitative examination of the impacts resulting from changes to privileged processes. Likewise, the research examines examples of UK-based animation to understand process alterations in the transnational US/Hollywood animation model. Therefore, certain factors may differ between UK and US studios, organisational size is one factor that may vary between these studios. Such factors may influence the nature of findings relating to labour organisation, potentially limiting this chapter's conclusions to 2D cut-out series-making with smaller production teams.

As such, future studies can use quantitative data to generate new in-depth understandings of privilege impacts on processes. Likewise, subsequent research can investigate privilege in other geographic locations. Such studies can generate new understandings concerning the impacts of privilege allocation on practitioners and processes in the US/Hollywood production model. The next chapter examines animation workarounds in the storyboarding process.

CHAPTER 8

The Storyboard Process In 2D Cut-Out Animation

This chapter explores the relationship between animation workarounds and the storyboarding process. To date, only a limited number of animation workarounds have been identified in the storyboarding processes of contemporary animation production. This chapter sheds new light on the function and motivation behind the design and implementation of process changes in the storyboarding stage of 2D cut-out series-making. The first section of this chapter – *The Storyboard and Animatic* – will examine animation workarounds in the storyboard-animatic transition, while the second section – *Storyboard Shot and Sequence Changes* – explores shot and sequence changes made during the storyboarding phase.

SECTION 8.1

The Storyboard and Animatic

Before the chapter begins to discuss the relationship between animation workarounds and storyboarding activity, it is important to define important key terms underpinning the discussion. Janet Blatter provides useful terms for analysing storyboard activity, identifying that storyboards facilitate three aspects of animation production: **organisation** (the *directive* domain), **story logic** (the *fictive* domain), besides **filmic storytelling** and **continuity** (the *filmic* domain) (Blatter, 2007, pp.9-13) in a *Classical Hollywood Cinema* (Bordwell et al., 1985) mode of film-making. Blatter's argument is based on observation of storyboard artists and storyboard meetings, however, as Pallant & Price (2015, p.157) observe, Blatter's analysis only looks at storyboards, ignoring animatics and other forms of previsualisation. Thus presenting an empirical limitation to the model. Nonetheless, this theory is useful for understanding and categorising the activities involved in industrial animation production, specifically planning and producing activities, providing useful terms to analyse and categorise storyboarding activity. This study expands upon the limits to Blatter's framework by examining the activity occurring during the transition from storyboard to layout.

This early part of the section discusses the different ways of approaching storyboarding practice and how they are utilised in contemporary production. Two approaches to storyboarding practice can be identified. The first is the traditional storyboarding approach, where the narrative is refined in an inexpensive medium before animation commences. The second is the real-time evaluation and testing approach, where story ideas are tested and evaluated in an animation render environment in real-time (Davis et al., 2011, p.207). In the traditional storyboarding approach, narrative ideas are worked out far in advance of production, whereas, Davis et al. (2011, p.207) recognise the real-time evaluation and testing approach allows the discovery of ideas that were not possible using traditional methods, however, observing that this process lacks a high-level narrative overview that is often provided by a script, beat-sheet or thumbnail, for instance. The need to control project costs to meet the conditions of commercial production means that the traditional storyboarding approach is predominantly utilised in commercial production processes. This is motivated by the need to reduce unused content generation. Practitioners use aspects of the real-time evaluation and testing approach when developing ad hoc changes to production practices. These modifications are often made using animation software like Adobe Animate, CelAction, or Storyboard Pro. The discovery of new creative ideas is a key point regarding in-environment articulation.

This creative discovery process often requires significant time, a luxury that may not be readily available in a commercial production environment. Pallant & Price (2015) and Ward (in: Honess Roe, 2020, p.160) both acknowledge that instrumentalist texts portray the storyboard as being invented in a determinist manner. However, acknowledging that the development of the storyboard and storyboarding activity was an iterative process influenced by key contextual factors, such as the need to develop a means of articulating animation narrative and organising the production of shots in a profitable animation enterprise. On the other hand, machinima animation – the source of Davis et al.'s identification of real-time processes – is predominantly a single-person, non-profit mode of production. As such, Davis et al. fail to consider commercial influences on narrative articulation. Storyboards coordinate the labour of multiple practitioners, as acknowledged by Ward (in: Honess Roe 2020, p.155). The need to storyboard is driven by the requirement to ensure articulation of the animated narrative and project profitability. In-environment testing and evaluation allow the serendipitous discovery of new creative ideas impossible in other approaches. Such discoveries can be narrative or take the form of animation workarounds, hence this topic's validity in this thesis' discussion. This chapter explores changes to storyboarding processes, utilising aspects of this real-time evaluation and testing approach.

The traditional storyboarding approach has been formalised into accepted animation assembly processes. Instrumentalist texts, such as *Producing Animation* by Winder & Dowlatabadi (2001, pp.186-197) describe a storyboarding procedure consisting of **thumbnails**, a **rough pass** and finally, the **cleaned up storyboard**. This three-stage method is often presented as the standard storyboarding approach in studio practice and instrumentalist literature, failing to consider how other activities may perform scripting articulation, as recognised by Wells in Nelmes (2010). It should be acknowledged that this example does not consider animation narrative development in other forms and geographic locations of animation production. However, concerns about clarity and efficiency can influence how individual storyboard artists approach their work.

Storyboards visualise scenes and allow *directive* decision-making. The arguement concerning the significance of preproduction processes and artefacts managing labour in animation assembly is provided by Ward (in: Honess Roe 2020, p.155), who argues storyboards inhabit a contradictory space, being vital pipeline aspects yet are devalued as subordinate parts of animation activity. Specifically arguing that storyboards visualise and articulate the narrative and are planning and management tools formulating practicalities of shots, budgeting and resource provision (ibid., pp.160-163). These comments suggest that storyboards are scene and sequence representations used in mobilising production and personal resources, allowing productive decision-making.

Ward is a distinguished scholar, and the study is based on an investigation of production processes at Aardman Animations, and is, therefore, a useful illustration of stop-motion production processes. Ward (in: Honess Roe, 2020, p.160) also usefully identifies that storyboards coordinate the labour of different departments and practitioners and that studios use storyboards in different ways, likewise, that storyboard renderings influence the construction of physical sets and props. However, Ward's (ibid.,) argument relies heavily on 3D stop-motion production and does not consider 2D digital vector contexts. Therefore, storyboards may function differently in 2D cut-out animation than they do in other animation styles. The flat nature of 2D assets means that they have limited viewing angles. Therefore, the angle of a prop used in a storyboard panel may influence the creation of a new asset, as acknowledged by interviewee and Senior Layout Artist Anye Chen (2022b). Consequently, the traditional storyboarding approach is used as a means of testing, developing and eliminating *fictive* and *filmic* ideas before they are generated in the costly production phase. Therefore, the decision to utilise this approach is motivated by a desire to control production costs.

Artists can adapt these established processes. Rosie Cash (2022), a Senior Storyboard Artist and research participant, argues against constraining artists' early ideas. Instead, she advocates using thumbnail sketches in rough storyboard sequences, sometimes substituting drawings with written descriptors, such as 'close-up (CU) of a character'. Cash emphasises that this quicker method of storyboarding suits her non-visual thinking style. This comments suggest multiple methods of articulating narrative but fail to consider these because of a focus on personal process efficiency. A possible explanation for these comments might be that this animation workaround focuses on representational efficiency and facilitating storyboard decision-making. For example, using text descriptors to represent familiar elements frees the artist's attention to consider other *filmic* and *fictive* scene concerns, such as staging and dramatic impact. However, it should be acknowledged that this illustration works when storyboard artists and other key personnel can understand the panel's content and intention. Ward (in: Honess Roe 2020, p.160) usefully acknowledges that the storyboard acts as a *directive* document. Likewise, Blatter (2007, pp.16-20) identifies that artists can use supplemental communication alongside the information portrayed in the panel, such as hand movements, to aid in expressing the meaning, purpose, action within and intention of a panel or sequence of panels. Storyboards are therefore likely highly context-specific, as practitioners often communicate information through diverse modalities, such as visual, auditory, or kinestheticly. Consequently, we can infer that storyboards function *with* contextual information to portray and articulate the *fictive*, *filmic* and *directive* project aspects. These comments suggest that the idea posited by the *three pass* method is limited, failing to account for an individual's unique information processing tendencies and utilising supplemental communication through artefacts, writing and gestures. Hence, it could be conceivably hypothesised that practitioners alter the *three pass* method to increase efficiency, reducing the individual expenditure of personal **time** and **labour**.

This middle portion of the section explores storyboard functionality and animation workarounds in the storyboarding stage. Character model complexity and the required action influence sequence storyboarding decisions. Cash (2022) practically illustrates using the example of a character putting on a coat. Arguing that storyboard artists can cut from an interior shot of a character without a coat to an exterior shot of the character wearing a coat. Thus, avoiding showing the complicated action of putting on the coat. Likewise, in an example of a flying car, the car can drive off-screen and appear flying with extended wings in the next shot, rather than animating the extension of the car's wings, which is a complex action in CelAction. A possible explanation might be that, in these examples, the storyboard artist uses the principles of montage and cutaways to ensure audience comprehension of the animated narrative. Such an approach suggests a balance of practicality and conceptual concerns.

Complicated CelAction models in 2D cut-out production can impede artists' workflows and shot decision-making. Practitioners' ability to quickly conceptualise, execute, and evaluate results enables generative decision-making and reflection, increasing process efficiency that would not be possible without immediate access to animation assets. This is facilitated by the immediate access to assets and scenes in 2D vector production. However, in the example of physical stop-motion production, practitioners may put a coat (or other covering) onto the model for the shot, or animators may be influenced by the action portrayed in the storyboard. As a result, artists may look at the storyboard and amend the action. The complexity of animation models is a practical consideration and may become more apparent when physically working with the model, compared to the storyboarding stage, which may be focused on articulating conceptual production aspects. Therefore, an understanding of model mechanics and practicalities, both practical and conceptual, is required to make effective decisions to cut away to avoid additional work. For example, moving the model in a way that is not feasible or re-arranging action in a way that is challenging for an audience to understand. Decisions to cut away from an unimportant and complicated action are motivated by quality demands and meeting the conditions of commercial production. In general, it therefore seems that cutting away saves **time** and **labour** required in animating complicated action.

It has been established that the storyboard is a *working document*. Research respondent and CEO of CelAction Andy Blazdell (2022), makes the pragmatic case that storyboards articulate the broad strokes of narrative ideas, prioritising communication of the scene action over accurate representation of assets, emphasising that in doing so, storyboards may omit certain factors. Senior Layout Artist and interviewee Anye Chen (2022d) notes that storyboards often suffer from inaccurate perspective and scale, as storyboard artists frequently lack the time to create polished storyboards. By identifying and addressing these ambiguities, layout artists can gain more creative agency when assembling layouts, enabling them to develop compelling lighting compositions that align with the storyboard depictions. According to these data, storyboard ambiguity and established aesthetic style determine layout artist agency. For example, a stylised series may not be enhanced by adding high-contrast lighting in the layout stage. Therefore, storyboards articulate broad narrative action, creating ambiguity that affords layout artists agency in composition creation that is otherwise constrained by established project style. These contrasting sources suggest that storyboard ambiguity and functionality are contextually dependent and subjective. Thus, a universal definition of how much ambiguity is effective is difficult to achieve and potentially purpose-defeating.

Moreover, this crossover in practitioner decision-making is present in other parts of the production process. Interviewee and storyboard artist Liz Strawbridge (2021) makes the case that while editors traditionally manage cutting decisions and animatics, layout and storyboard artists can also contribute timing and cutting choices in their respective artefacts. These choices are indications of future timing and shot selections that allow the integration of decisions from other practitioners. Thus editorial changes made during the storyboard and layout stages are often less noticeable, yet more likely to be implemented in the final animation. Thus, complementary practitioner authorship and decision-making is hidden from the audience and other practitioners.

This latter part of the section discusses the storyboard-animatic transition and the role animation workarounds play in this part of the production process. Storyboards are two-dimensional artefacts, they possess quantifiable height (x) and width (y) dimensions, while animatics can thus be described as having an extra time (t) dimension above storyboards. Storyboard artists can utilise this quantitative data. Senior Storyboard Artist and interviewee Kayvon Darabi-Fard (2022) recognises that storyboard artists are not usually consulted on budgets, however, emphasises that storyboards can be used as a tool to make early calculations of frame counts, duration, backgrounds, layout reuse and musical cue length. Further highlighting that these estimates can be accurate if the animation is of a *production ready* standard and that these estimates are for personal use only. Thus representational concreteness increases future *directive* decision-making capacity.

The findings may be explained by the fact that storyboards often artificially represent 3D objects in a 2D flat medium, as observed by Blatter (2007, pp.9-11). Blatter further illustrates how the temporal dimension of film is determined by the number of frames shown per second and the construction of surface elements, as the storyboard itself is a flat, bounded 2D representation of the final animation. The animatic is also a flat and bounded 2D representation of the final animation with an additional temporal dimension, represented by the video file's frame rate (12, 24 or 30 frames a second, for instance). It is possible, therefore, that storyboards and animatics can plan personal (*micro-level*) animation activity. This estimation process can be categorised as the *Augmenting of Existing Routines Without Developing New Resources* in the *Theory of Workarounds*. It can thus be hypothesised that established processes are amended to provide personal planning functionality, as illustrated by Darabi-Fard's (2022) example. Therefore, the storyboard is a useful tool for coordinating individual's *micro-level* activities, however, this ability is influenced by representational concreteness and contextual and subjective considerations.

The differing dimensionality of the storyboard and animatic allows the two artefacts to articulate the animation narrative in complementary ways. Animatic's temporal dimension suits song sequence development. Blatter (2007, pp.9-10) observes that the constraints of the film/animation medium contribute to the form of storyboards. For example, storyboard aspect ratio and resolution mirror the final presentation format, such as the screen's aspect ratio. Interviewee and Senior Storyboard Artist Rosie Cash (2022), highlights that songs can be problematic to depict in PDF format storyboards, advocating that it is more effective for animatics of song sequences to accompany horizontal column formatted storyboards when sending sequences to an editor. Thus, artefact articulation effectiveness depends on representational and form accuracy. The storyboard's mirroring of the presentation format allows the calculation of final sequence estimates. Animatics are suited to temporal representation. For example, songs and notes can be placed at the corresponding interval on the timeline, aligned with the animated action. Animatics' temporal dimension directly mirrors the final sequence format. This allows practitioners to plan the song sequence in a format that mirrors the final animation, aiding comprehension compared to using a printed document that doesn't show time. Consequently, these factors mean that animatics are better suited to representing content with a temporal dimension.

The principles of digital mass-production facilitate the storyboard-animatic transition in digital production. For example, storyboard panel drawings in Storyboard Pro are composed of constituent parts, such as characters and background. These separate elements are used to create new panels by re-combining existing aspects or to simulate movement in animatics. A process facilitated by the principle of digital-interchangeability, these elements can be used in different contexts and combinations from their original intention. Likewise, 1-to-1 copies of storyboard panel drawings are referenced when creating an animatic. Finally, standardised file formats facilitate this referencing. The principle of digital-standardisation provides standardised file formats for editing within animation and image editing software. Animatic functionality allows storyboard artists to focus on staging and posing, while editors concentrate on timing and narrative. It can thus be hypothesised that this functionality facilitates parallel activities, potentially reducing required production **time**, facilitating the conditions of commercial production. Thus, storyboard-animatic transition in 2D vector contexts is facilitated by digital mass-production.

This digital functionality raises the potentiality that animation management may perceive that proceeding directly to animatics – bypassing storyboards and the storyboarding process – improves production progression and reduces the total cost of production by utilising fewer labour hours. Senior Storyboard Artist and interviewee Cash (2022) recognises that storyboard artists perceive that their role should focus on staging and posing, while animation editors' work should be concerned with timing and pacing. This view can be seen as the result of combining a detailed division of labour. Practitioners have distinct and complementary roles in the industrial assembly process and take pride in their roles. However, the comments overlook the issue of task crossover in teams with fewer members. *Chapter 7* established that studios and animation management sometimes request storyboard artists create animatics for specific sequences. However, such explanations overlook how digital tool integration has condensed role responsibilities in contemporary production, as recognised by Tarantini (2011). These findings support the idea that animation management perceive bypassing the storyboarding stage as accelerating production progression, and therefore reducing overhead costs. On the other hand, it might be the case that artists understand how distinct roles and artefacts articulate animated narrative in complementary ways using specific practitioner skills.

Here Cash (2022) provides a useful illustration of storyboarding and animatic development processes in larger studios, where the detailed division of labour and inherent role distinction is possible. In lower-budget productions with tight timelines, such as advertising, generating a comprehensive storyboard may not always be feasible within the available time. Consequently, the production team may use artefacts, such as presentations, to articulate *fictive*, *filmic* and *directive* decisions. Likewise, the ability to bypass the storyboard process depends on sequence complexity. Complex sequences need to be articulated, whereas simpler sequences might move to the animatic stage without too much development. Such decisions are also affected by production team size and available time for project completion. This mirrors Sito's (2006, p.12) recognition that animation artists perceive themselves as individuals when they are part of an industrialised assembly-line system. Thus, task progression is influenced by management thought, situational context and is subject to practitioner perspective.

> **Original Contribution to Knowledge: Digital Tool Integration Shifting Management Expectations of Labourers**
> *The integration of digital production tools and processes has shifted animation management expectations of animation labourers, perceiving that these tools allow practitioners to skip work stages and complete work in less time.*

This section has illustrated that storyboarding activity has evolved and adapted to commercial production requirements. This is manifested in idea exploration in an inexpensive medium – the storyboard – before costly mistakes may be made in the production process. These findings are established in animation literature, such as the work of Pallant & Price (2015). However, this section presents new understandings building upon those findings, illustrating that practitioners maintain storyboard functionality and panel rendering by changing these established storyboarding processes in light of changing designs and production contexts. Likewise, the section has demonstrated how the now pervasive influence of digital tools and their potential timesaving functionality motivates animation management decisions to reduce overheads and their impacts on practitioner working processes in modern series-making.

These results are important because they demonstrate how contemporary storyboarding practices evolve to accommodate the realities of commercial production environments, providing valuable insights into the adaptations made by industry professionals. Thus, this section presents new understandings of the growing examination of modern processes within animation scholarship. Literature and industry argue that established storyboarding processes lock the work required in preproduction to avoid costly mistakes in the production phase. These findings show that the plans are altered to create commercially viable animation, potentially avoiding costly revisions. Thus, illustrating that changes to established storyboarding practices are integrated into artists' processes to increase production efficiency. Therefore, demonstrating that animation workarounds are an intrinsic part of working and completing commercial animation projects. The next section explores the motivations behind shot and sequence changes made during the storyboarding process.

SECTION 8.2

Storyboard Phase Shot and Sequence Changes

The previous section has established that storyboarding activity is traditionally organised to explore and develop *fictive* and *filmic* ideas in a cheap and disposable medium before production begins. This section discusses how practitioners further alter these established processes in contemporary production. Interviewee Rosie Cash (2022) constructively highlights that cutting away from complicated action, such as a character putting on a coat, reduces work when storyboarding ambitious scripts. Further arguing that such decisions reduce the need for complex character models and layer orders that often link multiple character aspects, such as a coat, in a CelAction character. Likewise, interviewee and animation rigger Mat Dame (2021) illustrates that the action of a cut-out 2D character putting on a hat requires considerable work, often involving a complicated process where the hat is attached to the character during animation. Dame (ibid.,) contends that cutting away from the action eliminates this work: a character model is shown without a hat, followed by a reused exterior shot of the house, and then a shot of the character rig wearing the hat. These sources reflect artists' focus on workload reduction and execution over aesthetic concerns, such as perceived production value. According to this data, storyboards can be an effective tool for visualizing and planning cut-aways from complex and time-consuming animated sequences, thereby reducing the workload required for an ambitious script.

A possible contributing factor is the principle of digital-replicability, which allows cost-effective character model iteration: one without and another with the hat. This is a useful illustration of 2D cut-out animation processes avoiding the need to create additional angles and models of props and environments. As usefully illustrated by Dame (ibid.,) and Davis et al. (2011), cutting away from problematic action may be an option when there is not enough available time to design a more formal solution, such as generating additional assets. However, it should be noted that Davis et al.'s (2011) example is from a machinima context, where there is often little financial and production value cost to re-using footage. Storyboards are typically not required for practitioner idea communication, as most projects are handled by individual filmmakers working alone in this context. Thus in commercial contexts, altering sequences could reduce future and potential additional work, but time and budget constraints may prevent re-storyboarding the sequence. The findings reported here suggest that practitioners use workarounds to alter created storyboard sequences to reduce future complicated work in the production process.

This early part of the section explores the use of representational shorthands in the storyboarding stage of contemporary series-making. Storyboard artist and interviewee Liz Strawbridge (2022) pragmatically highlights that storyboard artists often create a character shorthand to complete panels without waiting for character design approval. The comments illustrate an artist focus on personal process efficiency, ignoring other uses of panels such as animation management project communication and representation. Nonetheless, these findings suggest that representational shorthands allow artists to work faster, creating multiple panel iterations without redrawing complex character designs. Representational shorthands function well in this context because they are a visual representation of information in the panel, limited extra activity is required to decipher this information in the time-sensitive context of the storyboard review. However, character designs may change through the production process to a point where the shorthand does not accuratly represent the new model. Likewise, the rendering of the shorthand may shift too far from the design to be recognisable, creating scenarios where mistakes requiring costly revisions can occur. Thus representational shorthands enable artists to maintain consistent character, environment and prop scales, helping them avoid production delays and incomplete storyboards. Therefore, artists use animation workarounds like representational shorthands to maintain process effectiveness and efficiency in changing production conditions.

It is possible for changes to established storyboarding processes to facilitate more efficient working methods. Strawbridge (2022) fruitfully identifies that storyboard artists may use initial character designs from early storyboards to create representational shorthands, which are refined as character designs progress. Strawbridge (ibid.,) strongly argues that this process maintains pipeline momentum while avoiding time and labour wastage on redrawing designs. However, these comments only consider storyboarding processes, ignoring other pipeline aspects and decision-making. An explanation for these comments might be that representational shorthands facilitate improved efficiency of animation labour. Artists can work on different tasks in parallel: using shapes allows storyboard artists to concentrate on staging and composition, while editors and animators focus on timing and performance. Conceptually speaking, this point is valid, as shorthands allow work to progress without a completed character design. However, storyboards and representational shorthands may become unusable if a new design dramatically differs from the shorthand. Therefore, for shorthands to facilitate parallel work, they must remain identifiable concerning the intended character design. Shorthands may enable parallel working within character model recognition and identification limits, but their broader impacts are unclear. According to this data, we can infer that practitioners can use animation workarounds, such as representational shorthands, to facilitate parallel working within commercial series-making.

These changes to established production processes are focused on maintaining storyboard functionality throughout the preproduction phase. Strawbridge (2021) constructively identifies that approximate character silhouettes provide individual representation and scale relationships to other characters and props. Likewise, highlighting that rough character silhouettes are used for continuity across departments, and to evade potential inconsistencies once the final designs arrive. Strawbridge (ibid.,) further argues that these representational shorthands are indispensable for storyboard artists. These comments suggest representational shorthands are only locally effective. Supplemental contextual and content information required for comprehension is lost out of this local context, mirroring the findings of Blatter (2007). Character deconstructions into constituent shapes allow swift rendering across multiple panel iterations. An explanation for these accounts might be that representational shorthands facilitate continuity and design changes, ensuring storyboards remain functional as production progresses.

Shorthands can serve as functional and recognisable stand-in character models during preproduction. However, it is important to acknowledge that silhouettes must be recognisable, or key identifiers may be lost, potentially generating confusion as characters may be created iteratively, and may have the same – or similar – silhouettes. Thus illustrating that shorthands must be instantly recognisable to all team members to ensure maximum functionality across sectors. Consequently silhouettes facilitate functionality when artists can recognise the referenced character models. These results suggest that shorthand functionality is determined by maintaining recognisability. Therefore, animation workarounds, such as representational shorthands, help ensure the functionality of working assets during the preproduction stage of contemporary series production subject to instrumental recognisability.

Original Contribution to Knowledge: Practitioner Process Flexibility
Storyboard Artists alter their working processes to maintain flexibility, adapting to changing decisions and design choices in commercial production conditions.

Character shorthands can be interpreted through the *Theory of Workarounds*. Representational shorthands can be classified as the *Augmenting of Existing Routines Without Developing New Resources* in this framework. This change is intended to overcome the production **time** and **labour** required to update panels as character designs progress. This example is an instance of bricolage, as artists use available materials, such as character designs. Therefore, shorthands are an adaptation implemented into established animation production methods. These functional local changes and shortcuts alter wider organisational processes.

This thesis has discussed that Alter (2014) has emphasised the importance of appropriate and relevant knowledge in helping to develop effective workarounds, and in preventing the development of solutions which can cause issues if designers lack understanding of the motivations for existing routines and processes. However, Alter's industry-neutral approach creates ambiguity when applying the model to specific industry contexts, such as animation production. Therefore, the thesis overcomes this limit by considering the animation process and studio procedures as forms of *knowledge*. Representational shorthands epitomise how practitioners work with this required *knowledge* in the production process. This is demonstrated in team members needing to recognise character representations to retain board functionality. A possible explanation might be that practitioners need to recognise the shorthand, otherwise, time is lost trying to understand what the shorthand represents. Or at worst, decisions are made based on the incorrect character model, which may cost additional **time**, **budget** and **personnel** to revise. It is possible, therefore, to hypothesise that in animation production, practitioners need to utilise relevant knowledge when developing and implementing animation workarounds to prevent implementing solutions that may cause issues further along in the production process. An approach facilitated by an understanding of the rationale for established processes in animation assembly.

Shorthands are created with contextual knowledge, such as the specific sequence and characters involved, and need to stay relevant to said knowledge to prevent errors. For example, a potential misunderstanding of which characters are represented in a storyboard panel. Likewise, practitioners need contextual knowledge of the scene to work with storyboard panels containing shorthands. These factors suggest that the successful development and implementation of animation workarounds requires both knowledge of the rationale for established processes **and** project-specific contextual knowledge to generate changes that can be understood in current project contexts. Consequently, it seems that knowledge of specific sequences and characters is required to maintain representational shorthand functionality.

Contextual knowledge and agency are required for local animation workaround functionality. Likewise, this thesis has established that Alter (2014, pp.1048-1049) identifies that workarounds are about *human agency*: practitioner's ability to make contextual choices. It is possible to infer that storyboard artists use shorthands in referencing and articulating narrative in the context of changing character designs, as recognised by Strawbridge (2021). An explanation for this approach might be that ensuring consistently accurate renderings of characters in functional storyboard panels consumes unnecessary **time** and **labour**. Artists coordinate their efforts for the most effect in the production process, using *human agency* to reduce the required drawing **labour** in the storyboarding process.

One of the main difficulties with this line of reasoning is that shorthands may be present in material used exclusively by the production team. For example, shorthands and other working visuals that do not match established visuals are not used in storyboard panels presented to executive producers or external clients (Page, 2022). Senior Storyboard Artist and research participant Rosie Cash (2022) has recognised that individuals may not comprehend the reasoning behind the use of shorthands, and consequently, they may request revisions. Therefore, it could be conceivably hypothesised that the use of practitioner agency is subject to organisational situations and constraints. These findings support the hypothesis that animation workarounds, such as representational shorthands, are instances of human agency subject to contextual constraints in their functionality.

This latter part of the chapter examines the types of changes made to shots and sequences during storyboarding, and their motivations. It is possible for *filmic* considerations to motivate sequence and shot changes. Senior Storyboard Artist and interviewee Darabi-Fard (2022) practically highlights that shots may be changed in the storyboard-layout transition to reduce jumping colours and shots, besides facilitating stronger storytelling and communicating scene intention and emotion. However, such explanations overlook the fact that **time** and **budget** limitations may constrain shot changes. A possible explanation might be the need to ensure audience comprehension of the narrative action occurring in the scene, ensuring a pleasant and coherent viewing experience. It seems possible, therefore, that **time** and **labour** are invested in maintaining visual quality and audience viewing. These findings support the hypothesis that changes to storyboarded shots and sequences are conducted to facilitate audience engagement and comprehension.

Likewise, it is possible for practical factors and *directive* considerations, such as the future organisation of the project, to motivate changes to established shots and sequences. Research respondent and Senior Layout Artist Anye Chen (2022b) acknowledges that shots often need to be simplified due to **time** and **budget** constraints, as well as to accommodate other departments later in the process. Similarly, she pragmatically points out that a shot may be altered to reuse a background or animation. This case has shown that practitioners alter shots and sequences concerning the required **time** and **labour**. These findings support the hypothesis that storyboarded shots and sequences are simplified to accommodate available assets and other department requirements.

Likewise, practical – *directive* – considerations include the availability of assets and animation production resources. Asset and resource availability influence changes to storyboarded shots and sequences. Chen (2022d) supports this hypothesis, pragmatically highlighting that shot and sequence requirements dictate change magnitude. For example, emphasising that character assets may be changed 'for the purpose of being simpler, easier to reuse and animate although this usually happens before layout stage' (Chen, 2022d). A possible explanation for these comments might be that these pragmatic changes are motivated to facilitate efficient use of production **time** and **labour**. For instance, a simpler character model may be easier to animate than a complex one. It seems reasonable to conclude that these practical changes streamline animation assembly activity. Within the *Theory of Workarounds*, such changes use available materials and are instances of bricolage. Hence, it could be hypothesised that asset and resource availability influence shot and sequence changes. These *directive* factors influence shot alterations, which generally use available assets and materials in contemporary series-making. Furthermore, it is possible to infer that such changes are motivated by the conditions of commercial production. Resource costs are restrained when changing established sequences. Thus pragmatic factors and audience comprehension influence storyboarded shot and sequence changes.

Likewise, prior processes influence alterations to established shots and sequences in the storyboard-layout transition. The case for representational considerations motivating shot and sequence changes is demonstrated by Chen (2022d), who gainfully highlights that time constraints may result in storyboard artists incorrectly drawing character scale. However, Chen emphasises that this can be done intentionally. For example, a dragon may be drawn larger than a human for dramatic effect, as long as the scale is believable and does not result in continuity issues. An explanation for these findings might be that storyboards are representations of staging and narrative. So, instances of incorrect scale in these panels are examples of decisions moved to a future point in production. The tone of Chen's comments suggests these decisions are viewed as little consequence and constitute an established layout routine. Thus delayed decisions are a normal part of transitioning from storyboard to layout.

This section has reviewed the key aspects of changes to shots and sequences made in the storyboarding stage of animated series-making. The section demonstrated that storyboard artists adapt established processes to increase efficiency and to account for contextual problems in the production process. Likewise, the section illustrates that knowledge of established storyboarding processes and contextual production factors is required to prevent workarounds from causing additional production problems. Finally, the section has highlighted the motivating factors behind changes made to shots and sequences in the storyboarding stage. These findings add new understandings of practitioner agency and digital functionality and their impact on the storyboarding process to the expanding field of animation manufacture inquiry within *Production Studies*. The findings reported here shed new light on how animation workarounds are required to overcome sequence changes without using additional animation production resources. Such new understandings illustrate that animation workarounds are a necessary part of commercial production processes required to overcome obstacles in contemporary series-making. The terminal part of the chapter presents some final thoughts and conclusions on these research findings.

Conclusions

The findings presented here indicate that storyboard artists use a combination of formalised and ad hoc personal processes to complete storyboards despite asset conditions, production constraints and missing and delayed design information. This chapter has shown that the storyboarding process focuses on the broad articulation of the narrative, before focusing on staging, posing, acting and subsequently, timing and pacing in the animatic. The research has also shown that practitioners alter shots and sequences to consider audience comprehension and the limitations and conditions of assets.

An explanation for these results might be that practitioners use *human agency* to alter storyboarding processes to meet contextual demands. Storyboard artists utilise human agency in response to delayed information, such as emergent and variable character designs. Using agency in this way lets information flow through the production process, enabling storyboard artists to finish panels even when some information is missing. Another explanation of the findings might be that these storyboard panels and sequences are representations which offer cost-effective alterations. Such an interpretation matches the functionality of the traditional storyboarding approach. Another explanation for these findings may be that storyboard workarounds require, and are based on, practitioner knowledge. Such an interpretation means all personnel need working knowledge and an understanding of what the representation is substituting to maintain storyboard functionality.

The chapter has extended Davis et al.'s (2011) model of the real-time evaluation and testing approach from the study of machinima production to animation assembly. The current study highlights that practitioners alter assets and sequences *within* the animation render environment. The findings presented here provide a deeper insight into applying Blatter's (2007) storyboarding functionality model into series animatic and layout activities.

This study's exclusive focus on animated series limits its understanding of the relationships between storyboard, animatic and layout processes in animated feature films, which often have a longer development cycle. Likewise, the study's narrow focus on digital production presents a limitation. Within this media, sequences remain *mostly*[1] digital, meaning assets can be easily replicated and changed non-destructively. Such a process may differ from physical models. For example, in physical stop-motion animation, it may cost additional **time**, **budget** and physical **equipment**, such as puppet fabrication tools and 3D printing facilities, to make asset changes in the storyboard-layout transition. This chapter's scope was also limited by a focus on storyboarding and layout, ignoring how ideas are changed and manipulated in the ideation and scripting stages, and how ideas from initial thumbnails may alter character, environment and shot designs.

Future research in this field would greatly help to investigate workarounds in the storyboarding-layout transition in animated feature-making. Such studies could examine the design and implementation of animation workarounds in the additional development time offered in feature production processes. Further research might explore the transition from storyboard to animatic and layout in physical animation production. Such investigation may bring further understanding of activity and asset changes in storyboard and layout processes. Moreover, future research could usefully explore the relationship of animation workarounds concerning changing ideas, asset design and functionality in the scripting stage of animation assembly. The next chapter explores how animation workarounds function in the layout process of 2D cut-out series-making.

[1] Aspects of this activity may use physical objects, such as thumbnail storyboards, schedules and other supplementary artefacts, however, the vast majority of these assets, such as character models, retain digital form in the storyboard-layout transition.

CHAPTER 9

The Layout Process In 2D Cut-Out Animation

This chapter explores the function and motivation of workarounds in 2D cut-out animation production layout processes. Very little is known within the field of animation scholarship about the role of animation workarounds in the layout stage of contemporary series-making. The current chapter proposes new insights into the motivations and consequences of changes made during the layout stage of modern series-making in the United Kingdom. Beginning by exploring the process of working with 2D cut-out assets in layout in the *Creating 3D Environments With 2D Assets* section, before moving on to discuss the *Working With 2D Assets in Layout* portion, and finally analysing the motivations and impacts of asset and sequence alterations in the *Layout Changes* section.

SECTION 9.1

Creating 3D Environments With 2D Assets

This early part of the section establishes some general concepts regarding the narrative, aesthetic and production organisation conventions of contemporary series-making. Editorial activity in animation is focused on the early stages of assembly, in contrast to live-action production. In an interview, storyboard artist Liz Strawbridge (2021) explains that during animation production, editorial activities like shot exploration and sequencing decisions happen during the preproduction storyboarding stage. This contrasts with live-action filmmaking, where editors can choose from multiple takes during the postproduction phase. Strawbridge further notes that animation editors may stay involved with a project until the postproduction stage to integrate the final shots. This is a wider-scale production perspective, in actuality, post or preproduction decision-making may be spread across the process without clear distinctions. These differing arrangements may be motivated by the ability to generate material concerning the required resources. In live-action production, footage can be generated relatively rapidly once the actors, cameras and crew are ready to record. Likewise, new ideas for shots and action may occur during filming, hence it makes sense to leave editorial activity until after the creation of all material. However, in animation, editorial consideration occurs concurrently with and *when* generating footage. The labour-intensive nature of producing animated footage means the allocation of labour and materials requires careful consideration to maintain cost-effective production.

The example discusses an idealised model of feature film production, which differs from the faster-paced, rolling delivery schedules of animated series. This shorter turnaround for animated projects may leave less time for editorial work during the preproduction phase. Layout and other postproduction processes may conduct additional editorial activity to compensate for lost development time in preproduction. It is consequently conceivable that narrative and *filmic* animation workarounds may be more common in the layout stages of series-making, as changes made at this point may be considered part of normal working processes. Hence, weighting editorial decision-making towards the earlier preproduction phases is motivated by the labour-intensive nature of animation manufacture and the conditions of commercial production.

Live-action cinematographic conventions also influence animated shot choices. Strawbridge (2021) practically identifies that 3D cameras and animated environments can be a practical choice for complicated shots. Further highlighting that these can be placed anywhere in a scene, potentially reducing production **time**, **labour** and **budget** involved in scene creation. These comments reveal that practitioners often select tools based on their function. However, they overlook the organisation's influence on tool selection, such as software licenses and client expectations. Nonetheless, these findings support the idea that series visual style typically simulates the limited movement of the live-action camera. The integration of live-action camera conventions into established animation limit *filmic* and camera angle choices in commercial production, irrelevant to software offered potentialities. These choices become embedded into a common language and expectation of narrative animation. It is possible, therefore, that these *filmic* choices are thus limited by audience expectations and understanding of the unfolding narrative.

This example works in the contexts of feature and student animation production, where there is time to develop technology and shots; however, series production may lack this time, so practitioners use simple methods, such as flat layers and blurs to simulate these live-action camera lens phenomena in series-making contexts. 3D conventions dictate *filmic* decisions despite the media used. In narrative series, practitioners use animation workarounds to simulate and emulate live-action shots and camera phenomena. Therefore, the series visual style typically simulates the limited movement of the live-action camera.

Likewise, digital cameras in 2D cut-out production are similarly constrained. For example, Strawbridge (2021) constructively highlights that cameras in Adobe After Effects can move around a computer representation of 3D space/time and can be placed in any position relative to 2D cut-out assets. However, recognising that the movement of 2D cameras in cel animation is limited. This is an effective illustration of software functionality that tacitly alludes to the influence of past cel processes on contemporary project aesthetics. A possible explanation for these potential movement constraints might be that camera practicality, technical considerations and projected sequence and shot costs limit this camera placement in 2D cut-out animation. In 2D digital animation, the limited camera placement and framing options can be used pragmatically in the layout process. This constraint may benefit the creative choices in layout, as will be explored further in the chapter. The source provides a relevant and valid discussion of the technology and software used in contemporary animated series-making in the United Kingdom.

It should be acknowledged that the student experience of making animated content has similar time constraints to commercial series-making, but a negligible budget, as observed by interviewee and Professor of Animation at Sheridan College, Canada, Tony Tarantini (2021). Therefore, we can infer that time and practicalities affect *fictive* choices. Hence, we can hypothesise that practicality influences shot transition from storyboard to layout, as traditional 2D animation camera limitations influence shot choices.

Likewise, human visual perception phenomena are mirrored in *hyper real* animation. Human perception of the real world has limitations, such as height and field of view. These conditions and physical camera limitations inform live-action cinematography, and consequently, animated visual storytelling. Wells (1998, pp.23-24) highlights that in the late 1920s, Walt Disney modelled Disney studio processes on live-action assembly methods. In this re-organisation, Disney preferred a language for cartoon and full-length features based on live-action assembly and style, overshadowing other innovations in animation. *Chapters 2* and *4* discussed this. These influences can be observed in *filmic* choices. For example, many wide-shots, mid-shots and close-ups in features and television are shot as if the camera is at human eye height and are framed to portray a sense of perspective within the composition. As a result, the physical limitations of live-action, and animation, cameras directly influence the *filmic* decisions in series manufacture.

This remainder of the section explores methods for creating 3D and non-3D aesthetics using 2D cut-out assets in the layout process. Not all series aesthetics are required to mirror the 3D world. For example, interviewee and Senior Layout Artist Anye Chen (2022a) usefully highlights that a particular show may have a flat style, while a combination of 2D cut-out assets and 2D drawn animation may be reserved for dynamic moments. This illustrates that aesthetics influence practitioner decision-making. These findings suggest that if the aesthetic style of the series mirrors that of our reality, then there is a need to create the illusion of our 3D world, whereas, project aesthetics that do not directly mirror such visual phenomena eliminate the need to replicate these representational aspects. Therefore, the series' visual style directly influences methods used in scene creation, such as character and environment model design. Chen is experienced in UK series production, having worked on numerous series, each with different visual styles, making this a reliable source for this discussion.

It is also possible that illusions of 3D environments can be created with other methods, including photo collage and movement of pieces and layers, as illustrated by research participant and CEO of CelAction, Andy Blazdell (2022). These are effective examples of materials used to create 3D environments in animated series production. Blazdell's experience as the CEO of CelAction and 2D cut-out processes make this a valid source for the thesis discussion. These different methods have differing practicalities and expenses. Hence, it is conceivable to hypothesise that available animation production resources and practicalities determine chosen methods. Thus, the requirement to create the illusion of 3D environments depends on series visual style, asset practicality and resource costs.

When there is a need to create a 3D environment with flat 2D assets, multiple methods might be used, and these differing techniques are effective in different compositional situations. Chen (2022b) pragmatically foregrounds that artists can generate *comp kits* in layout. For example, in a *point-of-view* shot of a character driving a car, flat layers – representing environment assets, such as trees, buildings and sky/background – are generated and handed to the compositing department, who then create the illusion of movement by increasing the asset scale to simulate trees approaching the camera from a vanishing point. These assets in 2D cut-out animation are still and flat representations of objects and characters, and the illusion of depth is created by simulating the movement of objects as they are passed.

This illusion is facilitated by breaking down the image into constituent layers (foreground: car interior and characters, background: trees and horizon, for instance). Keyframe animation of the element scale and position creates an effective sense of movement through 3D space. Therefore, the illusion of 3D depth is created through moving still animation assets and layers, simulating observable phenomena, such as vanishing point(s). Thus illustrating that digital mass-production is a routine part of practitioner decision-making. and the illusion of depth is created by simulating the movement of objects as they are passed.

These examples focus on creating the illusion of 3D environments using 2D cut-out assets, which can only be viewed from one angle, whereas 3D *computer generated imagery* (ibid.,) and stop-motion models can be viewed from many angles. Therefore, digital assets can be used in a real-time testing and evaluation process to develop new creative ideas in the storyboarding and layout processes. Hence, scene readability determines the methods used when a 3D environment is required, as in series-making, *fictive* and *filmic* readability determines asset type used in the final composition.

Likewise, simulating perspective can create an illusion of 3D environments when using 2D cut-out assets. Interviewee and storyboard artist Liz Strawbridge (2022) distinguishes that perspective can be created in a storyboard panel by drawing a grid to show the angle and scale of a scene, which can be beneficial in a close-up shot where there is little angle and perspective within the frame. Illustrating that animation workarounds function in local artefact construction, altering local processes to achieve orthodox organisational goals. This animation workaround functions by simulating visual phenomena, parallel lines and objects are viewed as converging towards a point, usually the centre of the frame.

Moreover, spatial relationships can be created within a storyboard panel. Strawbridge (2021) highlights practical techniques for showing spatial relationships in storyboard panels. These include: obscuring a character with another to show distance from the camera, using perspective lines to show frame depth and varying the size of characters and objects to convey their relationship to each other in the frame. For example, placing objects, such as characters and props, close together creates scale relationships. These representations of 3D depth, scale and spatial relationships are often made with line drawings of the characters and environments in the storyboard scene. These are made so that the depth, scale and spatial relationships make sense in the scene portrayed in the panel. Therefore, approaches that aid perspective and composition creation in storyboards are based on traditional drawing techniques.

It is also the case that consistent scale and perspective can be simulated by emulating live-action camera movements. Strawbridge (2021) argues programs that can work with 3D models, such as Storyboard Pro, streamline the storyboarding process, reducing the **time** and **labour** required. For example, using 3D cameras and models to simulate extreme angles and movements when creating animatics, emphasising that simulated parallax can create an illusion of 3D space in moving shots. Interviewee and Senior Storyboard Artist Rosie Cash (2022) explains that the appearance of depth can be created in storyboards by sending storyboard panels to an editor as interlaced .png files, who then moves the background and foreground elements at different speeds in creating parallax. These sources illustrate that the illusion of panel depth creation is locally functional and subjective, aimed at facilitating wider storyboarding functionality and decision-making.

This simulation of depth – via artificial parallax, perspective and scale provides a sense of 3D space in the panel, rather than an accurate scene description. Additionally, it is possible that the three layers move the same throughout, allowing practitioners to use personal estimates to plan activity, as acknowledged by interviewee and Senior Storyboard Artist Kayvon Darabi-Fard (2022). This example works in cases of 2D animation, where the medium does not change in the storyboard-layout transition, whereas 3D mediums change from flat illustrations in the storyboard and animatic to 3D character models in the animation process.

Likewise, series assembly may have tighter rolling production schedules, encouraging practitioners to hone sequences as early as possible in the process. The distinction is that in 2D animation, the illusion is created, whereas, in 3D animation, 3D environments are simulated or replicated, resulting in mediating steps being required in 2D cut-out mediums to simulate 3D environments accurately. Therefore, animation production resources are targeted at simulating phenomena understood by an audience. Consequently, this illusion is created by breaking the panel/scene into constituent parts.

Likewise, Senior Layout Artist and participant Anye Chen (2022a) recognises that the impression of a 3D scene can be created by dividing the layout into the constituent foreground, mid-ground and background layers. These are moved to generate the illusion of parallax, as the environments act and move in the frame as if they were 3-dimensional. For example, the scale of x, y and t dimensions of these elements are separately manipulated to simulate visual phenomena. The creation and use of these foreground and background layers is facilitated by the principles of digital mass-production.

Integrating these digital mass-production principles allows elements to be iterated, and for transformations to be applied without damaging the original. Digital-standardisation maintains file and reference formats, allowing importing and reference of 2D cut-out images by the animation program, such as Adobe After Effects. Digital-interchangeability allows the application of movements to these assets within the animation program, while digital-assembly allows these aspects to be combined in the final composition.

Separating an image into distinct layers, such as background, midground, foreground, and animated elements, also enables the application of various visual effects. For instance, applying a blur or movement to specific layers can simulate natural phenomena. One example is moving the background layers faster than the foreground to create a parallax effect, enhancing the sense of depth and dimensionality. Hence, breaking up the image into constituent layers is the primary method for creating the appearance of 3D space using 2D assets. Thus illustrating that local real-time evaluation and testing approaches are a routine part of local practitioner processes, even if instrumentalist texts posit a wider use of traditional storyboarding approaches and task division, creating a potentially unrealistic illustration of contemporary production realities.

Original Contribution to Knowledge: Breaking Down Animated Images
Separating the animated image into constituent parts facilitates labour-saving through reuse and creating 3D environments with 2D assets.

Thus far, the section has demonstrated that live-action visual conventions influence animated series' visual style. As such, the simulation of 3D environments using 2D assets depends on a particular series' visual style. When an illusion of a 3D environment is required, this is primarily achieved by breaking up the animated image and separately manipulating these elements to simulate visual phenomena as they are observed through live-action cameras and the human eye.

These findings are important because they contribute a new understanding of how digital mass-production principles facilitate layout creation in contemporary series-making. These findings shed new light on how these principles are integrated into practitioner and organisational working processes in the layout stage. This understanding is important because it shows that animation workarounds may be used to make ad hoc changes during the layout process to avoid extra costs via revision. For example, these unplanned alterations are required to make environmental changes to reduce potential production costs. Having focused on generating 3D environments with 2D assets, the chapter will now turn to the conditions of working with 2D cut-out assets in the layout process in modern series-making.

SECTION 9.2

Working with 2D Assets in Layout

This early portion of the section discusses the role and function of the layout process and the part that animation workarounds play in achieving the completion of final layouts. Senior Layout Artist and interviewee Anye Chen productively recognises that the 'role of layout is to translate storyboards into solid layouts for animation to take place' (Chen, 2022b). This is a practical role description, based on studio job descriptions influenced by the detailed division of labour in studio processes. These findings suggest that materiality is the key difference between a storyboard/animatic and a layout. It is possible, therefore, that storyboards and animatics present a representation of the scene that will appear in the final animation, and that the layout is the preparation of said scene ready to be animated. Chen is very experienced in modern animated series production in the United Kingdom, a factor that makes this a very valid source for the discussion of this thesis. The layout is, therefore, a scene construction with actual character and environment models created and manufactured by designers, modellers and riggers. Consequently, the layout process translates storyboard panel scenes into a format ready for animation.

Chapter 6 established that commercial animation organisational structures often mean workers complete tasks while working in silos – separate from each other, potentially unaware of others' activities. This raises the possibility that animation assets, such as character rigs, have been created by different artists and technicians, usually following a design process that moves from a rough sketch to a final 2D cutout model. These models likely progressed through a design and manufacturing process as part of this procedure. Thus, aspects of this model might have changed through this progression. These changes are most likely the result of changing materiality. For example, a sketch is a 2D-dimensional line-based representation of the asset, the model itself is constructed from rigged bones and shapes representing parts of the character's anatomy: arms, legs, torso, head, hands and feet, for instance.

In larger studio organisations, the detailed division of labour often results in assets being created by different artists. Shifting to a similar parallel example in software development, Norman (1999, pp.93-94) acknowledges problems occur in software manufacturing where the work of multiple labourers is combined for the first time. Dividing tasks in an organisation can lead to confusion among local workers. This is because they may not completely understand the overall task, resulting in incomplete information. A result of separating *conception* and *execution* in management thought and its application in commercial assembly. It is possible that a similar process occurs in animation production, that problems occur when the work of multiple animation labourers, such as asset designers, is combined for the first time in layout. It is reasonable to infer that the layout role focuses on reconciling these differences inherent to the reification of the animated scene, ready for animation to occur.

It should be acknowledged that studio series production may reuse layouts, as usefully illustrated by research participant and Senior Storyboard Artist Kayvon Darabi-Fard (2022), to reduce the time requirement for a scene, sequence or episode, and to facilitate stronger storytelling and background staging. Thus local pragmatic decision-making and process adjustments are designed to meet wider organisational goals. Manufacturing and organisational processes optimised to reduce production costs can create unforeseen problems, such as colour and scale differences in assets. This changing materiality alters the practical parameters of the models from design to employment, including scale, movement and aesthetic, generating new conditions that need addressing in layout.

These layout processes require human interaction time with the created assets to construct the scene. Interviewee and Senior Layout Artist Anye Chen (2022b) productively highlights that practitioners and studios automate manual processes:

> Throughout all the productions I have worked on, we try to make use of scripts to automate more tedious tasks such as file naming and publishing. For example, we have scripts that export our PSDs into the correct layers for the next department. Or scripts to flatten layers, save out JPGs/PNGs etc. Each production has different scripts and pipelines. (Chen, 2022b)

Thus illustrating local process alteration and practitioner agency aimed at meeting studio goals. This is under-documented in instrumentalist literature. Manual processes are automated for efficiency. Likewise, these fixes minimise time spent on manual processes, freeing human interaction time for tasks that require creativity, such as problem-solving.

This source is relevant to the materials and processes used in contemporary UK series-making, thus making this a valid research discussion point. This reduction of manual tasks in the animation production process is comparable to the findings of Gowanlock (2020, pp.66-67), who found that channelling creativity by controlling manual tasks presents a positive face on management tools. Therefore, automating manual processes to focus on creative ones is tacitly built into studio management processes. Hence, it could be conceivably hypothesised that in contemporary series-making, human interaction time is organised so that non-creative tasks are automated to maximise efficiency.

This efficient allocation of human interaction time extends to material reuse and organisation. Chen (2022a) fruitfully highlights that layout artists often reuse assets, such as trees or similar objects to accelerate the production process, further identifying that '[i]t is useful to build in asset/layout library so these are easy for artists to locate' (Chen, 2022a). This is another illustration of local practitioner agency in meeting wider organisational project progression goals. These comments might be explained by layout artists reusing assets to accelerate the process, and in doing so, coordinate activities to reduce time spent on manual time-consuming tasks, such as searching for assets and files. Darabi-Fard (2022) usefully illustrates that reusing layouts helps maintain the continuity of staging and storytelling, while Byrne (1999, p.60) counteracts with the observation that too much reuse lowers a project's production value. These findings suggest that asset reuse is viewed and presented in different lights to minimise manual processes, thus eliminating required work. Thus studios and instrumentalist texts avoid espousing material reuse.

Manual processes and tasks are often viewed as uncreative, which may lead practitioners to see reuse in a similar light. Therefore, asset and layout reuse amounts appear to be minimised. It can thus be suggested that animation management influences labour saving in artists' processes, and this activity coordinates the vital resource of human interaction time most efficiently. Consequently, artists reuse assets to accelerate the production process in contemporary series-making,

This middle portion of the section explores the relationship between digital functionality and the layout process in contemporary series-making. Digital processes have shifted layout roles and activities. Interviewee and CelAction CEO Andy Blazdell (2022) productively highlights that digital 2D-cut-out scenes are constructed in layout. This further illustrates that the nature of layout artists has evolved – moving from draughtspeople, a less common tradition – to practitioners who can manipulate assets to their will. Furthermore, highlighting that to reduce overhead costs, animation management may ask storyboard artists to create layouts. These observational comments insightfully illustrate digital tools influence on process development. These results suggest the nature and demands of layout processes have shifted from technical activities to procedures where artists actively create and alter assets. Blazdell's specialist experience in 2D digital cut-out production problem-solving makes this a particularly relevant source and valid thesis discussion point.

Tarantini (2011, p.260) usefully identifies that digital tools democratised production processes and organisation: reducing team size. Likewise, these results suggest that layout can be perceived as a manual process, and as such, may be subject to minimisation by animation management. It is possible, therefore, that technology and management have changed the layout processes in contemporary production. Hence, it can be inferred that series production time and costs have accelerated the use of tools and processes to reduce required **time** and **budget**, while decreasing production team size, potentially reducing overhead costs. Thus shifting the roles and tasks of layout artists in contemporary production. This change has been motivated by adopting digital production capabilities and overhead cost control in series-making. According to these data, integrating digital production tools and animation management motivations for reducing overhead costs has shifted the role of layout artists from draughtspeople to active asset manipulators in contemporary production.

> **Original Contribution to Knowledge: Shifting Layout Roles**
> *The role of layout artists in contemporary industry has shifted from draughtsperson to asset manipulator. This shift is facilitated by the functionality of digital mass-production tools and processes along with animation management expectations.*

This shift to digital production tools has recast the materiality of animation media in layout. Blazdell (2022) gainfully highlights that environment construction kits for *Little Princess* (2006-2010) consisted of inside elements (a background wall, floor piece and skirting board hiding the join between these pieces) and outside elements (sky, hills and trees), that can be used to create compositions that can be changed. Further emphasising that these kits are created to maintain maximum flexibility. These findings suggest that modern layout backgrounds are comprised of construction kits. The creation of which is made possible by the principles of digital mass-production. Asset files with standardised file formats (digital-standardisation) can be copied (facilitated by the principle of digital-replicability), edited and referenced in software such as CelAction and After Effects (facilitated by digital-interchangeability). As mentioned earlier in the section, Blazdell's experience with problem-solving in contemporary UK series-making provides a broad overview of making many series in the sector. This factor makes this an extremely relevant source for this discussion topic. Thus digital composition kits are an essential part of contemporary layout processes.

While construction kits may be easier to create for 2D animation, the same may not hold for stop-motion or 3D computer-generated imagery (ibid.,) processes, which can present greater challenges in fabricating scene-specific elements. The 2D cut-out medium may enable cost-effective composition methods, as permutations of flat elements can be easily combined into new scenes. Reuse systems and shorter production time are intrinsic aspects of 2D cut-out series-making, as composition kits facilitate reuse systems through the principle of interchangeability, which may strengthen storytelling and the making of new scenes. The principles of digital mass-production enable the efficient construction of series content by minimising the human labour needed for scene creation. Thus, digital mass-production is an intrinsic part of local practitioner methods.

The final part of the section discusses the role of animation workarounds in allowing layout process continuation despite production obstacles and constraints. Storyboards may be incomplete. According to Senior Layout Artist and research respondent Anye Chen (2022b), storyboard artists often begin their work without access to the final approved asset designs. As a result, the storyboards they create may not accurately reflect the final visual elements. The wider studio process limits storyboard completeness. A possible explanation might be that asset design and scale may change as production progresses to layout. This need to advance the production means accurate information, such as character designs and scale calculations, may not be included in the storyboard-layout transition. Chen is experienced in facilitating storyboard-layout transition in 2D layout, making this a relevant and valid source for this thesis discussion. Both Byrne (1999, p.60) and Tarantini (2021) pertinently acknowledge that a higher amount of reused elements is common in series-making. However, it is important to consider that series delivery has a rolling deadline, with less time to wait for props to be finished.

This case may differ in animated feature production contexts. Series production schedules and conditions may influence practitioner decisions. *Chapter 4* identified that practitioners show an implicit investment in project organisation and completion, employing instances of bricolage – using available props and other assets – to complete projects despite obstacles, such as incomplete props, thus preventing potential bottlenecks. Hence, it could be conceivably hypothesised that in contemporary series-making, practitioners use animation workarounds, such as placeholder props, to complete required shots on schedule in light of incomplete production artefacts.

It has been established that layout artists use placeholder props when assets are not ready. However, there are instances when assets, such as props, may not be available when needed for layout completion. Chen (2022b) pragmatically recognises that reference props are often designed and created by layout artists first, and these references are often used directly. In other cases, highlighting that actual props can be *redesigned* based on reference props to account for additional camera angles. Further observing these props can be designed after the layout stage, ensuring that unnecessary prop angles are not created. Chen (ibid.,) proactively illustrates that the creation of assets needs to be prioritised so that they are built ready for scheduled animation. For example, layout artists fill missing angles constituting gaps in location designs with visual reference material. Thus illustrating local pragmatic practitioner agency and decision-making in meeting organisational goals. An explanation for these comments might be that layout artists utilise the real-time evaluation and testing approach in animated content creation.

Placeholder props are created by working in the render environment – a version of the final render image. This process enables consideration of the necessary assets and props for specific camera angles and shot compositions. Chen's example illustrates how layout artists use bricolage to complete scenes and keep up with assigned schedules, maintaining the assigned schedule prevents potential production delays and the need for revisions. The limited production timelines and rolling delivery dates inherent to series-making mean using placeholder props an interesting feature of 2D cut-out animation. This is especially true given that 2D asset alteration is often easier than changing 3D assets. The context of 2D production and flat 2D media means that placeholders can be generated relatively quickly, making them suitable for the fast-paced context of series-making.

This example usefully highlights animation management expectations of the use of practitioner agency. Animation management may perceive practitioners using agency acceptable when meeting organisational expectations, and less acceptable when reducing labour time on manual tasks, rather than designing new assets. Therefore, animation management tightly controls the use of practitioner agency. It can thus be hypothesised that using placeholder assets in 2D digital cut-out production results from series production context, 2D materials and digital mass-production principles.

Utilising placeholder props can be understood through the *Theory of Workarounds*. Alter (2014, p.1048) highlights that workarounds primarily concern human agency and agent's choices. Alter fails to consider *local* and *broader* practitioner agency. This results from an industry-neutral approach. The current study overcomes this limit in articulating local practitioner agency in production contexts. The design and use of placeholder props are instances of local *human agency*. Layout artists make choices regarding their actions in the production process, evaluating the effectiveness of different courses of action, and considering contextual factors, such as available production labour, established job role expectations and project delivery dates.

A further explanation regarding contextual agency might be that the design and use of the placeholder asset uses distributed cognition. Placeholders are designed and selected within the animation render environment – the animation program

– allowing artists to test and evaluate the applicability of ideas in the scene context. There are additional material contextual factors to this example, such as the computing power of the animation workstation and the ability to import flat files into the scene facilitating placeholder creation from available materials. This is a form of bricolage. Thus practitioners use bricolage to progress to the next production phase despite potential obstacles. Hence, it can be hypothesised that bricolage and using 2D materials and digital mass-production principles allow artists to use agency in solving and overcoming production obstacles.

The principles of digital mass-production facilitate the creation of additional versions of placeholder and reference assets. Digital-replicability allows placeholder asset creation by making a 1-to-1 copy of an asset and adjusting aspects to create a new asset. Placeholder assets are created in the same file format as the original, allowing these assets to be opened and edited in the animation and image-editing program – often the same program as the original asset. Digital-interchangeability allows parts of referenced assets to be used interchangeably or for use in place of another asset(s). 2D assets, such as flats and textures are easier for layout artists to change compared to 3D *computer generated imagery* (CGI) or 3D stop-motion production counterparts. Substantial changes to these assets require sending the asset to riggers. Manufacturing historian and practitioner Christoph Roser (2017, p.58) usefully identifies that pre-fabricated items with blank spaces for customisation are common in antiquity manufacturing, illustrating that pre-fabrication can be a valuable labour-saving tool in manufacturing. Hence, the principle of digital-replicability facilitates the creation and manipulation of placeholder props, allowing 1-to-1 copies of animation assets to be made non-destructively at little additional cost.

This section has shown that the layout process is focused on transforming the scene depicted in the storyboard ready for animation, demonstrating that the process is concerned with resolving problems resulting from creating assets in isolation and reconciling these differences. Likewise, this section has shown how digital production tools have shifted layout artists' roles in modern series-making. The section contributes to the growing study of animation assembly processes in *Production Studies* and animation scholarship, highlighting new understandings of practitioner agency afforded due to integrating digital production technologies in modern series-making.

These findings are important because they illustrate that animation workarounds are required to make assets created separately – a product of silosation and mass-production – work together in a scene without resource-costly sequence and asset revisions. Therefore, illustrating that animation workarounds are both a condition of, and a necessary part of, successful commercial animation production processes. This chapter's final section discusses layout-stage asset, shot and sequence changes.

SECTION 9.3

Changes Made During the Layout Process

This early part of the section discusses the reasons and motivations behind alterations to created assets, shots and sequences made during the layout phase of contemporary series-making. Changes to assets may be motivated by *fictive* considerations. Senior Layout Artist and interviewee Anye Chen (2022b) practically highlights that assets may be changed in layout to create an accurate perspective so the animation department has a greater understanding of the location, scale and movement of characters in a scene. This is illustrative of the traditional layout role description, yet also highlights local practitioner agency in meeting studio work progression goals. A possible explanation might be that such processes result from storyboard artists focusing on conveying the narrative action of the scene rather than establishing a technically accurate composition.

It has been established that storyboard artists delay scale calculations and use representational shorthands in panels and that assets might be changed to match these representations. *Figure 9.1* displays the processual impacts of delaying scale calculations, and *Figure 9.2* illustrates the influences behind these decisions. Chen is experienced in the *fictive*, *filmic* and *directive* aspects of layout and how these influence layout decision-making. These factors make this a valid account of layout activity in larger animation studios, and this knowledge potentially influences practical choices in the storyboarding phase. Therefore, continuity and staging calculations motivate asset changes.

Moreover, the scale of assets may differ from the scale portrayed in storyboard panels. Format conditions prevent universal asset scale. For example, bitmap assets are created as large as possible to overcome scale limitations (Chen, 2022c). Thus tools and artefacts influence individual local practitioner working methods, while wider production narratives remain consistent. Artists may maximise model resolution to create more flexible assets that overcome the limitations of pixel-based bitmaps. Therefore, the storyboard establishes relative asset scale, and layout artists seek to

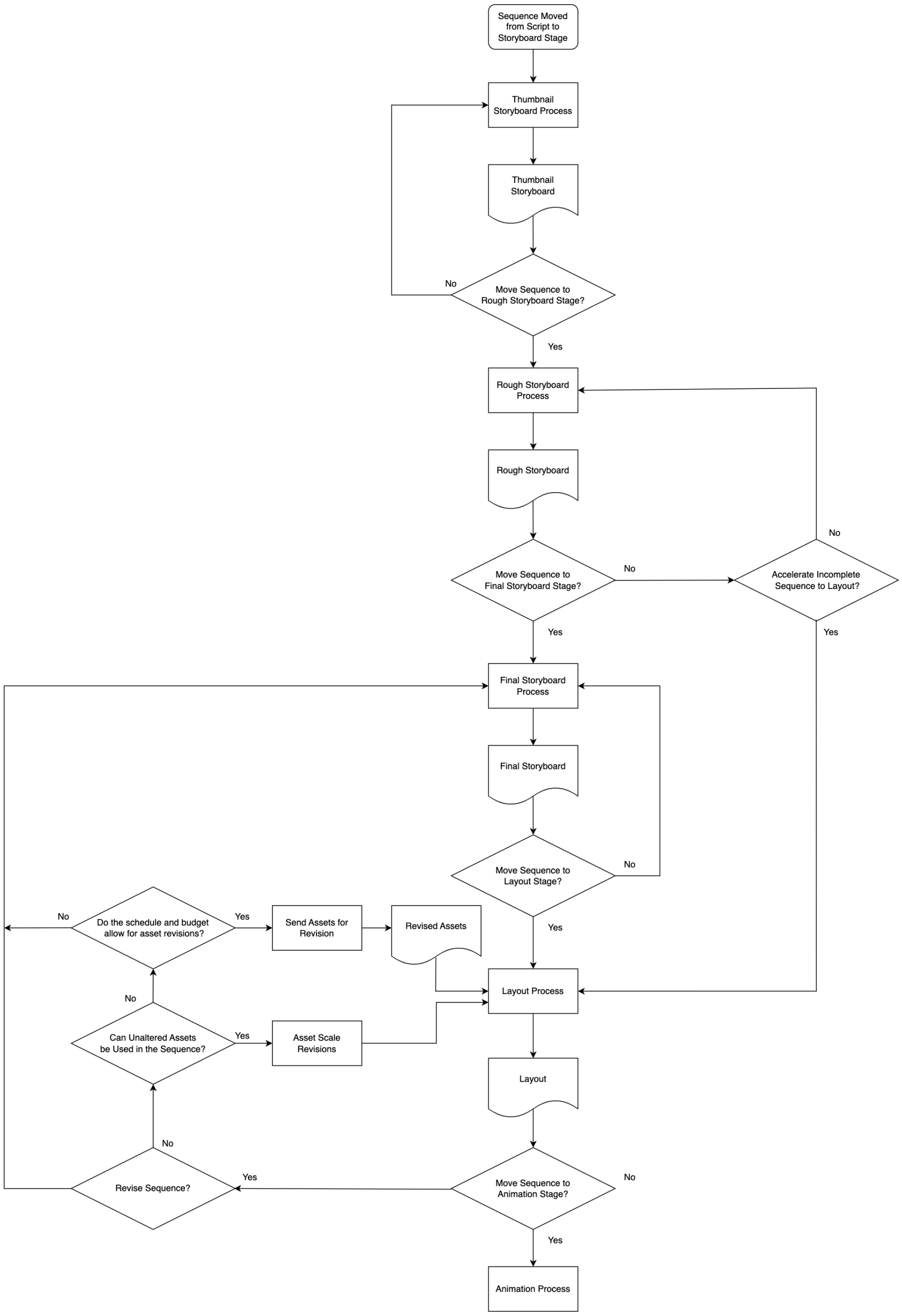

Figure 9.1: Process Diagram Showing the Decision-Making Process of Moving from Storyboard to Layout.

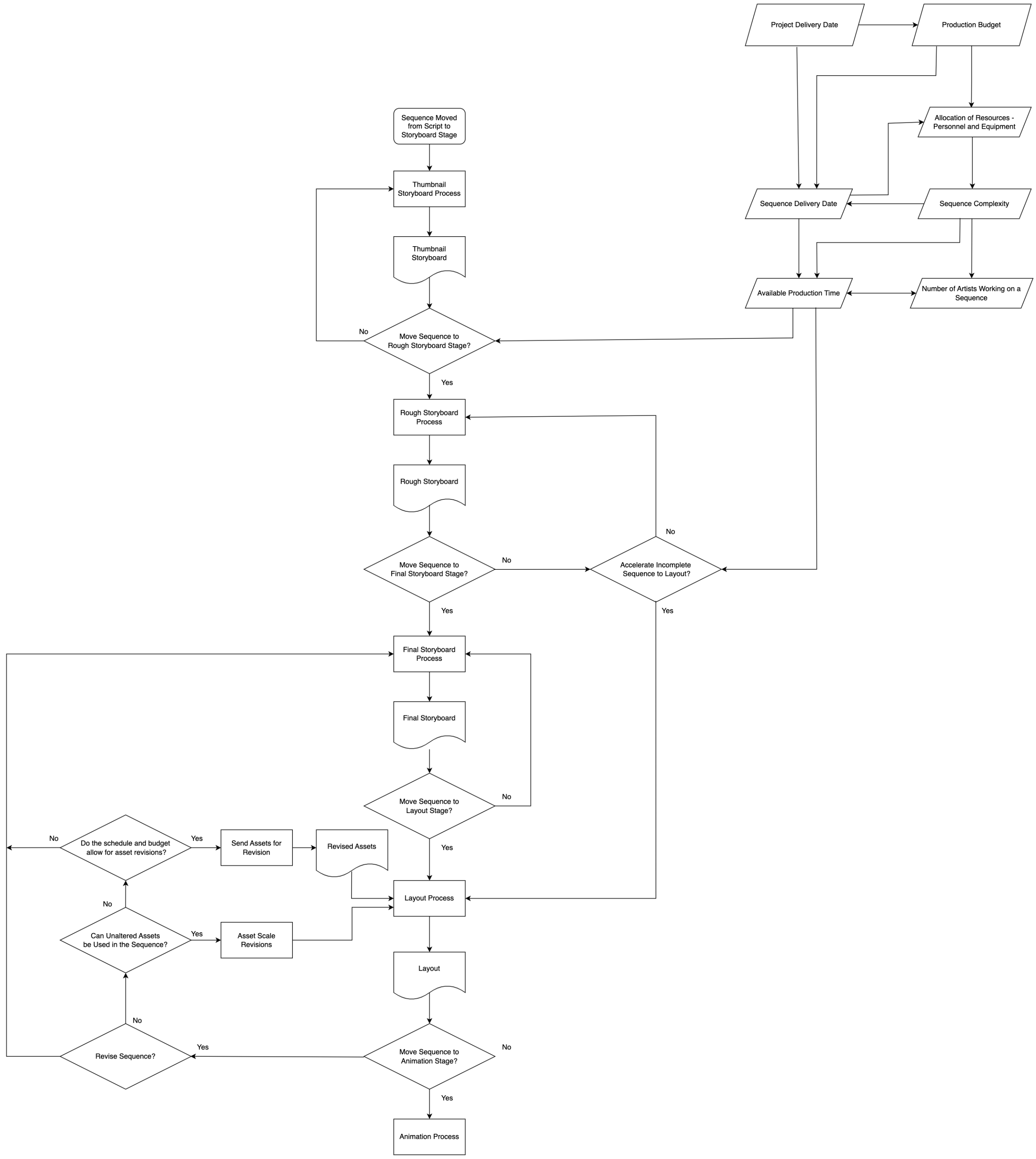

Figure 9.2: Process Diagram Showing Influences of the Decision-Making Process of Moving from Storyboard to Layout.

maintain and enhance this established composition.

This section has raised the idea that assets may be changed to match storyboard representations. Chen (2022d) highlights that storyboard artists often adjust location and environment assets in their layouts to align with the intended narrative, even if the full design is unavailable. This allows them to take creative liberties, changing a location to fit a gag or action in the story. In these cases, Chen (2022d) emphasises that the layout supervisor is responsible for identifying design changes and ensuring that these are applied across multiple layouts for continuity. This result may be explained by the fact that production practicalities shift decision-making to a future point in the assembly process. As a result, layout artists – and supervisors – reconcile these deviations and potential delays to maintain the production schedule. Thus practitioners utilise local agency to overcome process ambiguity resulting from decision-making synchronicity in the wider production process.

This is a valid illustration of the influence that storyboards can exert over aspects of the production process, as usefully observed by Ward (in: Honess Roe, 2020, p.156). This example shows that storyboard artists can add and influence *fictive* and *filmic* data through the storyboard-layout transition. This observation supports the idea that location assets may be changed to portray the narrative action established in the storyboard.

Style considerations also motivate asset changes. Chen (2022d) recognises that environment concepts and designs may need refinement or further style development. Likewise, observing that designs from different artists may create previously unidentified continuity issues, all of which need rectifying in layout. These problems arise from silolisation in deep organisational structures, such as the organisational hierarchies of larger animation studios. These structures lead artists to produce work in isolation. Therefore, the work of different artists is combined for the first time in layout. This example illustrates how production schedules and activities can progress unevenly, and how designers often underestimate the time needed to create assets.

Results from *Section 7.2* have shown that the work and progress of design practitioners and departments may be delayed because of the impact of shifted work from privileged individuals and sectors. Design practitioners and departments may be perceived as *manual processes* and *workers*, and therefore, may be undervalued in the production hierarchy. This raises the possibility that creativity also motivates process changes. Thus, the layout process represents the first chance to notice these potential continuity problems and maintain a coherent visual style in series-making.

Certain assets are easier to change than others in layout. Chen (2022d) pragmatically identifies that layout artists avoid character model alterations, further observing that environmental changes offer more flexibility. Additionally emphasising that action and storyboard changes are required when characters and environments cannot be altered. Process ambiguity is worked around with local practitioner agency: layout artists work with available materials – a form of bricolage. In this process, layout artists are subsequently limited by asset construction and the constraints of the approval process.

Practitioner knowledge, ability and a focus on preventing future problems might explain a hesitance to alter complex character rigs for fear of breaking them. It should be acknowledged that this example assumes that the storyboards are *locked* – with no further changes made to the panels. However, it is conceivable that a *back-and-forth* process may be accepted in feature production contexts, which might have additional available preproduction development time. These findings support the case that artists avoid changing assets unless motivated by *filmic* considerations, such as continuity and representation. Thus, these motivating factors dictate whether artists work with the available assets.

Likewise, asset alterations that require less work are pursued first. Chen constructively observes that: 'if characters/environments can't be changed, then a sequence may need revising through a storyboard to accommodate what can be done with what we have available' (Chen, 2022d). Local agency pursues less-labour-intensive paths first. These findings suggest that a *path of least resistance* can be observed in the priority of changes. Less severe and labour-intensive modifications to accommodating assets are pursued first. If these alterations are ineffective, practitioners look to change the more complicated character rigs. As a last resort, the storyboard is sent for revision. Chen has provided a useful illustration of how practitioners pursue a *path of least resistance* when making asset and sequence changes.

Such a process facilitates the conditions of commercial production. Revisions cost production **time** and **labour**. Altering less complex composition elements, such as environmental aspects, may yield an equally effective result with a lower resource cost. Hence, the degree of asset changes follows a *path of least resistance* in contemporary series-making.

> **Original Contribution to Knowledge: Path of Least Resistance**
> *The severity of asset and sequence changes made during layout follows a path of least resistance as practitioners pursue swifter labour and time-effective alterations first, before considering more drastic changes.*

It is possible that the conditions of silolisation in studio organisational hierarchies can delay asset problem identification until layout. Chen (2022b) highlights that assets are generated by different practitioners, which conventionally is not a problem in layout. Approved assets are always reviewed by directors, art directors and department supervisors to ensure visual and technical consistency. Thus illustrating the *conception* and *execution* divide in commercial assembly. Work divided under the detailed division of labour is aligned with studio objectives in routine control processes. An explanation for these comments might be that creating assets in silos means their technical considerations are first identified when placed together in a layout.

Larger organisations often have a deeper organisational structure. In such structures, artists may create assets in silos, separate from each other[1]. Animation labourers may not know what other artists are doing. The detailed division of labour means that different assets, such as character models in the same animated series, are created by various artists, often working in silos. This means there is often no direct interaction between these assets. For instance, they might not be placed in the same scene until the layout is finalised. In this process, the making of a product is broken down into discrete segments, and each worker is assigned to repeat a constituent part of the process. Animation assets are subsequently created in silos. Therefore the layout process focuses on identifying and solving technical problems between assets, reconciling these differences so animation can begin. Thus, it is conceivable that these commercial studio practices have evolved to minimise costly aesthetic differences and asset alterations.

> **Original Contribution to Knowledge: Short-changing Production Tasks**
> *Delaying production calculations intermits rather than eliminates tasks.*

[1]Silolisation can also occur in smaller organisational models that rely on freelance/remote workers where there is little communication between animation management and animation labourers regarding project intentions and expectations.

The creation of assets in silos has local and wider impacts. It has been established that storyboard artists may cheat composition aspects in a panel. Chen (2022d) expounds that storyboards often have inconsistent perspectives, which may need correcting in layout. These changes are subject to context and are made to create a more logical perspective and scale for animation. Furthermore, Chen (ibid.,) usefully highlights that this is contingent on the visual style of the show, and it is therefore not always a requisite for realistic behaviour in layouts. An explanation might be that studio organisations use the detailed division of labour – the separation between conception and execution – and a deep/vertical hierarchical structure to create cost-effective animation, thus separating storyboard and layout processes and artefacts.

The storyboard and layout are constructed in isolation. In this model, the creative work of animation labourers is coordinated and controlled through the approval process, preventing costly aesthetic deviations. Alter constructively highlights that agents need to understand the 'rationale (if any) for existing routines or processes' (Alter, 2014, p.1049). Aesthetic alterations may require a greater investment of the artist's time to change, which has the potential to delay their current work to complete any revisions. It is conceivable that shifting an asset to the layout process – and the required manual alterations – allows work to occur in parallel: both the layout artist and character designer complete work that has not been sent for revision. Such organisation and actions might manifest the *local consequences* of organised and controlled assembly, bringing the *broader consequences* of animation labourers creating assets while working in silos separate from each other. Therefore, differences in technical – not aesthetic – aspects of assets may arise, such as differences in scale, as artists try to maximise the constraints and conditions of bitmap files, for instance. Studio organisational structures mean such discrepancies are only identified when assets are placed together in a layout.

This section has illustrated that asset changes may be motivated by a need to facilitate continuity, style and staging, in addition to matching the storyboard. Model functionality impacts the ease of asset alterations. The section has shown that the severity of these changes follows a *path of least resistance*. Solutions requiring the least work are pursued first. Likewise, the section has highlighted new understandings of the storyboard-layout transition, illustrating that storyboard stage resource limitations result in fewer panels being created, often meaning that subsequent compositions need additional calculations and corrections at the layout stage.

The findings reported here shed new light on the impact of organisational factors, such as the integration of pyramidal studio structure and the detailed division of labour, on the layout process and practitioner working methods. These findings show that animation management decisions to control production costs through constraining overhead costs and accelerating work to future production process stages instead *delay* work and calculations to a later point, such as the layout process.

Similarly, these results shed new light on layout process functionality in this context, illustrating that layout processes exist as a space and time to make these technical adjustments after the storyboarding stage, demonstrating an organisational adaptivity to process alterations. Finally, this section has provided a deeper insight into the influence of digital production tools on the role of layout artists in contemporary production, observing that role and agency within layout artists processes has shifted resulting from the integration of digital production tools. The last part of the chapter presents some final concluding thoughts on the topics discussed here.

Conclusions

The research findings indicate that creating the illusion of 3D scenes with 2D cutout assets is based on digital mass-production principles. The research has shown that the role of layout artists has shifted from draughtspeople – who execute other artist designs – to active manipulators and creators of digital assets. The results show that when assets and sequences are changed in layout, the severity of the changes follows a *path of least resistance*. The study has found that when these alterations are made, artists often change assets within the rendering environment, such as an image-editing program, and in doing so, they are using aspects of the real-time evaluation and testing approach. The results also show that organisational structures affect working processes. The chapter has demonstrated that increased worker silolisation increases the potentiality for asset alterations during layout.

A possible explanation for these findings might be that the established and pervasive use of digital tools has increased crossover in practitioner roles and responsibilities. Furthermore, digital functionality has increased layout artists' capability to manipulate assets, which is less possible when working with physical media. A further interpretation might be that the *path of least resistance* regarding asset changes is influenced by the conditions of commercial production, avoiding potentially unnecessary resource-costly changes. These results may also be due to animation management attempting to cut overhead and production costs by using digital tools to save labour and combine roles. However, the results have shown that these changes may ignore important practitioner knowledge and consequently cost extra **time** and **labour** as extra revisions.

The study extends our knowledge of Staiger's (in: Bordwell et al., 1985, pp.90-92) model of understanding mass-production from live-action production into both digital animation and layout processes. This study is the first to examine the animation workarounds employed in digital layout processes, the evolving roles of layout artists within modern series production, and changes driven by the widespread adoption of digital production tools. The present chapter has demonstrated that changes to shots, sequences and assets follow a *path of least resistance*: less severe changes are pursued before more labour-intensive changes are attempted. Therefore, this is the first study to highlight the commercial influence on the design and implementation of animation workarounds in the layout stage of contemporary digital series production.

As mentioned in the previous chapter, one issue with the current study was its exclusive focus on digital production processes. Likewise, a lack of textual analysis data from storyboards, assets and layouts limits the present chapter's findings. Further examination in this area could lead to the discovery of additional animation workarounds. Nonetheless, a major strength of the present study is using key interview sources to generate in-depth and relevant results. Another source of uncertainty is the focus on series layout activity, which is examined to understand actions in the transnational US/Hollywood model. However, there may be differences within various approaches to this production mode, such as layout processes in animated features, which may limit the generalisability of the present findings to animation production within this model.

As such, future research could usefully explore asset changes in physical animation mediums, such as stop-motion animation. Such studies have an interesting opportunity to generate new understandings of digitally facilitated asset manipulation in modern animation assembly. Further research in this field would greatly help in examining the storyboard-layout transition in US-based or offshore studios, providing an understanding of how prime and outsourced teams generate and alter assets and sequences. Likewise, further study could investigate layout processes using additional interview participants to generate generalisable conclusions from a range of production contexts. Finally, the absence of textual analysis of digital layouts has been a limitation of this study. As such, further research might explore the role of changes in production processes by examining layouts themselves. The final chapter moves on to present and discuss the major findings of this research, recommendations for both industry and future academic inquiry, and highlight this present study's original contribution to knowledge.

Part III

Animation Workarounds in Reflection

CHAPTER 10

Discussions, Conclusions and Contributions

This chapter presents a discussion of the research results and conclusions. The study aimed to understand the motivations and processes involved in implementing animation workarounds into established production processes. This was chosen because of the author's interest, experience and familiarity with 2D cut-out animation processes. Likewise, researchers have not investigated the design and implementation of workarounds in series-making, thus motivating the generation of new understandings. The research questions in this study focused on how alterations to established animation methods overcome obstacles, how these alterations can become folded into future processes, how animation workarounds function in reuse systems, changes to assets and sequences, and how practitioners and management view these process alterations. The study aimed to answer these questions by investigating a single point in the animation production process: the storyboard-layout scene transition. The research approach gathered data using semi-structured interviews with relevant practitioners. These accounts were thematically analysed and interpreted through the *Theory of Workarounds* (Alter, 2014). This final chapter contains five main sections. The first – *Research Question Discussion* – discusses the major findings concerning the literature. The second presents this study's *Original Contribution to Knowledge*. The third section discusses the *Research Limitations*, and the final section – *Recommendations* – presents practical and theoretical applications of the findings for industry and scholarship to build upon this study's limitations.

This early part of the chapter highlights the main themes from the research data. The research has found that animation production processes are constantly evolving. A recurring theme was that changes to accepted methods can become normative practices if they facilitate the conditions of commercial production, principles of mass-production and digital mass-production. In the same way, these processes expand and contract, making use of available animation production resources – procurable **time**, **budget**, **personnel** and **equipment**. The research found that successful changes to established ways of making animation are those modifications that allow for project delivery within the allotted schedule and budget. A major consensus was that access to production resources could be limited. These limitations result in practitioners and departments becoming dependent on changes originally meant to be temporary. A process influenced by the need to channel the organisation of animation manufacturing to control expenditure of animation production resources.

A significant theme was that producers and practitioners can become more adept and efficient as production progresses, changes developed in one season improved through this knowledge and proficiency increase can become integrated into subsequent seasons. Another key trend was that animation workaround solutions can be designed and implemented at any time in the production process. However, organisational production and knowledge constraints limit this potential change development and implementation.

A major theme was that most proposed activity modifications do not work and that these unsuccessful changes tend to be undocumented because practitioners may wish to avoid admitting their mistakes. However, there was a consensus from the data that even recognised successful changes can meet resistance, possibly motivated by a reluctance to make substantial and potentially costly changes to established processes, besides individual practitioners not wishing to move out of their comfort zone by working with unfamiliar tools and methods. Likewise, when practitioners have the potential to create alterations that might manifest additional problems in the production process when they lack knowledge of specific animation methods and rationales.

A recurrent trend was that changes made during the preproduction phase often represent an investment of time and labour in reducing resource expenditure. An important contrary theme was that animation workarounds implemented in the postproduction phase tend to be smaller scope changes focused on preventing the loss of completed work and preventing mishaps that can impact timely project completion. Another trend was that these changes to accepted ways of making animation can be divided into two groupings: *macro level* coordination of activity across studio departments facilitated by hierarchical decision-making authority, and *micro level* coordination of individual practitioner tasks which is constrained by a lack of decision-making authority in the studio organisation.

SECTION 10.1

Discussions in Relation to Research Questions

DISCUSSIONS IN RELATION TO RESEARCH QUESTION 1

This area discusses the results of the first research question: ***How do workarounds function in the transition from storyboard/animatic to layout?***

The current study found that series visual style reflects live-action and traditional 2D drawn aesthetics. The results found that the visual – *filmic* – style of most contemporary animated series production mirrors the visual *filmic* style of traditional 2D drawn animation and live-action content. *Chapter 9* discussed this issue. These results are consistent with Staiger's (in: Bordwell et al. 1985, pp.90-92) identification of early live-action film-makers orientating their creative output towards fictional films, taking advantage of fictional film's suitability to mass-production. Likewise, these results align with the findings of Wells (1998, p.24), who highlights Walt Disney modelled studio production on these processes from the mid-1920s onwards. In summary, these results show that the visual style of most modern series mirrors the visual filmic style of traditional 2D drawn animation, live-action features and series.

The results indicated that this visual style influences the requirements and methods of creating a 3D environment with 2D cut-out assets. 2D cut-out aesthetics primarily create the appearance of 3D environments by breaking the image into constituent parts and separately manipulating each one, utilising the principles of digital mass-production discussed in *Chapter 5: Mass-production in Animation*. While *Chapter 9: The Layout Process* identified that when a 3D environment is required, simulating visual phenomena of human vision creates this appearance. For example, generating the illusion of parallax by breaking backgrounds into distinct layers and moving these at different speeds, using photo collages of physical models to simulate the perspective and scale of 3D objects, or using complex arrangements of 3D space and cameras. *Section 9.1* discussed these methods. An explanation for these findings is that digital mass-production principles facilitate the creation of 3D environments in modern 2D cut-out series. These principles allow image elements to be non-destructively separated, iterated, animated and reassembled in the final image.

This decision to use complex methods is determined by balancing required labour, time and technical skill in development against visual style and aesthetic pay-off. This finding is consistent with those of Wells (2006, pp.23-24) and Canemaker (1994, p.14), who both observed that commercial animation aesthetics and assembly models mirror those of narrative live-action production. Therefore, the aesthetics of what is now understood as *commercial animation* generally mirrors the production models and aesthetics of Disney *hyper real* animation. These findings suggest that the requirement to create the illusion of a 3D world using 2D cut-out assets depends on series aesthetics, technicality and the potential pay-off of proposed methods.

These findings indicated that storyboards and animatics articulate narrative development in complementary ways. *Chapter 8* identified that storyboarding activity focuses on staging and posing, whereas animatics centre on *higher-level* timing and editing. Storyboard artists and animation editors view their roles as separate, although they can collaborate on animatic creation. Studios seek to cut overhead costs by combining the roles of storyboard artist and editor. However, this inhibits potential artist collaboration. These setups ignore the unique skills of both board artists and editors.

These findings confirm the link between using the detailed division of labour, as Crafton (1993, p.163) found and the assembly-line process, as Gadassik (2015, p.275) and Wells (1998, pp.23-24) established. Likewise, these findings match Blatter's (2007) observation that storyboards reify practitioner intentions. These findings extend this observation to animatics, and in doing so, overcome a limit of Blatter's research, namely the sole focus on storyboards over other production artefacts and processes, such as animatics and pre-visualisation, as recognised by Pallant & Price (2015, p.157). These findings show that storyboards and animatics perform complementary roles in articulating narrative in commercial animation manufacture.

The function of both artefacts and processes is a product of integrating the detailed division of labour and mass-assembly principles in industrial animation processes. As such, these findings suggest that storyboard and animatic functionality is a product of integrating labour-saving processes and methods in commercial studio production procedures. Therefore, these findings contribute a clearer understanding of how storyboards and animatics function in the production process and the allocation of animation production resources.

Likewise, the results have shown that the storyboard and layout have different functions in animation assembly, storyboards broadly develop ideas while layout prepares these scenes for animation. Blazdell (2022) highlights that storyboards focus on developing and articulating the broad strokes of the narrative, while layout identifies and solves the technical aspects of the scene. For example, storyboard artists often cheat characters and environment scale when drawing a panel, resulting in inconsistent scale for the created assets when combined in layout. These findings have shown that artists perceive these scale adjustments as routine parts of the layout process.

This result further supports the idea that digital tools allow condensation of traditional animation production roles, as recognised by Tarantini (2011, p.260). Assembly-line commercial animation manufacture traditionally utilised the detailed division of labour, separating the construction of the animated image among higher and lower-skilled and paid employees, as recognised by Crafton (1993, p.143), Gadassik (2015, p.273) and Stahl (2005, p.94). Adopting these processes aimed to increase the cost-effectiveness of animated image construction in the industrial model. In summary, these results show that storyboard and layout have complementary roles in animated sequence development, much like the conceptual crossover of the storyboard and animatic.

An intriguing discovery was that storyboard artists have varying approaches when storyboarding. For example, storyboard artists may use representational shorthands, such as silhouettes or text, to account for changing asset designs and reduce panel drawing time. Likewise, artists can also use placeholder text to represent shot aspects. *Chapter 8* discussed these factors. The results revealed that such representational shorthands allow artists to convey shot intention and meaning without having to draw detail, reducing rendering **time** and **labour**. These different processes focus on representational efficiency and facilitate decision-making during storyboarding processes.

Such findings are consistent with Wells (2006, pp.23-24) observation that Walt Disney created an industrialised profit-driven animation production model that overshadowed other innovations and fabrication methods. This observation is confirmed by Gadassik (2015, p.273) and Ward (in: Honess Roe, 2020, p.158). This industrialised production model broke down animated image construction to increase cost-effectiveness, according to Gadassik (2015) (op cit.,). These trends confirm that the dominance of the US/Hollywood production model with uniform assembly models and processes, has, to a degree, homogenised production methods and artefacts, as confirmed by Langer (1991, p.6).

These findings show that practitioners utilise individual activities and methods within these formal job roles in the industrialised manufacturing system. Likewise, the findings extend those of Southall (1997), identifying that the expectations of these formal roles in the assembly system can overlap and become less formalised within smaller production teams. Thus these findings show that storyboard functionality facilitates individual practitioner approaches in task organisation (*micro-level activity*).

An interesting finding illustrated that storyboards can provide personal sequence estimates. Artists could use the storyboard to generate sequence length estimates to aid in background library creation. Practitioners use these approximations in *micro-level* workload organisation, whereas, animation management personnel, such as technical directors and department supervisors, set up project-specific processes (Gancheva, 2022). Personal calculations facilitate *micro-level* planning and coordination between artists. For example, storyboard visuals allowed rigger Mat Dame (2021) to communicate with a storyboard artist when deciding to *avoid complicated action* in a shot, such as a character putting on a hat or coat. This local decision-making complements the high-level coordination made by supervisors and department heads.

These findings are consistent with those of Blatter (2007, p.9), who found that the storyboard mirrors final sequence presentation formats. Furthermore, these findings support Tarantini's (2011, p.267) identification of the pervasive utilisation of digital production tools in contemporary series-making. The non-destructive and iterative functionality of digital image editing and presentation format mirroring allows practitioners to utilise the real-time evaluation and testing approach in identifying how the sequence and potential changes may manifest themselves in the final animation. Therefore, digital functionality facilitates practitioner agency in idea creation, and the testing and evaluation of animated content in contemporary production. Consequently, artefacts can facilitate *micro-level* practitioner activity to help meet the conditions of commercial production.

The results indicated that layout processes reify a scene portrayed in a storyboard panel. A major point was that layout artist roles have shifted from a technical draughtsmanship-orientated process to one with agency in asset manipulation, as identified by Blazdell (2022) in *Chapter 9*. Digital mass-production principles enable this shift, as digital tools allow artists to efficiently create custom asset variations meeting scene requirements, rather than requesting resource-intensive revisions. For example, maximising human interaction time through using placeholder props when required assets are not ready in time for animation commencement. Likewise, the results indicated that creating an animation-ready layout involves an ad hoc problem-solving process, as asset problems and conditions might only become visible when they are placed together in a scene for the first time. These results corroborate the earlier findings of Blatter (2007, p.7), who recognised that the storyboarding artefact and process reify practitioner intentions for a potential animated sequence.

Furthermore, these findings provide support for the idea that this reification is cost-effectively broken down across commercial production assembly methods, which is consistent with the findings of Crafton (1993, p.167), Gadassik (2015, p.275) and Wells (1998, pp.23-24). Even though the increased use of digital production tools, as observed by Tarantini (2011, p.267), and the influence of contextual industry sectors, such as the UK-service sector, as recognised by Southall (1997), can reduce production team size while increasing role crossover. These results suggest that this reification process remains in distinct stages in practitioner working processes and discourse. In sum, these findings indicate that in commercial production, the layout process is a product of the detailed division of labour. The influence of digital tools and processes and silolisation have shifted layout artists' roles from execution to active creation and manipulation in modern digital series-making.

One interesting finding is that digital production tools have conflated job roles and increased responsibility crossover. The *digital shift* identified in *Chapter 2: Research Context* allowed formally distinct roles organised under the detailed division of labour to be synthesised into new positions. For example, the newer *Flash Animator* position integrates the roles of assistant animator, background artist, ink and painter, and compositor into one role, as identified by Tarantini (2021, p.260). Likewise, *Chapter 7* recognised that UK service model conditions contributed to practitioner role overlap.

A related trend was that animation management may seek to control production costs by reducing team size. A recurrent theme was that studios may seek to reduce team size through role amalgamation. For example, the findings revealed that studios may ask storyboard artists to create layouts to reduce overhead costs. Participant responses indicated that such cost reduction creates consequences, such as increasing work for remaining team members and delaying decision-making, both leading to potential bottlenecks, as the data found that this did not eliminate decision-making, instead, merely delaying it. These influences have consistently pressured animation management to reduce overhead costs to meet the conditions of commercial production, as indicated by the data.

Furthermore, the data suggested that differing perspectives of the assembly process create an unawareness of the impacts of such decisions, highlighting a perspective difference between animation management (such as, producers and the animation studio) and animation labourers (storyboard artists and editors, for instance). These findings are likewise consistent with those of Tarantini (2011, p.260), who recognised that digital production tools have increased role condensation, and Southall (1997, p.45), who identifies that the size of production teams expands and contracts depending on context in the UK service animation sector.

The results suggest how animation management may view these situations and phenomena as motivating factors and opportunities to reduce and control production costs through minimising overhead costs – eliminating members of the production team – and allocating the same work volume among remaining team members. Therefore, these results suggest that contextual factors and technologies influence team size and responsibilities in commercial production. Likewise, these findings reveal that overhead reduction potentially increases the required production **time** through delayed decision-making and reduced capacity for parallel working.

DISCUSSIONS IN RELATION TO RESEARCH QUESTION 2

This portion discusses the results of the second research question: ***How do workarounds function in reuse systems?***

The results indicate that studio methods evolved to incorporate mass-production and digital mass-production principles. This can be seen in how both image assembly and studio labour are dissected into constituent parts. *Chapter 4* and *Chapter 5* recognised how this manufacturing method has become the standard commercial process, as also acknowledged by Langer (1991) and Gadassik (2015). Furthermore, the findings demonstrate that separating animated images allows task specialisation in labour and element reuse. A process allowing efficient animated image construction, helping to mitigate the labour-intensive nature of animation assembly. These findings support Jelinek's (1980, p.54) observation of the two main trends of management thought: *execution*: through detailed descriptions of the task to be completed and *management*: thinking about the work that is to be done, in that, digital processes have been amalgamated into accepted methods because they facilitate these labour-saving principles. Overall, these findings illustrate that industrial animated image assembly is now a highly segmented process, motivated by the conditions of commercial production and the labour-intensive nature of animation creation.

The present study has indicated that digital Reuse systems are based on digital mass-production principles, as identified and discussed in *Chapter 5*. Another important consideration is that the principle of digital-replicability facilitates the iterative creation of new assets in digital production. With minimal additional time or labour expenditure, practitioners can replicate *parent* assets and make non-destructive changes to the subsequent *child* assets. This allows assets to be created, stored, accessed and assembled into multiple combinations, potentially facilitating efficient workflow organisation, which is key to meeting the conditions of commercial production in modern series-making. These findings are consistent with Gadassik's (2015, p.275) observation that commercial assembly-line animation production utilises archived collections of movements and other visual elements in efficient and cost-effective image assembly.

The findings presented here suggest that commercial practitioners use and integrate tools and methods into established processes to increase the cost-effectiveness of making animated content. The results illustrate that these archives are now digital in contemporary 2D cut-out series-making, which is consistent with the observations of Tarantini (2011). These trends suggest that the new process and method adoption is driven by the need to maintain cost-effective production, as identified by Langer (1991, p.6) in the commercial US/Hollywood production model. Therefore, the findings presented here reveal that the conditions of commercial production have meant digital tools and libraries have become standard aspects of animation assembly.

This integration of digital production tools into established methods facilitates cost-effective assembly, helping to meet the conditions of commercial production through potentially reduced manufacturing costs. Tarantini (2011) establishes that the *digital shift* in series production increased crossover in practitioner responsibilities, reducing schedules and overhead costs. Digital tools reduce the time and labour required for image assembly, with knock-on effects of reducing labour force size and increasing responsibility crossover, somewhat amalgamating role distinctions formalised under the organisation of the detailed division of labour in industrial image-making.

Such findings support the idea that commercial processes have evolved into an assembly-line system, as recognised by Gadassik (2015, p.273), Crafton (1993, p.143) and Wells (1998, pp.23-24), and that contemporary series processes extensively use digital tools, as recognised by Tarantini (2011, p.267). Therefore, contemporary series-making processes utilise the principles of mass-production and digital mass-production. In summary, these results show that integrating digital mass-production tools and processes has changed studio methods and organisation, increasing efficiency and reducing animation assembly while inflating role and responsibility amalgamation.

These findings have illustrated that the UK service-based sector and the digital production tool shift have influenced animation team role organisation. An Additional component of these findings was that these factors have reduced team size, increased responsibility crossover and decreased reliance on accepted methods, as practitioners need to adopt new processes to meet the conditions of commercial production. These research findings have revealed this is especially true in smaller production teams, such as those in the UK service sector. Changes to established animation processes are more likely to occur in smaller animation studios, often possessing a flatter organisational structure with a greater overlap in job roles and responsibilities.

The results support the idea that smaller production team size, predominantly the case in the UK-service-based sector, as observed by Southall (1997, p.45), increases role and responsibility overlap, exacerbated by the influence of digital production tools and processes. As such, the findings support Tarantini's (2011, p.260) recognition of the widespread shift to digital production tools, such as Adobe Flash and its ability to condense traditionally distinct roles and processes in series-making. These factors have increased the potential for magnified role and process crossover in contemporary series-making. The general findings indicate that animation workarounds introduced to adapt to these production conditions have become integrated into accepted activity in smaller-scale series-making.

One of the most interesting findings suggests that digital tools are now an accepted aspect of animation assembly, raising the importance of practising *digital literacy*, highlighting that this is vital for file access and re-commoditisation. For example, *Chapter 5* highlighted issues with digital asset file management, including the ease of potentially overwriting digital files, and how continued file access is required for series production and re-issue. These results highlight that *digital housekeeping* is an implicit and necessary part of working with digital files, ensuring completed created work is preserved in a useable file format for project delivery. The research recognised that these digital file considerations and *digital housekeeping* can be key in completing sequences and series re-commoditisation.

The current study found that re-using layouts reduces resource expenditure. An important factor was that human interaction time is the most important resource, as identified by Blazdell (2022), and that layout reuse allows the re-utilisation of expedited human interaction time invested in the original layout creation. This means that the specific calculations and problem-solving process of creating a layout are not repeated, hence the potential for saved labour hours in generating new scenes using reused layouts. The research has identified that layout reuse is facilitated by the principle of digital-replicability, allowing a new layout iteration, creation and modification without changing the original.

These results are consistent with that of Gadassik (2015, p.273), who recognised that the assembly-line animation system is based on re-using movements and visual elements accessed from stored archives of assets and backgrounds, reducing the labour and costs of content creation. The findings extend this observation, showing that archives can store artefacts like storyboards and layouts for future reuse. This functionality is facilitated by the pervasive use of digital production tools in contemporary series-making, as identified by Tarantini (2011, p.267). These findings reveal that reusing human interaction time can be a key factor in meeting the conditions of commercial production in animated series-making.

An important finding was that practical and organisational motivations limit material reuse in contemporary series-making. The results illustrate that a variety of factors, including production value, asset construction and creative ambitions limit the amount of reuse in series-making. *Chapter 5*, *Chapter 7* and *Chapter 8* discussed these limiting factors. However, an interesting outlier to this trend was that song sequences allow material reuse without continuity considerations. Utilising reuse systems can help meet the conditions of commercial production by reducing the **time** and **labour** needed to create animation assets.

Result trends also showed that organisational and practical influences constrain material reuse. This finding is consistent with that of Wells (2006, pp.23-24) who found that the narrative, aesthetic and manufacturing models of Disney *hyper real* animation created a production model where increased visual quality was highly valued, subsequently channelling attention away from other approaches, further highlighting that this model was created with the aim of increased exhibition revenue. It is therefore possible that adherence to the aesthetic and production approaches established in the *hyper real* method may be perceived as possessing increased commercial viability, meaning that increased material reuse may be perceived as limiting production value. Such perceptions may channel and limit practitioner choices and views on the visible reuse of material in contemporary commercial production. Consequently, the findings suggest that adherence to *hyper real* aesthetics and production methods may be the product of commercial influences. In summary, the findings show that a balance exists between reused material volume and the production value of the animated content in series-making.

DISCUSSIONS IN RELATION TO RESEARCH QUESTION 3

This element discusses the results of the third research question: ***How are assets and sequences changed when combined in the initial layout?***

Perhaps the most compelling finding is that human interaction time is a vital production resource, as recognised by Blazdell (2022) and discussed in *Section 7.1.* This finding highlighted that potential animation workarounds need to consider the impact of human interaction with the process, as delaying and/or reducing human interaction with the animation production process can create bottlenecks; as other practitioners need information and decisions to action their workloads. Likewise, the findings demonstrate that the development and implementation of animation workarounds needs to consider the interaction time lost in solution creation against potential upsides.

Moreover, the data highlighted that the animation labour types and amounts need additional consideration. For example, the results revealed that riggers are among the smallest and least privileged sectors. Therefore, the available labour hours of animation riggers are of a higher premium than those of other team members, which becomes evident when riggers' time is needed to swiftly action changes required for prompt animation delivery, such as fixing a recently broken character rig needed to complete a scene with an immediate delivery date.

This finding is consistent with Gowanlock's (2020, pp.66-67) observation that animation management seek to control and influence practitioner interactions to increase the generation and cross-pollination of ideas for use in commercial production. Likewise, observing animation management strategies at Pixar focus on developing digital production tools. For example, fur simulators that free up animator's time from *manual tasks*, shifting practitioner time from perceived technical tasks, such as the animating of CGI character's fur to perceived *creative* tasks like character animation. These findings and literature trends suggest that animation management prioritise using **labour** on tasks perceived as *creative*, as these are perceived as having greater production value as the results are visible in the final presentation. The findings illustrate variety in how human interaction time is viewed and controlled by animation management. The findings therefore show that the design and implementation process of animation workarounds must consider local and wider impacts on human interaction to meet the conditions of commercial production.

Perhaps the most obvious finding to emerge from the analysis is that only animation management can coordinate animation workaround activity and allocate animation production resources across studio departments. These personnel have decision-making authority in the organisation. The findings in *Chapter 7* and *Chapter 9* show that only practitioners with decision-making authority can make change implementation decisions requiring significant resources. These individuals can coordinate animation production activity and changes to established processes on a wider level with a higher-scope view of the changes, as opposed to task execution conducted by animation labourers.

These results are consistent with those of Jelinek's (1980, p.80) highlighting of the separation between conception and execution in management thought, which is visible in the pyramidal organisational structure of commercial studio organisations, as identified by Langer (1991). These findings show that *macro-level* change instigators conceptualise the resource allocation required to implement substantial changes to accepted assembly methods.

Another significant finding is that choke points can hinder production progress. *Chapter 7* identified that the approval process potentially obstructs the completion of animation assets and material. For example, highlighting that animatic review can be a major production bottleneck and that external client review can compound approval delays. The results showed that practitioners can work around these constraints by increasing personnel for processing information, which limits the number of passes in the decision-making process, thus reducing the amount of information for processing and its travel time. These results reveal that practitioners use *human agency* and *appropriate knowledge* to navigate the conditions of choke points in commercial series-making; selecting and filtering information for approval to prevent bottlenecks. Thus subverting the original intention of the control point: to control animation activity. Practitioners take selective agency over the check process, yet are still subject to it.

These findings are consistent with those of Langer who recognised that '[e]very industry has its traditional paths by which authority is exercised. In animation, control of creativity equals control of authority' (Langer, 1991, pp.12-13). Likewise, the findings are consistent with those of Deneroff (1985, p.270) who identified that the approval of story ideas and the design and layout of characters and scenes are traditional control points in generating created content in commercial production. Therefore, the study highlights a complex inter-relationship between practitioners and control points, as artists make choices to mitigate the impacts of checks on production progress.

One of the most obvious findings is that control points seek to reduce changes that may require additional work in animation assembly. A common view amongst interviewees was that the approval process reduces asset style and aesthetic differences. Thus avoiding costly style changes later in the production process, the results indicated that technical alterations are intentionally left to the layout stage. These findings suggest that the approval process acts as a gate, reducing style discrepancies through channelling designs and delaying technical changes to the layout process. A process conducted to meet the conditions of commercial production. Labour and artist content creation are controlled to reduce additional practitioner **time** and **labour** expenditure later in the assembly process.

This finding confirms the association between traditional creative content in the design of animated characters recognised by Deneroff (1985, p.270), acknowledged by Langer (1991) and Stahl (2005). This result extends literature understandings, generating an improved knowledge of the labour consequences of channelling design decisions in contemporary digital commercial production; highlighting that such design process choke points exist to avoid resource-costly design changes later in the production process. Such a process reflects *the line* between creative and technical labour in production, as recognised by Stahl (2010, p.55). In summary, the results indicate that choke points act as a decision-making gate, channelling content discrepancies and delaying certain decisions, aligning the efficient use of labour to create content.

One of the most interesting findings is that there are two types of changes made to assets and sequences. *Pragmatic changes* focus on reconciling differences between animation production artefacts. For example, channelling discrepancies between the storyboard and animatic. Alternately, *creative changes* are assets and sequence alterations motivated by team members' creative ambitions. The creation of novelty is a key part of commercial animation, as identified by Stahl (2005) and Langer (1991). The results reveal that control points, such as the approval process, channel creativity for efficient control of labour in content creation. An interesting outlier to this case was that these decisions can be overruled to maintain perceived production value.

As with the previously reported research finding, this result supports the idea that *creative* and *technical* labour are valued differently in commercial production organisations, as recognised by Stahl (2010, p.55). This result suggests that *pragmatic changes* are motivated by the aim of overcoming potential production obstacles and reducing project costs, while *creative changes* facilitate audience comprehension. Overall, the results show that control point decision-making is a complex and subjective amalgamation of pragmatic and creative considerations. Neither can exist in isolation, yet both inform and, occasionally, supersede the other.

One of the most significant findings was that the magnitude of sequence alterations determines the extent of animation asset changes. A recurrent theme among *Section 8.1* was that storyboard artists may use representational shorthands to compensate for changing asset designs throughout production, as identified by Strawbridge (2021) and (2022). These results illustrate that storyboards can be modified to fit specific production requirements and asset limitations. These changes are limited by quotas, a process that helps control production costs and maintains the visual quality of animation in a series, as revealed in the data. Likewise, another prominent finding was that asset alterations follow a *path of least resistance*.

An important theme in both *Chapter 8* and *Chapter 9* was that changes requiring less human interaction are pursued first, such as environment alterations. If these do not work, practitioners pursue changes requiring substantial labour, such as changing a character rig. Another key factor was that said changes depended on the series' visual style. Moreover, the current study found that sequences and layouts may be changed to meet animation asset limitations, and these changes are considered and executed to maximise efficiency. For example, artists change storyboards to facilitate asset reuse, conforming the storyboard to previously created models, rather than using a new design, as also discussed in *Chapter 8*. Likewise, the research found that designers create animation assets with these limitations and constraints in mind. The findings indicated that these changes are minimised to reduce total labour expenditure and human interaction invested in asset libraries.

Likewise, trends in the data illustrated that digital mass-production principles facilitate the reuse of previously created assets with minimal additional resource expenditure and that these decisions are made on an ad hoc basis. The conditions of commercial production and available animation production resources pressure decision-making: team members pursue perceived low-cost solutions first, perceiving more labour-intensive paths may take time and budget away from the current work in progress.

This finding supports the idea that commercial production activity tacitly focuses on controlling production costs, as recognised by Langer (1991, p.5). These specific findings extend the understanding observed in the literature, illustrating that the less labour-intensive – and resource-costly – changes are pursued before more drastic and costly alterations, demonstrating a tacit aim of reducing potential labour and effort by practitioners in commercial content making. These findings illustrate that asset interaction and series visual style can influence decisions on updating design changes in storyboard representations. Likewise, these findings show that **time** and **budget** limitations channel change execution into a *path of least resistance*.

Another striking finding is that a power balance exists in production teams. Trends in the data revealed that privilege is allocated according to the size and visibility of an individual/department and also depends on the work nature of said sector. For example, larger and more visible creative departments are more privileged than smaller groups of individuals who conduct technical tasks. This power balance was recognised by multiple participants and was discussed in *Section 7.2*. The data indicated that this power balance can affect animation workaround development and work allocation.

Likewise, the findings show that vocal individuals/sectors can offload work onto less privileged practitioners/departments. This result is consistent with the findings of Stahl (2005, p.101), who identified that animation management make artists *work to rule*, such as performing tasks like visualising management ideas in production meetings and negating the creative ideas of storyboard artists. These results and literature trend are in line with the findings of Jelinek (1980, pp.66-67) who identifies one of the predominant trends in management thought is the separation between *conceptual*: tasks concerned with strategy and foresight performed by management, and *execution*: manual tasks performed by lower paid and unskilled labourers.

These findings and the literature suggest this separation of *conception* and *execution* tasks influences animation management perspectives and approaches, who perceive the execution of creative ideas as a manual task; suggesting that perceived creative tasks might be higher regarded than manual tasks. Therefore, the identified power balance in production teams potentially influences the allocation and shifting of work between practitioners and departments.

Another significant finding is that privileged individuals and departments could shift work onto meeker team members and sectors. The data revealed that technical, design tasks and decision-making are the work types most frequently shifted. The findings also revealed that this task and responsibility shifting can create bottlenecks and delays. This is because the cost of production labour is doubled. Shifted work delays less privileged practitioners' original workloads and production progression may require completion of this original work, therefore, shifted work delays overall progression.

This result is consistent with the findings of Stahl (2005, p.55) who found that differential privilege can be allocated to practitioners within the organisation depending on where they fall concerning *the line* between *technical* and *creative* employees – who are often more privileged than their technical counterparts. The findings have extended these observations, illustrating that increased privilege allocation to *creative* employees allows these practitioners to influence the organisation and execution of production activity within contemporary series-making. Overall, these findings show that shifted work is a *shadow process* with the potential to cause considerable costs and delays in assembly activities.

DISCUSSIONS IN RELATION TO RESEARCH QUESTION 4

This area discusses the results of the fourth research question: ***How are workarounds viewed in contemporary 2D series production? (by practitioners, management, and studios?)***

These results found that successful animation workarounds allow animation assembly to continue despite obstacles. The results found that successful animation workarounds – those that allow animation production and delivery to continue despite the impact of obstacles, anomalies and mishaps – can potentially become integrated into future established assembly activities. *Chapter 4* identified that only successful procedural modifications are recorded and that even positive changes can meet resistance. These successful alterations can be integrated into future established processes, whereas unsuccessful modifications are discarded and forgotten. Therefore, the results showed that in commercial production, animation workarounds must help meet the conditions of commercial production for possible integration into future activity.

This finding supports the idea that commercial producers adopt processes and methods which increase the commercial viability of animation manufacture, as recognised by Crafton (1993, p.137), Gadassik (2015, p.275) and Tarantini (2011, p.267). Likewise, the findings show that this integration of new processes often involves an iterative consolidation process, where the changes are gradually improved upon, in line with the findings of Crafton (1993, p.146). Such trends and the findings suggest that this iterative integration process is honed to balance the improvements to cost-effectiveness with reductions and increases in image quality. In summary, animation assembly has evolved through a process of implementing successful changes over time.

The research found that studio processes have evolved to meet commercial assembly and exhibition requirements. This evolution was the subject of the *Commercial Production Processes* section of *Chapter 2: Research Context*, which recognised that early animation production was originally thought of as an artisanal enterprise and that studio animation production adapted technologies which facilitated the detailed division of labour, such as the cel and assembly-line production methods, to meet the conditions of commercial production. In this process, temporary adaptations that helped the studio meet these conditions eventually became systematised into established production processes.

This finding supports the idea that the narrative and assembly methods of industrial production have evolved to maximise commercial viability, as recognised by Staiger's (in: Bordwell et al. 1985, pp.90-92) observation of live-action processes. These findings confirm that changes to accepted processes which facilitate overcoming production obstacles and meeting the delivery and exhibition date(s) have a higher chance of being integrated into future processes. It is also possible that practitioners and animation management may become dependent on these changes to continue profitable project production within the current conditions, such as reduced staff members and swift delivery dates. Overall, it can be concluded that commercial animation depends on producers being able to regularly manufacture animated content for exhibition – matching the release output of live-action cinema while controlling the costs of this production. These are the conditions of commercial animation assembly. Potential changes must facilitate these considerations to be integrated into future processes.

One of the most significant findings was that changes suited to mass assembly will likely be integrated into studio processes. A key theme from *Chapter 5* was that commercial animation practices evolved and amalgamated mass-production principles. Likewise, the results identified that modern-day series processes rely on the principles of digital mass-production. For example, studios and practitioners seek to create asset libraries on both a *macro-level* and a *micro-level*. These libraries contain assets, such as character models and background elements, that can be used in multiple sequences without the need to re-construct these assets, reducing production **time** and **labour** in sequence construction.

This finding supports the idea that commercial animation production methods have evolved into mass-assembly-line processes to increase commercial viability, as recognised by Gadassik (2015, pp.273-275), Wells (1998, pp.23-24), Ward (in: Honess Roe, 2020, p.156) and the broader observation of the nature of commercial film production made by Staiger (in: Bordwell et al. 1985, pp.90-92). These trends and the result findings illustrate that commercial production processes have evolved into assembly-line manufacturing systems utilising the principles of mass-production. Therefore, potential changes to these now-established methods must be compatible with these principles to become fully integrated into future processes, as the cost of altering the established process would render any potential change ineffective in terms of cost. Furthermore, the results show that changes made to contemporary digital production processes, such as those in modern series-making, should be compatible with the principles of digital mass-production, in line with the pervasive integration of digital tools recognised by Tarantini (2011). In summary, the results have shown that the suitability of mass – and digital mass – assembly should be considered when designing and implementing changes in contemporary series-making.

One of the most important findings was that practitioners prefer familiar working methods, limiting the integration of unfamiliar changes. The results showed that practitioner process familiarity is a limiting factor in the adoption of new change. The results revealed that this is exacerbated when a team member suggests potential modifications to practitioners higher in the studio hierarchy, as professionals are unwilling to move from their comfort zone. Likewise, the trend indicated that awareness of possible change benefits can influence decisions. These findings support the idea that practitioners prefer to design and implement familiar processes and changes.

This finding is tangentially related to those of Ward (2006, pp.229-230), who observes that animation is a multi-faceted activity, and Wells (1998, pp.23-24), who recognises that assembly-line production systems over-shadowed other narrative, aesthetic and manufacturing approaches in commercial animation making. The result also aligns with the findings of Langer (1991, p.6), who identifies that the pyramidal organisational studio model and utilisation of the detailed division of labour was disseminated by Bray's top employees, such as Paul Terry, Walter Lantz, Jam Handy and Max Fleischer. Therefore, the findings support the idea that contemporary production's commercial focus channels practitioner and animation management decision-making to consider decisions and actions focused on maintaining the project's cost-effectiveness over other potentially outlandish, creative or labour-intensive solutions, processes and methods. Overall, the findings show that process familiarity, hierarchical position of the change suggester and team working knowledge are determining factors in animation workaround implementation decisions.

Another striking finding was that studios and teams can become dependent on transient changes. The trends in the data indicated that successful animation workarounds can become integrated through experiential improvement and formal reflective processes. The conditions of commercial production may result in studios becoming dependent on these transient changes, as they allow the project to be completed with minimal additional production costs. *Chapter 7* found that departments may take on additional responsibilities to overcome temporary staff shortages. Furthermore, the trends in participants' responses indicated that studios can expect sectors to take on these responsibilities permanently. The requirement for regular content with controlled costs means that studios can become dependent on changes which help to overcome temporary limitations in animation production resources, thus helping to meet the conditions of commercial production only in the short term.

This finding is tangentially related to Langer's (1991, p.6) observation of knowledge proliferation in commercial production from the dissemination of Bray's methods and organisational structures. This proliferation of industrial knowledge and organisational structures across the animation industry suggests that studios and personnel must utilise similar and compatible methods to work together. A contrasting illustration can be observed in single-person production contexts, such as machinima, where there is no need to communicate intentions among team members, as recognised by Davis et al. (2011).

One of the most important findings was that successful animation workarounds can become integrated through experience and reflective processes. A key theme was that positive changes may be integrated through experiential improvement and formal processes. *Chapter 7* found that improvements can become integrated into subsequent seasons through *post-mortem* reflection. Likewise, trends in participants' responses revealed that practitioner working efficiency increases throughout a season as practitioners gain familiarity with specific practicalities and processes. Hence, it is conceivable that experience and competence improvements are naturally integrated into accepted activities. For example, the data revealed that difficult project aspects may be left towards a season's end when practitioners are more familiar with the specific working processes and practicalities.

This finding supports the idea that the problem-solving strategies of experts in a field exhibit an approach of broadly exploring a problem, investigating and developing sub-solutions in parallel, as observed by Cross (2011, p.145). Therefore, the findings suggest potential animation workarounds are developed and tested in parallel and iteratively improved through integration with working processes. The findings indicate that successful change implementation occurs over time through the integration of experience and reflection on past performance.

Another significant finding was that short production deadlines prevent potential solution development. The research findings identified that most animation workaround ideas were not implemented, as there was a lack of available time to develop and integrate the change. For example, upcoming production deadlines mean limited time to explore and design the potential solution, as recognised by Blazdell (2022), in addition, Tarantini (2021) identifies constant budget and time constraints in commercial animation production, making this limitation of potential animation workaround development pervasive. *Chapter 4* found that potential solution development requires **time** and **labour**, which Tarantini's comments reveal are at a premium in commercial production. The findings revealed that these resource costs double when practitioners are taken away from project work: the original **labour** hours are lost, besides the **time** required to develop any potential solutions and to catch up on incomplete work. Practitioners working in these conditions are therefore limited in the **time** and animation production resources that they can allocate to solution development during the current production.

This finding supports the idea that the assembly-line nature of industrial production overshadows alternate and individual approaches and innovations, as recognised by Ward (2006, pp.229-230) and Wells (1998, pp.23-24). This production model's commercial nature channels practitioner decision-making, focusing on maintaining cost-effective production, and discarding courses of action perceived as resource-intensive. Consequently, potential changes in development can be inhibited by the conditions of commercial production and limitations in animation production resources.

The results indicated that relevant production knowledge is a key requirement for designing and implementing successful changes. *Chapter 4* identified that practitioners may not understand established procedures' rationale. The results revealed that designing and implementing modifications without knowledge regarding the purpose of existing methods potentially creates additional problems. The data indicated that practitioners need to utilise *synthetic thinking*: analysing the efficiency, effectiveness and rationale of specific processes and relevant *knowledge* when designing and implementing potential solutions.

This result is consistent with Alter's (2014, p.1049) finding that groups and individuals require relevant knowledge to prevent potential problems and facilitate the successful integration of workarounds. Likewise, Alter (ibid.,) observes that: '[w]orkarounds are more likely to create new problems if work system participants who design workarounds do not understand the rationale (if any) for existing routines or processes' (Alter, 2014, p.1049); such as the separation between storyboard and layout, to prevent potential production delays that might arise from animation management attempting to combine storyboard and layout artist roles to reduce overhead costs. These results suggest that an understanding of the rationale for existing practices is a prerequisite for designing and implementing successful animation workarounds.

One of the most significant findings was that animation management often attempts to bypass early tasks to reduce overhead costs and meet delivery times with a reduced overall production cost. A key theme was that studios and practitioners often attempt to bypass early production tasks, seeking to move to the next process stage to save **time** and practitioner **labour** hours. These phenomena were identified by Blazdell (2022), who highlighted that work is not eliminated in these occurrences, instead it is shifted to a future point in the production process.

This finding supports the idea that digital production tools allow the condensing of practitioner roles and tasks, as identified by Tarantini (2011), who observed that the newer *Flash Animator* role condensed the previous roles of layout, ink and paint compositor and animator in the development and use of Flash pipelines in Canadian series-making (ibid., p.250). Animation management uses digital tool functionality to allow required tasks to be completed by fewer production team members, aimed at controlling production costs through reducing overhead costs, such as production team wages. This role condensation, motivated by reducing production costs, influence animation management decisions to accelerate production progression by skipping tasks. Overall, the results indicate that shifting work to a future point in the assembly process potentially creates production bottlenecks and can be detrimental to meeting the conditions of commercial production.

The results of this study found that changes designed and executed in the preproduction phase focus on the initial investment of resources. A consistent trend was that preproduction stage workarounds focus on investing production resources, creating inventions and procedures used in reducing production and postproduction phase resource expenditure. More time is spent on designing and implementing animation workarounds in the preproduction stage compared to the production and postproduction stages. For example, interactions between the different perspectives of animation management and animation labourers in the approval process allow practitioners to identify which tasks they can work on without approval.

Likewise, the study has shown that production phase changes execute inventions and procedures designed in preproduction. A significant trend was that workarounds containing production phase activity focus on executing inventions and procedures designed in the preproduction phase, with the same primary goal of reducing the expenditure of animation production resources. Production stage workarounds were discussed in *Chapter 4*. As a result, other creative avenues that present themselves are not explored, due to the additional expenditure of animation **time** and **labour**. The findings indicate that postproduction modifications focus on successful project delivery.

A key trend was that postproduction changes are designed and implemented to reduce additional resource expenditure, and *Overcome IT Functionality*, thus facilitating error-free exporting of completed animated sequences. Consequently, these changes are focused on protecting the earlier investment of resources. These findings support the idea that commercial animation production processes have evolved into an assembly-line procedure, as acknowledged by Crafton (1993, p.143) and Gadassik (2015, p.273). This assembly-line method influences each production stage's function in the overall process, assembly activity is designed early and executed in the production stage, while the final stages focus on successful delivery. The results show that this minimises wasted animation labour hours and production **time**, allowing animation labourers to create a mise en place for their animation tasks and avoiding potential creative paths in meeting the conditions of commercial production.

SECTION 10.2

Original Contribution to Knowledge

The research has established that there is a knowledge gap in both workarounds research and animation scholarship. Roder et al. (2016, pp.9-8) demonstrated that inquiry into the design and implementation of workarounds exists in multiple industries, including higher education, healthcare, aeronautics and telecommunications. Likewise, Ward (in: Honess Roe, 2020, p.155) also highlights limited but growing research into animation assembly. This present study contributes to both existing animation scholarship and workarounds research, providing the first examination of changes to storyboard and layout activities in modern animated series-making through the lenses of *Work System Theory* (Alter, 2013) and the *Theory of Workarounds* (Alter, 2014). Furthermore, the research serves as a starting point for future inquiry into animation workarounds in animation production processes.

Before this study, evidence of the design, motivations and consequences of animation workarounds in production processes was predominantly anecdotal. This research addresses said gap by providing a new understanding of 2D cut-out animation assembly. This thesis contributes to a new understanding of contemporary production processes, demonstrating that studio processes are fluid and change to meet contextual conditions through change integration.

The thesis demonstrates that said modifications move through a process of suggestion, decision, implementation and evaluation. These findings illustrate how animation workarounds function to help production teams meet the conditions of commercial production in organising individual and departmental level activity. This was achieved by analysing processual changes in the storyboarding and layout stages of contemporary series-making. Thus, the study draws our attention to the fluid relationship between the ability to design and implement animation workarounds, the availability of animation production resources and their coordination in meeting the conditions of commercial production.

These results are important because they contribute a new understanding of production processes as information pipelines. This new comprehension shows how information – decision-making – cannot be eliminated from this pipeline, rather the thesis demonstrates that attempts to eliminate said decision-making or to condense job roles and responsibilities merely push the required decision-making to a future process point. Such a new understanding illustrates that animation management often attempt to reduce overhead costs by moving to the next production stage, whereas the examination of production methods as an information process shows that calculations are not bypassed, they are merely delayed, revealing that rectifying these actions costs additional **time** and **labour**. These understandings are particularly relevant to industry wishing to maintain cost-efficient and timely fabrication processes. indexoverhead cost(s), reduction of

This work contributes to the present knowledge by extending existing frameworks into new fields of inquiry. This present study has taken established models from the field of *Information Systems* (IS) – the *Theory of Workarounds* (Alter, 2014), and *Work System Theory* (Alter, 2013) – and used these to study animation process alterations. Thus extending these frameworks from the field of *Information Systems* (IS) to the examination creative production.

Likewise, the study provides a new understanding of change integration into orthodox processes, contributing to the study of animation assembly processes within the field of *Production Studies*. The approach taken in this research is important because it shows how both organisations, such as animation studios and individual practitioners, can change established practices and the motivations behind these changes. Therefore, the research can claim a modest contribution to knowledge through the extension of *Work System Theory* (Alter, 2013) and the *Theory of Workarounds* (Alter, 2014) into the field of *Production Studies* and the examination of activity modifications in UK contemporary series-making.

The present study contributes new understandings to the field of animation scholarship, extending Staiger's (in: Bordwell et al. 1985, pp.90-92) understanding of mass-production in content creation. This extension is twofold. Firstly, Staiger's original notion concerned the making of live-action content, this present study extends said model into the understanding of animation activity. Secondly, Staiger's original observation was based on production models utilised until the 1960s, before the pervasive use of digital tools in live-action and animation assembly. This current study extends these models to examine contemporary production processes.

Likewise, the study contributes to existing knowledge, extending the principles of mass-production into the examination of digital production processes, providing the framework of digital mass-production for future research to contribute to. This research provides new understandings of animation activity through this lens, allowing the excavation and examination of complex processes used in everyday animation work. Therefore, this analysis generates new understandings of the organisation and manufacture of animation materials and sequences in addition to their industry implications.

These findings are of critical importance to the animation industry. The thesis has shown that animation management may attempt to reduce overhead expenses to decrease production costs, which can be detrimental to meeting the conditions of commercial production, distributing the same work volume among fewer animation labourers. Reduced production team size also delays information processing through the information pipeline, as practitioners might skip key stages, such as storyboarding before animatic production or layout scale calculations, resulting in additional work to reconcile and catch up with the skipped decision-making. These factors potentially create costly production bottlenecks.

This understanding contributes to animation scholarship, introducing the study of information processing and decision-making at key points in the production process and the potential impacts of skipping or delaying this decision-making. Likewise, the study contributes improved understanding of the commercial motivations behind such decisions and their impacts. Therefore, this investigation contributes to understanding the impacts of comparatively short-sighted attempts at overhead reduction in commercial series-making.

This thesis contributes new understandings of production process evolution to animation scholarship. This study provides an analysis of studio process evolution. In this process, successful animation workarounds proceed from *adaptations* to *tested solutions* before becoming *systematised improvements*. This research demonstrates that animation workarounds result from practitioners and studios employing *synthetic thinking*, *appropriate knowledge* and *agency* to meet the conditions of commercial production with the available resources, equipment and personnel. Therefore, this research contributes a new understanding of animation assembly processes within the *Production Studies* paradigm. Having outlined the general contributions to animation scholarship and *Production Studies*, the discussion will move on to remap the frameworks discussed throughout this thesis specifically for contemporary animation production processes, based on the research data and conclusions.

SECTION 10.3

Remapping the Theory of Workarounds for Animation Production

This section remaps Alter's frameworks based on this study's findings to account for contemporary commercial production contextual conditions. A major advantage of the *Theory of Workarounds* is the cross-disciplinary nature of the model, allowing the framework to be applied to a range of organisational working processes and contexts. However, this cross-interdisciplinarity also has a shortcoming, as one can interpret the model as too broad to consider industry-specific factors that might impact the development and integration of workarounds. Likewise, a key limitation of Alter's approach is using secondary data to establish conclusions, and a focus on IT-reliant organisations. These limitations stem from Alter's model's focus on organisational contexts reliant on IT functionality.

Such limitations allow the current study to expand and develop Alter's frameworks using industry-specific conclusions driven from the primary data, and modifying the conceptual models themselves, remapping them to account for animation-specific change integration processes. This approach allows this research to propose a new version of the model that applies specifically to animation series-making activity. These new models allow practitioners to understand better the nature and conditions of change development and implementation in modern series-making, and for future researchers to extend into other animation production contexts, thus accounting for this study's focus on series processes. This section explores the application of the model to animation production, presenting a revised *Theory of Animation Workarounds* (*Figure 10.1*), a remodelled *Typology of Animation Workarounds* (*Table 10.1*) and a new *Animation Work System LifeCycle Model* (*Figure 10.2*).

THE THEORY OF ANIMATION WORKAROUNDS

As previously discussed, the *Theory of Workarounds* originally mapped general IT-reliant organisational workflows, which this model is successful in doing: analysing processes in an understandable and generalised manner. Thus the benefit of using the model is its applicability to a range of industries and contexts. However, a generalised framework has drawbacks, omitting factors unique to each industry. This model overlooks the essential role of curating and managing innovative content in commercial animation. Secondly, the generalised model fails to account for the widespread use of freelance employment in creative industries, such as modern series-making. Instead, the model considers all practitioners working on a project as *system participants*, which is useful for analysing the process, but fails to account for how animation practitioners may disseminate knowledge from one studio to another, a common practice in contemporary industrial media production. These limitations arise from the original model's utilisation of secondary data from different contexts and analysis of these to find strands of commonality.

To overcome these limitations, *The Theory of Animation Workarounds* (shown in *Figure 10.1*), has been remodelled, adding lines from the *Management Intentions* box in the *Intentions, goals and interests* stage to the renamed *Available Resources and Knowledge* box and the new *Management/client change perception* decision box. Similarly, in the *Structure*, *Perceived need for a workaround* and *Identification of possible workarounds* stages, the original arrow leading from the *Monitoring system* box to the *Potential need for a workaround* box was changed to now lead to the *Potential animation workarounds* box.

These changes were made to reflect the impact that control points have on practitioner decision-making and agency, and the animation workarounds used to overcome these choke points, such as sending *Parallel Information*, that was key in the primary data. This change better tailors the model to contemporary animation production labour and content control and practitioner agency concerning the conditions of creative control measures. The *Knowledge* process box in the *Identification of possible workarounds* stage was changed to include *Available Knowledge and Resources* to reflect the influence of resource availability on practitioner decision-making and subsequent animation workaround development.

Furthermore, the revised model contains two additional layers to the *Consequences* stage. These stages conceptualise the decision-making influences and procedures that channel change integration gathered from the primary data. These stages can be read with loose *scale* and *time* dimensions along the x and y scales respectively. Likewise, these dimensions influence the placement of the process and decision boxes in this revised section. For example, smaller-scale immediate impacts of changes, such as individual practitioner's process alterations, are located on the left-hand side, and larger effects that take longer to revise, for example, interdepartmental changes, which often incorporate additional communication, organisational controls and scale, are situated towards the right of the *Consequences* stage.

Now the revised framework models the specific nature of contemporary series-making processes and accounts for the need to channel creative content creation and the activity and influences involved in generating and implementing animation workarounds in contemporary series-making contexts. *The Theory of Animation Workarounds* displays these integrations and revisions to improve upon the contextual limitations of Alter's model.

THE ANIMATION WORK SYSTEM LIFECYCLE MODEL

The current study has remodelled Alter's *Work System LifeCycle Model* (WSLC) to better account for the context and industry-specific nature of change and animation workaround integration in modern series-making. Although the original model focuses on IT-reliant industries, it effectively conceptualises iterative change integration without being industry-specific, leaving some uncertainty about its applicability to these other industries. Nonetheless, the model has an advantage in that it can easily be applied to multiple industry contexts.

While the model's generalised approach has benefits, it fails to consider industry-specific factors and organisational realities that can significantly impact its application. Alter produces this limitation through utilising a broad approach to modelling change development and integration, as well as by utilising secondary data from previous scholarship in the *Information Science* and *Computer Science* fields to generate frameworks that could be applied to most contexts in which IT systems are used.

The Animation Work System Lifecycle Model (shown in *Figure 10.2*) displays the revised model which has been adapted based on the primary data gathered during this research. The *Animation LifeCycle Model* has been created to account for the iterative improvement processes that contemporary series-making methods move through as seasons progress. This *post-mortem* improvement was a key feature throughout the thesis discussion and is a key part of process development at larger studios with rigid role responsibilities.

The Animation Work System Lifecycle Model describes as assembly methods improving iteratively on a season-by-season basis. Practitioners and animation management source change ideas and engage in post-season discussions, development, and integration in the next season's preproduction processes. Having discussed the revised *The Animation Work System Lifecycle Model*, the discussion moves to the refined *Typology of Animation Workarounds.*

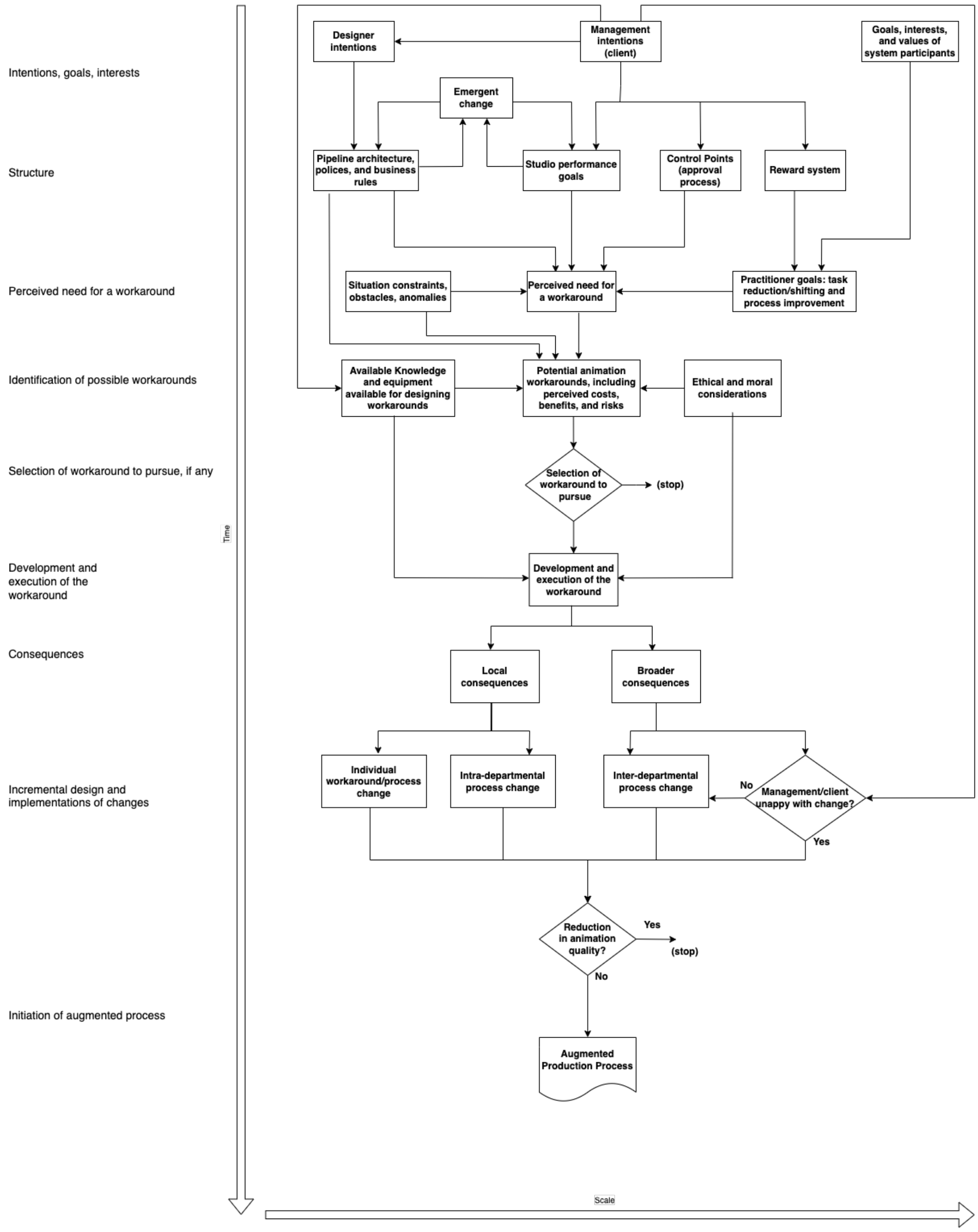

Figure 10.1: The Theory of Animation Workarounds.

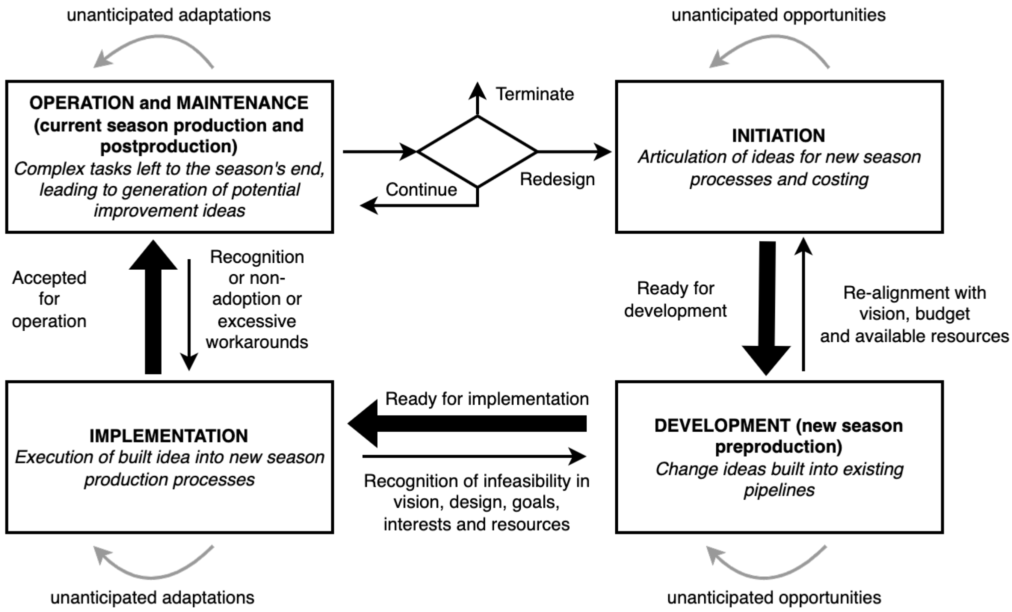

Figure 10.2: The Animation Work System Lifecycle Model.

THE TYPOLOGY OF ANIMATION WORKAROUNDS

As discussed in the *Theoretical Framework* section, Alter (2014) developed a *Typology of Workarounds*, grouping changes based on motivations and contexts. A major feature of Alter's model is the broad applicability and industry-neutral approach. These factors allow the model to be broadly applied to many industries and contexts. However, the current model of workaround typology suffers from unnecessary complexity. There are drawbacks to using additional workaround categories. For example, utilising a larger number of categories can make it difficult to conduct *shop floor* level theorising when developing and implementing animation workarounds. Likewise, having more categories increases the chances that changes may belong to multiple categories, increasing potential ambiguity when attempting to examine and organise changes and their potential impacts and motivations. Similarly, using more categories is symptomatic of an industry-neutral approach, as the model has used multiple categories to cover motivations and eventualities from many industries. The model may overlook factors relevant to one industry, but not another. These factors may affect workaround development, integration and theorisation. The lack of an industry-specific focus in the model is both intentional: as the model strives for universality, and methodological: as the model is based on secondary data and conclusions, and thus is susceptible to transferring context-specific factors from one industry to another where they may not be as relevant.

The current study presents a refined *Typology of Animation Workarounds* that condenses these categories to focus on factors relevant to animation production. For example, the revised model did not include the original category of *Lying, Cheating, Stealing for Personal Benefit* because such occurrences have not been present in the research data and are less relevant to animation production as an industry compared to retail and/or healthcare, as discussed in *Chapter 4*. *Table 10.1* presents the *Typology of Animation Workarounds*. The *Typology of Animation Workarounds* consists of five categories: *IT Functionality*, *Routinised Obstacles and Augmentations*, *Mishap Prevention and Avoidance*, *Resource Substitution and Development* and *Complying with and Subverting Management Expectations*. These categories have been foregrounded because of their relevance to animation production. We know that controlling labour and content is crucial for commercial production, and practitioners must interact and utilise agency within these structures and systems to ensure workload progression.

Likewise, the data illustrates that conservation of animation production resources is a key part of production decision-making. Therefore, the model foregrounds these categories to reflect the contextual conditions of contemporary production and the research results. The refined framework has tried to keep the relevant parts of Alter's model for modern series-making. For example, contemporary series-making utilises IT equipment for production and exhibition, in this manner, this category is largely interchangeable with Alter's original *Overcoming IT Functionality* category. Moreover, the refined model includes examples of animation workarounds collected from the research data, these can be seen in the Appendix: *Taxonomy of Animation Workarounds*.

This section has attempted to overcome some of the limitations of the original *Theory of Workarounds* framework, and thus presented refined a version of the *Theory of Animation Workarounds*, which outlines the motivations, development and implementation process of animation workarounds. Likewise, presenting the *Animation LifeCycle Model*, which demonstrates the iterative nature of seasonal improvement in contemporary series-making, and an industry-specific *Typology of Animation Workarounds*, which groups specific animation workarounds based on the relevant motivations in modern series-making.

These revised models have been extended and refined to account for decision-

Table 10.1: Typology of Animation Workarounds

Animation Workaround Category	Explanation
IT Functionality	Working around the conditions of IT use, such as, practitioners utilising IT in a non-standard or prescribed way to achieve outcomes, or developers excavating hidden software features for production team use.
Routinised Obstacles and Augmentations	Controlling labour and content generation are key for commercial production, practitioners may use *shop floor* agency to organise their own tasks to progress workloads despite organisational constraints.
Mishap Prevention and Avoidance	Practitioners utilise agency to prevent repeated potential delays and repeated work.
Resource Substitution and Development	Commercial series-making makes considerable use of animation production resources, both animation management and animation labourers design inventions and procedures to minimise resource expenditure to meet the conditions of commercial production.
Complying With and Subverting Management Expectations	As mentioned, control is key to cost-effective production, however, such systems can inhibit production progression, therefore, practitioners may pretend to comply with client expectations to prevent potential choke point delays.

making in contemporary production contexts and the impacts of animation workaround motivations, development and integration. The models presented here are important to animation production and theory because they overcome limitations inherent to the original models generated by a broad industry-neutral focus. Thus allowing practitioners and researchers to better understand animation workaround motivations, development and integration consequences.

These refined models show that normative changes are a part of commercial production. They help reconcile differences in available resources, creativity and execution. This is needed to maintain cost-effective production despite the specific factors of the animation industry. The models presented here make context-specific extensions to Alter's frameworks, developing these utilising rich context-specific data to model creative animation production processes. In doing so, these models strengthen the current study's contribution to knowledge both by overcoming the limits of Alter's industry-neutral approach and modelling change development and motivation in contemporary commercial series-making processes. Having presented refined versions of the *Theory of Animation Workarounds*, *Animation LifeCycle Model* and the *Typology of Animation Workarounds*, the discussion now moves on to consider the current study's limitations.

SECTION 10.4

Research Limitations

RESEARCH DESIGN

With regard to the research methods, some limitations need to be acknowledged. The research design of the present study has only examined 2D cut-out series assembly processes. This investigation's focus was contemporary 2D assembly, with comparative data gathered from other animation areas and stages. The research analysis has used historical examples from peer-reviewed journals to make generalisable claims regarding modification integration into accepted assembly activity in historical examples of studio fabrication. However, these results may not apply to all animation media and production situations. This limits the research conclusions to specific observations of digital production processes and generalisable judgements regarding the organisation of other non-digital animation media.

Being limited to a focus on animation workarounds in the storyboarding and layout processes, the findings of this study may not apply to all situations in which animation workarounds might occur in contemporary production processes. For example, animation workarounds may be perceived differently if they were to occur in a different part of the production process, such as early development. The research has established that practitioners perceive artefacts and choices as disposable during this phase. This perceived disposable functionality might affect the development of animation workarounds during preproduction processes. These potential differing situational factors might create difficulty when generalising the research results to other production process areas, such as character and environment design or postproduction, as contextual conditions may vary throughout the project duration. Although these factors present limitations to the findings, the strengths of this study include the gathering and analysis of in-depth primary data, allowing specific and relevant conclusions regarding the role of animation workarounds in the storyboard-layout transition in digital production processes.

A small sample size of interview participants restricts the research design. The research approach gathered primary data from semi-structured interviews with storyboard and layout artists. The small size of the dataset makes it difficult to generate generalisable conclusions regarding animation workarounds in storyboarding and layout processes in other geographic locations and production models. Although it is important to acknowledge these constraints, a key strength of the study is the in-depth focus on animation workarounds in the storyboarding and layout processes in digital series production in the UK. The research approach accomplished this using specific data gathered from selected participants to generate and contribute new contributions to existing knowledge and understanding of animation production processes.

The absence of quantitative data limited this study. In particular, the research identifies that privileged individuals/departments can shift work onto less privileged team members/sectors, in addition to highlighting the task types often shifted, as discussed in *Section 7.2*. However, the study could not determine the amounts, frequency and shifted work costs. Therefore, further data collection is required to determine the exact quantitative impacts of shifting work for the animation industry, such as lost **labour** hours and production **time**. The gathering of said quantitative data on these aspects may bring new research insights. Notwithstanding these data limitations, a key strength of this study is the identification of a privilege hierarchy in commercial studio departments, separated by work type, the ability of privileged individuals to shift work within contemporary production organisations, and the broad impacts on the wider animation assembly process.

This study was limited by the absence of in-person observation data of production and storyboard meetings and a lack of textual analysis data of storyboards and layouts. In particular, the study identified the approval process as a potential choke point and bottleneck in animation assembly, however, the study could not gather first-person observational data of the approval process. Therefore, further data collection is required to determine exactly how the nature of creative work approval might affect practitioner working processes and the creation of potential production bottlenecks. Although the absence of textual analysis and in-person observation data potentially limits the research design, the approach compensated by shifting to using in-depth interview data, allowing insightful conclusions regarding storyboard and layout artist's working processes.

CONCLUSION CONSTRAINTS

It is important to consider the research conclusion limitations. A limitation of the study is a focus on normative animation workarounds. This study investigated normative changes (*changes focused on achieving the norm*) in commercial animated series production. Therefore, data-gathering focused on collecting accounts of animation workarounds implemented to overcome obstacles and challenges perceived as preventing series project completion on time and within budget. However, these results may not apply to all forms and contexts of animation making, such as experimental and artistic modes, where artists perceive using non-standard materials as a normal part of the process. For example, experimental practitioners may create a sequence using coffee grounds on a lightbox, a medium that might seem quite out of place in a commercial production context. Although these findings might be limited, a key strength of the study is the data and conclusions regarding the use of animation workarounds in the North American/Hollywood production model. Therefore, the research conclusions are limited to the integration and consequences of normative changes to animation activity in the North American-led production model.

The study is limited to conclusions concerning the design and implementation of animation workarounds in animated series-making in the North American-led/Hollywood production model. To investigate this area, the research collected primary research data from practitioners working in the United Kingdom series-making industry. This specific and in-depth data was examined through the *Theory of Workarounds* to understand procedural modification integration in the US-led industry model. Although these factors limit the study's conclusions, a key strength of the investigation is the collection of interview data from relevant practitioners, analysed through pertinent frameworks, which provided an in-depth understanding of process modifications in animated series assembly, thus, making these results and conclusions nonetheless fit for purpose.

SECTION 10.5

Recommendations

PRACTICAL APPLICATIONS

The findings of this study have several important implications for future practices. This chapter part presents potential practical applications of this research that would benefit the animation industry. *Section 5.1* has shown that commercial animation production processes are based on the principles of digital mass-production, as such, there is a definite need for practitioners, small production teams and studios to consider how to apply the principles of mass-production, and especially those of digital mass-production when designing and implementing animation workarounds.

A second broad recommendation is for studios to consider using digital-replicability as a testing ground for future improvements. This principle enables iterative asset generation, allowing studios to create separate non-destructive copies of key files and the pipeline. These iterations can serve as a testing ground for potential solutions and ideas, reducing time, equipment and labour costs. Therefore, any potential changes should function with the principles of digital mass-production to ensure integration of future animation workarounds with current and future processes, methods and software. This is because it is necessary to continue making efforts to ensure that animation workarounds are compatible with, and can be integrated into, future established methods of series manufacture.

Another important practical implication is that these findings suggest that greater effort is needed to ensure there is time to develop production changes. The research findings in *Chapter 4* demonstrate that the design and implementation of animation workarounds requires significant investments of animation production resources. Practitioners and studios need to consider potential development costs against the resource costs of taking **time** and **labour** away from a project, and against the potential upsides of a change when deciding to implement a potential animation workaround. To compensate and account for these factors, animation management could allot earlier production time to designing and testing potential modifications before possible integration into established methods.

The provision of early production time for testing potential modifications could prevent resource limitations, such as unavailable time, from limiting animation workaround development. Likewise, such a process would allow some foresight into the advantages and disadvantages of potential modifications, indicating whether said change would either help to meet the conditions of commercial production or cost additional animation production resources to implement.

Furthermore, using preproduction time for animation workaround development and testing would allow fellow team members and supervisors to witness any successful process alterations, potentially increasing the integration of favourable modifications into future established methods. Such a process could generate new ideas and creative discoveries to develop new sequences and projects. Implementing this process has the potential to anticipate the situational outcome of possible modifications.

Another important implication is that, in this development, animation management should afford practitioners agency in workload organisation, providing artists with the ability to organise and prioritise their tasks in efficient completion of their workloads. Moreover, additional available postproduction time would allow artists to generate new creative outcomes using already created assets and shots. The only costs of said testing would be the **labour**, **time** and **equipment** expense. Scheduling this procedure into production downtime may mitigate these resource costs. Implementing these suggestions would seamlessly integrate animation workarounds into existing production workflows with minimal disruption.

A further important implication is that personal factors, such as potential group consensus in production teams, have the potential to prevent individuals from making suggestions for process improvements, as illustrated in *Section 7.2*. These findings suggest a course of action. For example, studios could allow anonymous suggestion of potential animation workaround ideas. This may prevent the impact of organisational and social barriers to change based on the hierarchical position and the personalities of individuals' suggesting potential activity alterations. Such a process may enable organisations to utilise suggestions from practitioners who may have otherwise felt reticent about expressing new ideas. Therefore, such a suggestion has the potential to democratise the development of future procedures and might overcome the impact of potential overbearing vocalisations of prominent team members that can inhibit the suggestion and development of novel solutions.

These findings have shown that animation labourer and animation management intentions are broadly aligned, namely, completing projects with minimal **time** and **labour costs**. However, the data shows their approaches to achieving this aim differ. For example, *Section 7.1* established that artists' interaction time is the most important production resource, and that animation management may wish to lower overhead costs by reducing the number of artists. However, the findings show that these changes do not eliminate total labour; instead, they delay it, which often increases future work through revising created content. This increases individual practitioner workloads, as the same volume of tasks is distributed among fewer animation labourers. Therefore, greater effort is needed to align *macro* and *micro-level* approaches and activities. For example, animation management could consult practitioners early in production to identify the most useful changes for development, utilising practitioner skills and expertise when developing organisational routines and procedures. By using the *execution level* expertise of practitioners in allocating animation production resources and organising production activity and tasks, studios and practitioners can save production **time** and **labour** in making animated content. Thus, the *execution level* knowledge of individual animation labourers can facilitate the conditions of commercial production. Such integration of *micro* and *macro* perspectives use specialist knowledge of animation practitioners in *synthetic thinking* processes when considering changing established methods.

The findings in *Section 6.2* demonstrate that the approval process, while a vital control point for channelling resource-intensive creative content, can be a major production bottleneck. Studios and animation management should exert greater effort to consider approval process impacts on practitioner workload and production progression. Therefore, studios could consider practitioner skills when making organisational decisions. Such consideration avoids allotting additional work to artists outside their skill set, emphasising artist specialisation and the detailed division of labour, increasing the potential for commercially viable production. Likewise, spacing the approval process differently would allow practitioners to complete work without awaiting approval, potentially avoiding bottlenecks. This can reduce the amount of **time**, **labour** and subsequent **financial** expense utilised in the production process.

The findings of this study also have implications for instrumentalist texts designed to prepare students for careers in the contemporary animation industry. *Chapter 9* has established that the role of layout has shifted from technical draughtsmanship to asset manipulation; as the construction of layouts has shifted to construction kits comprising layers and assets, where assets can be repurposed on an ad hoc basis. A key priority for future layout texts could be to educate prospective layout artists about these problem-solving processes that now occur in digital production assembly.

Likewise, *Section 6.2* found that control points can be a potential bottleneck for individual workload completion. Future texts might also advise students on strategies based on this thesis's results for workload management concerning potential choke points, and how to control the flow of information to make the approval process time-effective. Such changes would allow students and future practitioners to understand production processes in a new way and would equip prospective layout artists with relevant knowledge for contemporary layout industry roles.

A key consideration is sustainable production processes. Developing energy-efficient and carbon-neutral animation methods requires further work. The United Nations *Sustainable Development Goals* (SDGs) provide optimistic and challenging targets for talking about geopolitical relations, climate change and environmental preservation. These outcomes require significant political and organisational will, capital investment, and policy implementation to achieve the objectives within the Goals' shifting timescales. Nonetheless, there is a role for private enterprises, such as media production and consumption, as well as debate, to play in orientating towards sustainable production methods and consumption. The challenge now is to align commercial production processes with the SDGs.

It is necessary to put in greater efforts to ensure sustainable production. The key considerations for modern animation production are Goal 7: *Affordable and Clean Energy* and Goal 9: *Industry, Innovation and Infrastructure*. Goal 7: *Affordable and Clean Energy* targets a focus on businesses maintaining and protecting ecosystems by sourcing energy from renewable sources, prioritising less-energy intensive transportation and lowering total consumption (United Nations, n.d.). While Goal 9: *Industry, Innovation and Infrastructure* targets increasing small-scale industrial enterprise, upgrading and retrofitting industries to increase sustainability – specifically increasing the amount of research and development workers and research into development spending (United Nations, n.d). Policymakers should prioritise sustainable animation production processes as a key priority.

The findings identified in this study can be used to develop targeted interventions aimed at aligning commercial and sustainability concerns in modern series-making. The research has shown that contemporary production processes pervasively use digital tools for both production and exhibition. These digital tools require electrical energy to function. The study has shown that reusing labour, assets and process saves the **time** and **labour** required, thus increasing commercial viability. This material reuse also reduces the total energy consumption and potential carbon footprint of production. Therefore, increased use of re-used material can reduce the energy requirements and carbon impact of commercial production. Likewise, the study found that animation management expectations and practitioner agency impact process efficiency and cost. To boost sustainability, practitioners should consider reducing the transportation of physical animation assets, like stop-motion character rigs, which require energy-intensive shipping; instead, opting for digital alternatives such as 3D printed or vector-based assets. Finally, increasing the number of research workers and allowing for individual practitioner agency in production may allow industry concerns to align with sustainability concerns. Taken together, these findings suggest policy and organisational changes that can align commercial and sustainability considerations in contemporary and future animation assembly. Having discussed the implications for industry, the next section addresses areas of future research.

SUGGESTIONS FOR FUTURE RESEARCH

This study intends to act as a starting point of research into animation workarounds in animation scholarship. As such, this chapter portion presents suggestions for future researchers to build upon this study's findings. Future research might explore the development and integration of animation workarounds into the accepted processes in other commercial production models, such as animated features and media, like physical or 3D digital animation modes.

The study examined the relationship of animation workarounds in contemporary 2D cut-out animated series that extensively use digital technology. *Chapter 9* established the impacts and conditions of working with 2D cut-out assets. There may be additional fabrication cost concerns for physical animation media, such as prototyping assets. Future studies can investigate the design, implementations and consequences of animation workarounds in other animation media. For example, studying differences in process modifications between lens-based and digital animation assembly processes. In addition, research into workarounds in physical stop-motion animation assembly can create new understandings of digital mass-production functionality in 3D printing and rapid prototyping aspects of asset construction.

Furthermore, future studies can investigate how animation workarounds are developed in feature assembly contexts with a 3 to 4-year development cycle with a dedicated research and development phase. Such research can generate a more holistic and detailed understanding of workarounds in commercial animation processes.

An investigation into the approval process and remote working impacts on animation assembly in other geographic locations and production models could prove insightful. This research investigated animation workarounds in United Kingdom series-making to understand the integration of such changes into accepted activities in the North American/Hollywood-led production model. However, this study only looked at the impacts of shifted work in UK series-making. Future researchers can examine these phenomena in studios based in other geographic locations.

Likewise, in the time since this research began, attitudes towards remote working have shifted, with potential consequences for commercial producers in the control of remote artists and content and the wider relationship between animation labourers and animation management. Subsequent inquiry can seek to understand the limitations and constraints of the remote working model, such as tax credit allocation for nationalised employees, which may influence studio employee recruitment. To continue receiving potential tax credits, studios may prefer to hire only remote workers from the same country. Such new inquiry can study remote working impacts on routines and synchronicity: understanding how communication delays can affect production progression and bottlenecks.

Likewise, future research can ascertain the impacts of other aspects of production models that span multiple locations, such as *studios for hire* employed on an outsource basis, and the effects of shifted work in other models and locations. Therefore, future researchers can develop a more comprehensive understanding of animation workaround integration and the relation of employer-employee relationships in other forms and models of animation production.

This research utilised in-depth interview data to understand the motivations, generation and implementation processes of animation workarounds in contemporary production processes. What is now needed is further study utilising in-person observation and textual analysis data to increase our understanding of process alterations. Geographic necessity and shifting to using interview data instead of a textual analysis of storyboards and layouts constrained the data-gathering procedures of this research. Therefore, it would be interesting to assess the effects of incremental changes accumulating over time, or large alterations at key moments in the production process through a textual analysis of production artefacts such as storyboards, layouts and assets. Likewise, in-person observation of decision-making in production and storyboard meetings may produce interesting data and conclusions. Thereby, future researchers can build upon the findings of this study, developing a body of scholarship into animation workarounds and their impacts in commercial production.

Further research should focus on determining the quantitative impacts of animation workarounds and shifting work on individual and wider production processes. This research identified that successful animation workarounds have the potential to meet the conditions of commercial production. However, this study identified that successful changes are those that reduce the expenditure of animation production resources. As such, the research did not focus on producing a quantitative analysis of the impacts of this phenomenon. Future investigations could utilise quantitative data to examine animation production tasks and processes both **before** and **after** the design and implementation of a specific change. Such analysis could determine how many render or production working hours a particular animation workaround has saved or added to the production process. It would be vital to the commercial viability of the animation industry to understand better and use qualitative data such as this to generate a more nuanced and in-depth understanding of the impacts of shifted work, such as labour hours and production time costs.

Moreover, *cross-sectional* data analysis methods could generate further understandings of these impacts by sector, department and production phase. Likewise, a *longitudinal* analysis could investigate change effectiveness over different eras and geographic locations, such as series-making in 2004 compared to 2014. This could create new understandings regarding the cost of privilege and animation workaround effectiveness in commercial series-making. For example, assessing the impacts of a specific procedural change, regarding labour hours and monetary costs, besides identifying influential situational and contextual factors for workaround development. These understandings would provide industry and scholarship with discernment of the most efficient types of activity modifications to implement in commercial series-making.

Further research is required to understand better the complex association between the use of artificial intelligence (AI), digital-replicability and the implications of these in creating digital animated content. *Chapter 5* found that commercial production processes are based on the principles of mass-production and digital mass-production. Likewise, *Section 5.1* found that *parent-child relationships* can replicate errors during iterative asset generation, as digital replication duplicates both the asset and any errors and conditions therein. Moreover, generative AI can also replicate errors and conditions from source data. The implications of this are under-recognised in both animation scholarship and industry. More research is required on the quantitative impacts of digital mass-production principles on series-making methods, such as aesthetic aspects of animated frames: lines/colour in digitally drawn animation, and data storage formats – binary or hexadecimal formats, for instance. Such research could specifically focus on the implications of digital-replicability of file format access for both proprietary and open-source files.

Concluding Summary

These final paragraphs highlight the scholarly merit of the thesis, the contribution to knowledge that the research has made, and present a final recap of the major findings. A key strength of the present study is using appropriate methods and research paradigms to generate new knowledge of animation workarounds. Likewise, a major strength of this study's approach is that this research collected and analysed relevant data with academic rigour to produce conclusions with scholarly merit.

Before this study, the role and extent of use of animation workarounds was poorly understood in both the fields of animation scholarship and *Production Studies*. This lack of understanding also represented an existing knowledge gap in workarounds research. The study presented here is one of the first investigations to examine the motivations, processes, implementation and consequences of animation workarounds into established methods of animated series assembly.

The current thesis provides the first comprehensive study of animation workarounds, and in doing so has extended conventional workaround research instruments from examining IT-reliant businesses and applies these in studying contemporary animation processes. This present research extends our knowledge of animation workarounds. This is achieved by combining disparate concepts – workarounds with animation production processes – to investigate contemporary issues in series-making. The research has revealed new understandings of production team organisation and modern layout processes in contemporary series-making. This is the first study to use the *Theory of Workarounds* to examine modern series-making methods to draw new conclusions about contemporary processes. Therefore, the present study is vitally important in furthering our understanding of the role of animation workarounds in contemporary digital processes and hopes to provide a starting point for future research into these objective-based changes.

The results of this study indicate that animation workarounds function by bridging storyboard and animatic functionality, along with organisational changes designed to minimise production resource cost. Digital production processes are established in contemporary series-making, therefore, animation workarounds function accounting for the principles and considerations of digital production tools, allowing ad hoc changes that progress production and reduce resource expenditure, such as *on-the-fly* asset library creation. The evidence from the study suggests that practitioner labour hours are the most important production resource, as such, production activity is designed to minimise changes in created material via the approval process, when changes are made, a path of least resistance can be observed to avoid unnecessary labour hour expenditure. The study's findings suggest that process-based animation workarounds are viewed as a means of achieving the goals of production: completing the project on time with controlled costs. These can be tacitly accepted, whereas creative changes require management approval before acceptance and incorporation into accepted methods. Finally, the study has revealed that privilege allocation among individuals and departments allows the accepted shifting of work onto less privileged individuals and sectors and the sanctioned changing of established processes.

Glossary

adaptation – (Temporality of Workarounds) Part of Alter's (2014) *Temporality of Workarounds*, that specifically refers to short-term (occurring in seconds) changes to established processes that are designed and implemented to overcome the impacts of fixes to problems, constraints and obstacles (Alter, 2014, pp.1048-1049). 25, 312–318

animation labourer – An individual in the hierarchical organisational structure of an animation studio who does not have the authority to allocate work to other production personnel (an assistant animator or an individual in a technical role such as a rigger, for instance). Animation labour and *animation management* can be thought of as being separated by *the line* between creative and technical job roles. iii, 19, 22, 31, 32, 37, 44–48, 60, 61, 64, 67, 80, 84, 86, 87, 90, 94, 95, 100, 102, 105, 108, 112, 114, 126, 128, 129, 138, 147–150, 159, 164, 173, 180, 188, 194, 196–199, 202, 206, 217, 235, 247, 248, 262, 267, 277, 280, 287, 293, 296

animation management – Referring to individuals who are in hierarchical positions in the animation studio organisation who have the authority to make creative and organisational decisions (such as the positions of director, producer or head of a department, for instance). iii, 19, 22, 32, 37, 40, 42, 44–48, 55, 60, 61, 64, 67, 79, 80, 84–91, 93–95, 100, 102, 104–106, 108, 112, 114, 120, 125–129, 137, 138, 144, 145, 147, 150, 152, 159, 166, 170–173, 178, 180, 181, 184, 193–198, 201, 204, 205, 216–219, 237, 238, 240, 247, 249, 250, 260–262, 266, 267, 270, 272, 274, 276, 277, 279, 280, 283, 287, 291–293, 295, 296, 312, 320

animation production resources – The investment in **time** (the time required to complete tasks that the production schedule can allocate, **labour** (the human interaction needed to complete tasks), **budget** (the available funds to pay for staff to work on the project and to purchase/rent animation equipment and materials) and **animation equipment** (the equipment and materials that are needed to complete animated content, such as workstations, software and paper, for instance). 31, 36, 37, 39, 40, 49, 78, 79, 89, 95, 99, 117, 147, 150, 157, 158, 170–172, 182–186, 190–192, 195–198, 200, 206, 224, 225, 231, 233, 256, 259, 267, 270, 274–278, 286, 287, 291–293, 297, 310, 311, 315–318, 320

animation workaround – A deviation (either an invention or a procedure) from established animation production processes designed to overcome the impact of an obstacle, mishap or procedure that can be perceived as preventing an animated project from being completed on time and/or within budget. Animation workarounds can be divided into **normative workarounds**: workarounds to achieve the norm – the completion of the animation on time and within the production budget – and **creative workarounds**: a practitioner wishing to produce animation with non-standard materials and processes. iii, iv, 11, 12, 14–17, 19, 22, 24, 25, 27, 28, 33–35, 37, 38, 40, 43, 48, 51, 53, 54, 56, 59–65, 67, 69–71, 77, 78, 80, 84–95, 97–99, 101, 104–110, 113–118, 123, 125, 127–130, 133, 136, 141, 143, 148, 151, 158, 160, 161, 164, 165, 168–171, 173, 178, 181–183, 189–192, 196, 202, 205–207, 209–213, 215, 218, 220–223, 225–229, 232, 234, 239, 241, 242, 250, 255, 256, 264, 266, 267, 270, 271, 274–278, 280, 282, 283, 285, 286, 288–292, 295–297, 299, 300

assembly – (Requisites for Understanding Mass-Production) One of the three requisites for understanding mass-production, that specifically involves breaking down the assembly process into discrete segments and the detailed division of labour – the division between skilled and unskilled workers and specific animation roles, such as ink and painter and in-betweener. These principles of mass-production are utilised in animation production to reduce the cost of labour and time in the fabrication of animated content. 30, 134, 305

bricolage – (Temporality of Workarounds) Part of Alter's (2014) *Temporality of Workarounds*, referring to fixes to problems, constraints and obstacles that occur in a medium amount of time and making use of what is available (Levi Strauss, 1967, in: Alter, pp.1048-1-49). 25, 78, 79, 117, 128, 141, 150, 170, 221, 224, 239–241, 246, 309, 311–316, 318–320

choke point – A point in a production process or organisation where creativity is controlled. Harvey Deneroff (in: Langer 1991, p.12) states that control of creativity equals control of authority, identifying two traditional choke points of creativity in the animation production process: the story department and the initial layout and design of the film by the director (ibid.,). 172–174, 179–181, 267, 268, 282, 287, 290, 294, 320

conditions of commercial production – The demands that studio animation must meet to be a commercially viable part of the film industry, specifically that the makers of animated films must produce animated content for exhibition regularly and must control the costs of this production (Langer, 1991, p.5). 22, 29, 37, 39, 40, 42, 47, 76, 81–84, 89, 90, 92, 94, 95, 101, 103, 107, 108, 110, 113, 114, 122, 125, 126, 128, 129, 147, 150, 151, 156, 168, 170, 180–182, 185, 192, 194–196, 205, 210, 214, 216, 224, 228, 246, 249, 256, 260, 262–265, 267, 268, 270, 272, 274, 276–278, 280, 287, 292, 293, 297

digital mass-production – (Requisites for Understanding) An extension of Staiger's *Requisites of Understanding Mass-Production* – specifically focused on animation production with the aid of digital production tools developed as part of this research. Consisting of the animation-specific principles of: digital-replicability, digital-standardisation, digital-interchangeability and digital-assembly. The cost-efficient production of contemporary animated series is based on the utilisation of these principles. iv, 16, 39, 134, 135, 137–139, 143, 151, 152, 156, 158, 159, 216, 231, 233, 234, 238–241, 249, 256–258, 260, 262–264, 269, 273, 279, 291, 295, 298

digital-assembly – One of the three requisites for understanding digital mass-production, involving the construction of digital animation assets (character and environment models, for instance) and files (program files or the internal organisation of work within a program such as a organisational structure of bins in a non-linear editing suite, for instance). iv, 134, 135, 138, 144, 152, 233, 303

digital-interchangeability – One of the three requisites for understanding digital mass-production, referring to the idea that separate elements within a file, or collections of files, can be assembled in multiple combinations. For example, layers in a Photoshop .psd file that can be copied and pasted between different Photoshop files to create new files, such as new character models. iv, 134, 135, 138, 144, 152, 216, 233, 238, 241, 303

digital-replicability – One of the three requisites for understanding digital mass-production, referring to the capacity of IT hardware and software to produce a 1-to-1 copy (or copies) of digital files (or parts of digital files), which can be used to edit the created file while preserving an untouched copy of the original, or to create a backup. 134, 135, 143–146, 149, 152, 159, 198, 219, 238, 241, 263, 265, 291, 298, 303

digital-standardisation – One of the three requisites for understanding digital mass-production, the concept of conforming digital animation artefacts, such as animation program files, to the required standards that digital files should adhere to in order to be opened and edited within appropriate software. For example, a Photoshop file should be able to be opened, read, edited and saved by versions of Photoshop on both Windows and Macintosh platforms. iv, 134, 135, 137, 138, 152, 156, 216, 233, 238, 303

directive – (domain) Part of Blatter's tripartite model of storyboard functionality, specifically efficiently organising a future production activity (Blatter, 2007, p.8). 49, 52, 200, 210, 211, 213, 215, 217, 223, 224, 242

fictive – (domain) Part of Blatter's tripartite model of storyboard functionality, specifically referring to story logic and the hypothetical story world (Blatter, 2007, p.8). 49, 210, 212, 213, 217, 218, 230, 231, 242, 245

filmic – (domain) Part of Blatter's tripartite model of storyboard functionality, specifically, the nature of the intended film, including filmic continuity, consistency of location and staging in previous panels, in addition to visual perception (clarity) (Blatter, 2007, p.8). 49, 200, 210, 212, 213, 217, 218, 223, 228–231, 242, 245, 246, 257

improvisation – (Temporality of Workarounds) Part of Alter's (2014) *Temporality of Workarounds* – referring to short-term (seconds to minutes) activities in which design and execution often overlap (Miner, Bassoff, and Moorman, 2001 cited in: Alter, 2014, p.58). 25

interchangeability – (Requisites for Understanding Mass-Production) One of the three requisites for understanding mass-production, a characteristic which means that parts made by one worker fit parts made by another worker. For example, interchangeable mouths for stop-motion puppets. 30, 134, 155, 156, 238, 305

mass-production – (Requisites for Understanding) The requisites for understanding mass-production, as identified by Janet Staiger in (Bordwell et al., 1985, pp.90-92), consisting of: standardisation, interchangeability, and assembly. 30, 32, 34, 129, 134, 142, 143, 152, 158, 159, 250, 256, 257, 262, 264, 273, 279, 291, 298

real-time evaluation and testing approach – (storyboarding process) An approach to developing animation narrative ideas through the use of in-render environments, such as a video game engine in the case of machinima animation production, or the use of 3D character and environment models in the *shot generator* in applications such as *Storyboarder*. In this approach to creating narrative and filmic content, the testing of story ideas takes place in real-time – practitioners move the assets around the animated scene and test compositions and animations in the animation program. 51, 54, 56, 210, 211, 226, 233, 240, 249, 260, 306

reuse systems – A system of organising, creating and using assets and a process whereby an animation asset, such as a character model/environment or even an animated shot/sequence, can be used in multiple scenes without the need to create a new asset. iii, 14, 16, 19, 37, 56, 59–61, 64, 67, 81, 82, 119, 120, 133, 134, 143, 149, 151–155, 158, 238, 255, 262, 263, 265, 318

standardisation – (Requisites for Understanding Mass-Production) One of the three requisites for understanding mass-production, involving the standardised specifications of constituent parts and uniform conditions for animation presentation formats, such as export formats of 1920 x 1080 at 25 frames per second. 30, 134, 155, 156, 305

traditional storyboarding approach – (storyboarding process) The traditional approach to creating and articulating animation narrative and filmic content using a storyboarding process. Usually consisting of a process of working out fictive and filmic ideas firstly through *thumbnails*: small drawings to illustrate the action (Winder & Dowlatabadi, 2001, p.186), a *rough pass* that illustrates character placement and camera angles (ibid.,), before being developed into a *cleaned up storyboard* with fully rendered panels to provide all of the details of the scene (ibid., p.191). In this approach, the idea for the narrative and the contents of each scene are worked out far in advance of the animation process using relatively inexpensive materials, such as paper and pencils. This process allows the discovery of creative mistakes and effective ways of portraying the narrative instead of making expensive mistakes in the production phase, as opposed to the real-time evaluation and testing approach. 49, 51, 53, 210–212, 225, 233

work system – A unit of analysis for thinking about systems in which human participants/machines perform work using resources to produce goods and services for specific internal/external customers (Alter, 2017, p.2). Work systems evolve iteratively over time through a combination of planned change – formal improvement projects, and emergent/unplanned change through adaptations and bricolage – making do with what is to hand (Levi Strauss, 1967, in: Alter, pp.1048-1-49). 11, 22, 25, 26, 77, 88, 89, 103, 152, 276, 306

workaround – (Temporality of Workarounds) Part of Alter's (2014) *Temporality of Workarounds*, referring to fixes to problems, constraints and obstacles that occur in a longer period and that represent substantial changes to aspects of a work system to overcome problems. 25, 128, 309–311, 314, 316–318, 320

workaround – Goal-driven changes to aspects of a work system to overcome the impact of obstacles, practices or constraints that are perceived as preventing a work system or its participants from achieving the desired level of effectiveness, efficiency or organisational/personal goals (Alter, 2014, p.1044). Workarounds change aspects of the current work system without the separate allocation of significant project resources (Alter, 2013, p.82). iii, iv, 11, 14, 15, 19, 21–25, 27–29, 33, 54, 56, 57, 60, 61, 64, 67, 73–75, 78, 80, 81, 83–88, 90, 93–96, 98–104, 106–115, 117–119, 122, 124, 126, 127, 136, 142, 151, 164, 166, 169, 177, 178, 183, 190, 191, 206, 219, 222, 225–227, 240, 257, 262, 276–278, 281, 285, 295–297, 299

List of Participants

These are the details of the animation production professionals who assisted by participating in interviews for this research.

David Blanche is a freelance Producer, Director, and Artist working for studios such as Mackinnon and Saunders and is the Co-founder and Director of Small Fry Animation. David is an Arts University Bournemouth BA Animation Production course graduate.

Andy Blazdell is the Managing Director of CelAction Ltd., and specialises in providing technical consultancy to productions that use CelAction2D, such as *Mr Bean: The Animated Series* (2002 – 2004 and 2004 – 2019), *Sarah & Duck* (2013 – 2017) and *Bluey* (2018 – present).

Rosie Cash is a Freelance Storyboard Artist who has worked as a Storyboard Supervisor for Sixteen South and is an Arts University Bournemouth BA Animation Production course graduate.

Anye Chen is a Senior Layout Artist at Cartoon Saloon, who has previously worked as a Layout Artist at Brown Bag Films and is also a graduate of the BA Animation Production course at Arts University Bournemouth.

Mat Dame is a Freelance 2D Character Rigger and Animator specialising in working in CelAction, Toonboom, and Adobe After Effects. Mat has worked as a Technical Director at Lupus Films, a Lead Rigger at A Productions, and as a Rigger on *Horrible Histories* (2015 – present) at Studio43 Ltd. Mat is a graduate of the MA Animation Production course at Arts University Bournemouth.

Kayvon Darabi-Fard is a Senior Story Artist who has worked as a Senior Lead Storyboard Artist within the Feature Film Department at Cartoon Saloon and as a Storyboard Artist at Boulder Media, working on productions such as *Transformers: Rescue Bots Academy* (2019 – 2021), *My Little Pony: Rainbow Roadtrip* (2019), and *Littlest Pet Shop: A World of Our Own* (2018 – 2019). Kayvon is an Arts University Bournemouth BA Animation Production course graduate.

Antonia Gancheva is a Lead Layout Artist at Cartoon Saloon and has worked for Karrot Animation Studios, where she worked on *Sarah & Duck* (2013 – 2017) and *The Snowy Day* (2013 – 2017). Antonia is an Arts University Bournemouth BA Animation Production course graduate.

Carla Mackinnon is an Animation Producer, Festival Organiser and Animation Lecturer at various universities, including the Royal College of Art, London College of Communication, Central St Martins, Norwich University of the Arts and Ravensbourne University. Carla completed her PhD at Arts University Bournemouth.

Liz Strawbridge is a Storyboard Artist and Graduate of the MA Animation Production course at Arts University Bournemouth, specialising in the relationship between storyboarding and editing in the development of animation narrative.

Tony Tarantini is a Professor of Animation at Sheridan College, Canada, and worked as an Assistant Director at Cookie Jar Entertainment and has worked as an Assistant Director, Storyboard Artist, Layout Supervisor and Designer at Nelvana.

Taxonomy of Animation Workarounds

The *Taxonomy of Animation Workarounds* uses the research data to build and expand upon Alter's *Theory of Workarounds* (2014) presented and discussed throughout this thesis.

IT Functionality

OVERCOMING BUGS AND A LACK OF AUTOSAVE FUNCTION

Workaround description: Using a preview of a video layer in CelAction to trace over a previous drawing, saving completed work and thought processes to use when recovering from a program crash (Dame, 2021).
Obstacle to bypass: Limited software features, functionality and potential software bugs.
Temporality of Workaround: Bricolage/workaround.

OVERCOMING A LACK OF FAMILIARITY WITH SPECIFIC SOFTWARE PROGRAMS

Workaround description: Creating an entire animation project in one program. For example, Mat Dame (2021) created an entire animation project solely in Adobe After Effects as this software program he was the most familiar with at the time of

production.
Obstacle to bypass: Software familiarity.
Temporality of Workaround: Workaround.

IMPORTING 3D ASSETS INTO ADOBE PHOTOSHOP AND DRAWING ANIMATION OVER THEM

Workaround description: Using 3D models as reference for drawing complicated objects by importing the 3D models into programs, such as Adobe Photoshop, Storyboard Pro, and Toonboom, and drawing animation on a layer above the imported 3D object, much like a rotoscoping process (Dame, 2021).
Obstacle to bypass: Software familiarity and functionality.
Temporality of Workaround: Workaround.

MODIFYING THE PHOTOSHOP TIMELINE TO ACT LIKE A NON-LINEAR-EDITING SUITE

Workaround description: Alex Grigg manipulates the Adobe Photoshop timeline to behave like – and so that it can be controlled similarly to – a non-linear-editing suite, such as Adobe Premier. This is accomplished using three main methods: 1) layer animation, setting the system pre-sets to move the playhead forward/back one frame when the right/left arrow keys are pressed respectively; 2) Video-layers, allowing faster processing for some animations, as well as layers for clean-up and colour; and 3) Video groups: for organising the video layers (Grigg, 2013).
Obstacle to bypass: Limited animation production resources – production **time** and **budget**.
Temporality of Workaround: Workaround.

USING MULTIPLE COMPUTERS TO OVERCOME PLATFORM FUNCTIONALITY AND ACCESS CERTAIN SPECIFIC SOFTWARE FEATURES

Workaround description: Primarily working on one platform, such as a Windows PC and using another computer, for example, an Apple Mac, to access platform-specific features, such as Apple ProRes 442 Codec export functionality in Adobe Creative Cloud applications before 2018 (Blanche, 2021).
Obstacle to bypass: IT functionality and platform-specific hardware and software features.
Temporality of Workaround: Bricolage.

ANIMATING VISUAL EFFECTS WITHIN THE COMPOSITION

Workaround description: Designing a shot or sequence so that the majority of the visual effects are created and executed within the composition in the animation program, such as Adobe After Effects, rather than in postproduction, thus saving rendering time (Dame (2021).
Obstacle to bypass: Limited animation production resources – production **time**, **budget** and established practices and current schedule constraints.
Temporality of Workaround: Bricolage/workaround.

AVOIDING REPETITIVE TASKS AND OVERCOMING PROFESSION-SPECIFIC TRAINING AND EMBEDDED PROCESSES

Workaround description: Mat Dame's (2021) method of importing Photoshop artwork into ToonBoom to avoid completely redrawing the asset when transferring assets between software applications.
Obstacle to bypass: Specific training of animation specialities and established practices.
Temporality of Workaround: Bricolage.

BUTTING HEADS – OVERCOMING DIFFERENT PARTIES NOT UNDERSTANDING EACH OTHER/OR DIFFERENT (LESS FAMILIAR) ASPECTS OF THE PRODUCTION PROCESS

Workaround description: Overcoming potential knowledge state differences that mean animation management can make decisions that may hinder production progression. For example, end clients unfamiliar with production processes may request changes to production artefacts, such as storyboard character representations, without realising these do not represent the final character designs.
Obstacle to bypass: Organisational training routines, practices, project management expectations and individuals' different knowledge states.
Temporality of Workaround: Adaptation to bricolage

SAFE TO START RIGS

Workaround description: Identifying work that can be conducted and completed without needing to wait for an approval process. For example, Mat Dame's (2021) *Safe-to-Start* character rigs: character rigs with minor fixes that can be implemented without having to wait for a potentially slow and repetitive approval process.
Obstacle to bypass: The approval process, project schedule and the animation stu-

dio's and individual's established practices.

Temporality of Workaround: Adaptation and/or bricolage

AVOIDING COMPLICATED ACTION NOT INTEGRAL TO THE NARRATIVE

Workaround description: Considering the balance between the 1) work required to complete a shot against 2) the impact and result of that shot. For example, storyboard artists and animators split the action of a character putting on a hat into two shots: one shot with the character wearing the hat and the other shot without the character wearing the hat, to avoid using complex models and to hide the switch between the two models (Dame, 2021) and (Cash, 2022).
Obstacle to bypass: Complex and complicated action and animation, production schedules, asset practicalities and the animation of complex action.
Temporality of Workaround: Adaptation and/or bricolage

DIRECTING THE CAMERA AWAY FROM GLITCHED ACTION

Workaround description: Directing the camera away from a glitched or undesirable part of a character model, possibly to hide a glitched animation, then using another device, a sound cue, for instance, to convey the narrative action and story point (Michael Nitsche Mark Riedl, and Nicholas Davis, 2011, pp.58-59).
Obstacle to bypass: Animation glitches in assets needed to tell the story. In addition to undesirable character model parts that do not match the script/storyboard or other assets' visual style.
Obstacle to bypass: Animation glitches in assets needed to tell the story. In addition to undesirable parts of a character model that do not match the script/storyboard or the visual style of other project assets.
Temporality of Workaround: Adaptation and/or bricolage, potentially a workaround where there has been more planning involved in the shot choices.

DOUBLE-CHECKING COMPOSITION SETTINGS BEFORE EXPORTING

Workaround description: Double-checking the composition settings before exporting within the animation program, such as Adobe After Effects (Blanche, 2021).
Obstacle to bypass: Limited animation production resources.
Temporality of Workaround: Adaptation to bricolage.

PARALLEL WORKFLOWS

Workaround description: Creating a *first run* of scenes to be animated from the assets (character and environment models, for instance) that are available first, while remaining assets are being created in parallel in the production schedule. When these additional assets are completed, all the scenes that require these newly created assets are then animated (Teevan, 2011, pp.89-96).
Obstacle to bypass: Limited animation production resources.
Temporality of Workaround: Workaround.

SLAP A LUT (LOOK UP TABLE) ON EXPERIMENTAL ANIMATION, AND IT POPS!

Workaround description: Adding effects/colour layers to experimental animation to enhance the sequence, especially when the project team are not happy with the original animated sequence (Blanche, 2021).
Obstacle to bypass: Limited animation production resources.
Temporality of Workaround: Adaptation and/or bricolage.

DRAWING A PERSPECTIVE GRID IN A DIGITAL STORYBOARD PANEL TO DENOTE THE ANGLE AND PERSPECTIVE OF THE SHOT

Workaround description: Storyboard artists may draw a rough grid in a digital storyboard panel in Storyboard Pro, for instance, to show the angle and depth of the scene (Strawbridge, 2021).
Obstacle to bypass: Established processes, emulating a 3D world on a two-dimensional (flat) storyboard panel.
Temporality of Workaround: Adaptation.

BREAKING DOWN CHARACTERS INTO BASIC SHAPES IN A STORY-BOARD PANEL

Workaround description: Breaking down and simplifying the character design into shapes representing a specific character in a storyboard panel (Strawbridge, 2021).
Obstacle to bypass: Ensuring consistent, accurate character representations in storyboard panels against the contexts of limited drawing time, changing character designs and finite production schedules.
Temporality of Workaround: Adaptation.

GENERIC CHARACTER RIGS

Workaround description: Creating multiple character rigs from one primary character rig, then replicating and adjusting the rig to create additional characters (Teevan, 2011, pp.89-90).
Obstacle to bypass: Limited animation production resources.
Temporality of Workaround: Workaround.

GEOMETRY-OPTIMISED ASSETS

Workaround description: Assets that look different from different angles. So, the same asset can be used in different scenes and for different purposes, saving production time, compared to creating many assets that look different and rendering these in animation separately (Teevan, 2011, pp.89-91).
Obstacle to bypass: Limited animation production resources.
Temporality of Workaround: Workaround.

REUSE SYSTEMS

Workaround description: A process where assets, such as character models, environments, or entire shots, are designed to be used in multiple scenes and

sequences. Reuse systems are more common in animated television series production than in animated features (Tarantini, 2011). It should be acknowledged that care must be taken not to overuse assets (particularly backgrounds) as this runs the risk of lowering a project's production value (Byrne, 1999, p.57).
Obstacle to bypass: Limited animation production resources.
Temporality of Workaround: Adaptation to bricolage or workaround depending on the nature of the individuals and the reuse system itself.

PHYSICAL AND DIGITAL KITBASHING – REPURPOSING ELEMENTS INTO A NEW OUTCOME

Workaround description: Practitioners design and create new assets from the repurposed parts of existing assets, such as copying a character model's foot and editing this to become a hand. Likewise, *kitbashing* can be an accepted part of visual effects and design processes, as usefully illustrated by John Eaves designs for additional spaceships in *Star Trek: Enterprise* (2002-2005).
Obstacle to bypass: Limited animation production resources.

PERSONAL SCHEDULES

Workaround description: Mat Dame (2021) creates his own personal schedules to avoid having to look at numerous spreadsheets that have been created by many different production departments.
Obstacle to bypass: Organisational routines, project schedule and practitioner workload.
Temporality of Workaround: Bricolage

PROCEDURE LIST – LISTING THE INDIVIDUAL STEPS WHEN STARTING A NEW PRODUCTION

Workaround description: When starting on a new production, Mat Dame (2021) creates a list of steps to accommodate a production team's specific ways of doing

things, such as using specific ToonBoom colour pallets.
Obstacle to bypass: Lack of familiarity with a new set of established practices and specific hardware and software.
Temporality of Workaround: Bricolage.

Complying with and Subverting Management Expectations

FUNDING – THE 'ORIGINAL WORKAROUND'

Workaround description: Tailoring an existing project concept and execution to suit a funding application's criteria so that the project falls in line with the funding organisation's priorities in an effort to secure funding (Mackinnon, 2021).
Obstacle to bypass: Limited animation production resources.
Temporality of Workaround: Bricolage to workaround

INFORMATION DISTORTION

Workaround description: Tailoring information in artefacts for approval, conducted with the aim of minimising **time** and **labour** costs from animation management revision requests. For example, sending earlier – or selected, storyboard panels with renderings more closely resembling an external client's – such as an illustrator's – expectations, to minimise choke point impacts.
Obstacle to bypass: Lost time and labour from approval revisions.
Temporality of Workaround: Bricolage

Interview Questions

These are the questions participants were asked during the data-gathering process for this research.

Interview Questions Relating to Research Question 1: Storyboard-Layout Transition

How do constraints (time, budget, available physical space, available kit) affect your storyboarding process?

In general, what workarounds do you use in layout?

What workarounds do you use when importing assets (character/environment models) in the initial layout stage?

What factors do you find that you have to adjust the most when importing assets in layout and posing?

What workarounds are used to replicate the mise en scene of the storyboard frame in layout?

What workarounds are used to create the illusion of a 3D environment/scene when using 2D cut-out assets?

What workarounds are used to overcome the limitations of 2D cut-out assets?

How and when are storyboards and layouts changed to accommodate the limitations, and/or changing designs of the assets?

What (if any) cheats or workarounds have you seen storyboard artists use when drawing panels? (cheating perspective, character environment/scale to make the panel work, for instance)

Do you know of any workarounds that have been used when replicating a shot from a storyboard or animatic frame in layout?

What workarounds (or changes) do storyboard artists use to help create the illusion of 3D space on a flat storyboard panel?

How do storyboard artists consider the practicalities and limitations of character models and environment assets when storyboarding – for example with 2D cut-outs where only a limited number of angles are available?

Any thoughts you would like to give on the relationship between animatics and editing in animation you would like to provide would be great (this is a bit more of an open-ended question as I am very interested in this part of the process in general).

Interview Questions Relating to Research Question 2: Re-use Systems

Do you use storyboards to plan asset libraries for production? – If so, how do you go about doing this?

Do you use storyboards to plan, budget, and re-use shots? – If so, how do you use and adapt storyboards?

Do you know how storyboards can be used to design re-use systems in production?

How did you use a storyboard/animatic to plan the production process?

What workarounds are used when assets are not ready yet? – Will the artists use a shorthand for the characters?

What happens when assets created by different artists come together in the initial layout and have to be adapted?

What workarounds are used when 2D cut-out animation assets glitch?

How and when are assets changed to accommodate the storyboard/animatic? – Or conversely, how are the storyboard or the idea for a scene changed to accommodate the assets? + How and when are assets changed to accommodate the practical requirements of a particular sequence?

Interview Questions Relating to Research Question 3: Asset and Sequence Changes

How and when are storyboards changed to accommodate the limitations, and/or changing designs of the assets?

What workarounds are used to overcome choke points (such as the approval process) in production?

Why would a shot or scene be changed from the storyboard in layout?

What happens when storyboard artists cheat perspective in storyboard frames and panels?

Is the storyboard/animatic fixed early in pre-production? or constantly evolving/changing through production?

What obstacles/factors cause assets to not match the storyboard/animatic frame?

Why would a shot or scene be changed from the storyboard in layout?

How are assets changed to produce certain shots and sequences in layout? + What changes need to be made when assets do not match the storyboard frame or the original intentions?

What are the rigging, aesthetic, animation, narrative, and practical (time/budget, personnel, and project resource) constraints that mean assets have to be changed?

What happens when assets can't be changed? What workarounds can then be used?

What happens when storyboard artists cheat perspective, and scale in storyboard frames and panels? + Why/what factors mean that assets have to be changed in the initial layout (i.e., storyboard artist cheating scale/perspective in a panel)?

What happens to assets when plans for sequences are changed during production?

What workarounds are used when assets are not ready yet? and how are shots and productions changed to accommodate these missing assets?

How and when are storyboards changed to accommodate the limitations, and/or changing designs of the assets?

Do you know of any times when assets (character models, for instance) are changed to accommodate the storyboard/animatic (accommodating the demands of a newly designed sequence, for instance), or to accommodate the practical requirements of a particular sequence?

Interview Questions Relating to Research Question 4: Workaround Perception

Have you ever used a workaround in order to complete an animated film with the resources you had at hand?

If so, what would you say were the factors and constraints (i.e., time or budget limitations) that motivated you to design the workaround?

How did the workaround affect production? Did it improve production or were there consequences to using a workaround?

Would you use that particular workaround again?

What workarounds are used to overcome choke points (such as the approval process) in production?

Have you noticed that people become dependent on workarounds that were originally designed as temporary fixes?

Do you find that workarounds can be a source of future improvements? If so – what long-term changes have you observed?

Are your colleagues and superiors more open to suggestions for future improvements after witnessing a successful workaround?

Do you view workarounds as necessary for overcoming the functional shortages of software/hardware and/or animation equipment and/or resources?

Do you find that when people have less knowledge of a process and/or an area they are more likely to design a workaround that creates new problems (for example, they don't understand the rationale (if any) for existing routines and processes)?

Have you had any production experiences where you had to use a workaround to overcome any software/hardware functions?

Have you ever used a workaround to bypass obstacles built into an organisational routine?

Have you had any production experiences where you had to use a 'quick fix' to overcome a mishap?

Have you had any production experiences where you had to make up for unavailable or inadequate resources?

Have you had any production experiences where you had to use a procedure to prevent future mishaps?

Bibliography

Alter, S. (2013). Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. *Journal of the Association for Information Systems*, *14*(2), pp.72–121.

Alter, S. (2014). Theory of Workarounds. *Communications for the Associations for information Systems*, *Volume 34, Article 55*(55), pp.1041–1066.

Alter, S. (2017). Work System Theory and Work System Method: A Bridge between Business and IT Views of IT-Reliant Systems in Organizations. In *Proceedings of the 10th Innovations in Software Engineering Conference on - ISEC '17*, (pp. 211–211). Jaipur, India: ACM Press.

Azad, B., & King, N. (2008). Enacting computer workaround practices within a medication dispensing system. *European Journal of Information Systems*, *17*(3), pp.264–278.

Bancroft, T. (2013). *Directing for Animation: Everything You Didn't Learn in Art School*. Focal Press, 1st ed.

Barrier, J. M. (1999). *Hollywood Cartoons: American Animation in Its Golden Age*. New York: Oxford Univ. Press.

Beer, S. (1981). *The Brain of the Firm*. Bath, Avon United Kingdom: Allen Lane The Penguin Press, 2nd ed.

Bendazzi, G. (2017). *Animation: A World History*. Boca Raton, FL: CRC Press, Taylor & Francis Group.

Blanche, D. (2021). Re: Research Project Questions. Email to Author (1607262@my.aub.ac.uk).

Blatter, J. (2007). Roughing It: A Cognitive Look at Animation Storyboarding. *Animation Journal*, *15*.

Blazdell, A. (2022). Interview with benjamin oakley. Remote Zoom Interview with Author.

Bordwell, D., Staiger, J., & Thompson, K. (1985). *The Classical Hollywood Cinema: Film Style & Mode of Production to 1960*. London New York: Routledge, Taylor & Francis Group.

Boudreau, M.-C., & Robey, D. (2005). Enacting Integrated Information Technology: A Human Agency Perspective. *Organization Science*, *16*(1), pp.3–18.

Braun, V., & Clarke, V. (2022). *Thematic Analysis*. London: SAGE Publications Ltd, 1st ed.

Brazel, J. F., & Dang, L. (2008). The effect of ERP system implementations on the management of earnings and earnings release dates. *Journal of Information Systems*, *22*(2), pp.1–21.

Byrne, M. T. (1999). *Animation: The Art of Layout and Storyboarding : Complete Step-by-Step Techniques in Drawing Layout and Storyboards for Classical, TV and Computer Game Animation*. Leixlip, Co Kildare: Mark T. Byrne Production.

Caldwell, J. T. (2008). *Production Culture: Industrial Reflexivity and Critical Practice in Film and Television*. Consoleing Passions. Durham, NC: Duke Univ. Press.

Callahan, D. (1988). Cel Animation: Mass Production and Marginalization in the Animated Film Industry. *Film History, 2(3), 223-228*, *2*(3), pp.223–228.

Campbel, D. (2012). Public Managers in Integrated Services Collaboratives: What Works Is Workarounds. *Public Administration Review*, *72*(5), pp.721–730.

Canemaker, J. (1994). Life Before Mickey. *The New York Times*, (4 July. p.14).

Cash, R. (2022). Interview with Rosie Cash Freelance Storyboard Artist.

Chen, A. (2022a). Layout vs Background. Conference Presentation. Arts University Bournemouth.

Chen, A. (2022b). Re Layout research project. Email to Author (1607262@my.aub.ac.uk).

Chen, A. (2022c). Re: Layout research project. Email to Author (1607262@my.aub.ac.uk).

Chen, A. (2022d). Re Layout Research Project. Email to Author (1607262@my.aub.ac.uk).

Cherns, A. (1987). Principles of Sociotechnical Design Revisted. *Human Relations*, *40*(3), pp.153–161.

Crafton, D. (1993). *Before Mickey: The Animated Film, 1898-1928*. Chicago: University of Chicago Press.

Cross, N. (2011). *Design Thinking: Understanding How Designers Think and Work*. Oxford; New York: Berg.

Dame, M. (2021). Research Project Questions. Email to Author (1607262@my.aub.ac.uk).

Darabi-Fard, K. (2022). Questions - Answered! Email to Author (1607262@my.aub.ac.uk).

Davis, N., Li, B., O'Neill, B., Riedl, M., & Nitsche, M. (2011). Distributed creative cognition in digital filmmaking. In *Proceedings of the 8th ACM Conference on Creativity and Cognition - C&C '11*, (p. 207). Atlanta, Georgia, USA: ACM Press.

de Lauzirika, C. (2006). *The Path to Redemption – Kingdom of Heaven Director's Cut*. [Film]. USA: 20th Century Fox.

Deena Skolnick Weisberg, R. M. G., Kathy Hirsh-Pasek, & McCandliss, B. D. (2014). Mise En Place: Setting the Stage for Thought and Action. *Trends in Congitive Science*, *16*(6), pp.276–278.

Deneroff, H. R. (1985). *Popeye the Union Man : A Historical Study of the Fleischer Strike*. Ph.D. thesis, University of Southern California.

Eaves, J. (2009). *The Starships of the Expanse*. [Online. Accessed On: 24-01-2022]. URL https://johneaves.wordpress.com/2009/04/27/the-starships-of-expance/

Fitzpatrick, G., & Ellingsen, G. (2013). A Review of 25 Years of CSCW Research in Healthcare: Contributions, Challenges and Future Agendas. *Computer Supported Cooperative Work (CSCW)*, *22*(4), pp.609–665.

Flick, U., Kvale, S., Angrosino, M. V., Barbour, R. S., Banks, M., Gibbs, G., Rapley, T., & Flick, U. (2007). *The Sage Qualitative Research Kit*. London: SAGE.

Furniss, E. b. M. (2009). *Animation - Art and Industry: A Reader (Paperback) - Common*. John Libbey Cinema and Animation.

Furniss, M. (2017). *Animation: The Global History*. London: Thames & Hudson.

Gadassik, A. (2015). Assembling Movement: Scientific Motion Analysis and Studio Animation Practice. *Discourse*, *37*(3), pp.269–297.

Gancheva, A. (2022). Re Research Project. Email to Author (1607262@my.aub.ac.uk).

Gasser, L. (1986). The Integration of Computing and Routine Work. *ACM Transactions on Information Systems*, *4*(3), pp.205–225.

Ghertner, E. (2010). *Layout and Composition for Animation*. Burlington, MA: Focal Press/Elsevier.

Glebas, F. (2013). *The Animator's Eye: Adding Life to Animation with Timing, Layout, Design, Color and Sound*. New York London: Taylor and Francis.

Gowanlock, J. (2020). Animating Management: Nonlinear Simulation and Management Theory at Pixar. *Animation-an Interdisciplinary Journal*, *15*(1), pp.61–76.

Grigg, A. (2013). *Photoshop Animation Techniques (Redux, Creative Cloud)*. [Vimeo. Accessed On: 25-03-2021].
URL https://vimeo.com/80851591

Grinter, R. E. (2000). Workflow Systems: Occasions for Success and Failure. *Computer Supported Cooperative Work (CSCW)*, *9*(2), pp.189–214.

Hahn, D. (1994). *The Lion King: A Memoir with Don Hahn - Making of the Movie – the Lion King Blu-Ray Diamond Edition*. [Film]. USA: Buena Vista Pictures.

Halas, J. (Ed.) (1976). *Visual Scripting*. The Library of Animation Technology. London ; New York: Focal Press.

Halbesleben, J. R. B., Savage, G. T., Wakefield, D. S., & Wakefield, B. J. (2010). Rework and Workarounds in Nurse Medication Administration Process: Implications for Work Processes and Patient Safety. *Health Care Management Review*, *35*(2), pp.124–133.

Hart, J. (1999). *The Art of the Storyboard: Storyboarding for Film, TV, and Animation*. Boston: Focal Press.

Heller, S. (2019). Below-the-line creativity and authorship in animation: The reality of animation production. *Revue française des sciences de l'information et de la communication*, (18).

Herhuth, E. (2017). *Pixar and the Aesthetic Imagination: Animation, Storytelling, and Digital Culture*. Oakland, California: University of California Press.

Honess Roe, A. (2020). *Aardman Animations Beyond Stop Motion*. London; New York: Bloomsbury Academic.

Jarulaitis Gasparas, E. M. (2009). Cross-Contextual Use of Integrated Information Systems. *Proceedings of the 17th Europeean Conference on Information Systems Proceedings, Verona, Italy. 2009*.

Jeaks, G., & Tetali, P. P. (n.d.). *Layout Design for Animation*. [Online. Accessed On: 18-03-2024].

Jelinek, M. (1980). Toward Systematic Management: Alexander Hamilton Church. *Business History Review*, *Spring*, pp.63–79.

Kanfer, S. (2000). *Serious Business: The Art and Commerce of Animation in America from Betty Boop to Toy Story*. New York: Da Capo Press.

Kaplan, R., & Norton, D. (1992). The Balanced Scorecard: Measures That Drive Performance. *Harvard Business Review*, *70*(1), pp.71–79.

Kling, R., & Scaachi, W. (1979). Recurrent Dilemmas of Computer Use in Complex Organizations,. In *1979 International Workshop on Managing Requirements Knowledge (MARK)*, Managing Requirements Knowledge, International Workshop, (pp. 107–116).

Kmetz, J. L. (1984). An Information-Processing Study of a Complex Workflow in Aircraft Electronics Repair. *Administrative Science Quarterly*, *29*(2), pp.255–280.

Koopman, P., & Hoffman, R. (2003). Work-arounds, Make-Work, and Kludges. *IEEE Intelligent Systems*, *18*(6), pp.70–75.

Koppel, R., Wetterneck, T., Telles, J. L., & Karsh, B.-T. (2008). Workarounds to Barcode Medication Administration Systems: Their Occurrences, Causes, and Threats to Patient Safety. *Journal of the American Medical Informatics Association : JAMIA*, *15*(4), pp.408–423.

Langer, M. (1991). Institutional Power and the Fleischer Studios: The "Standard Production Reference". *Cinema Journal*, *30*(2), pp.3–22.

Levitin, D. J. (2015). *The Organized Mind: Thinking Straight in the Age of Information Overload*. London: Penguin Books.

Levy, D. B. (2009). *Animation Development: From Pitch to Production*. New York: Allworth Press.

Lutz, E. (1926). *Animated Cartoons*. New York: Charles Scribner's Sons.

Mackinnon, C. (2021). Re: Ben meet Carla. Email to Author (1607262@my.aub.ac.uk).

Mason, J. (2005). *Qualitative Researching*. California: SAGE Publications Ltd, 2 ed.

Mat Germonprez, Hovorka, D., & Gal, U. (2011). Secondary design: A case of behavioral design science research. *12*(10), pp.663–683.

Mayer, V., Banks, M. J., & Caldwell, J. T. (Eds.) (2009). *Production Studies: Cultural Studies of Media Industries*. New York: Routledge.

Michael Nitsche Mark Riedl, and Nicholas Davis (2011). Creativity, Cognition, and Machinima. *Animation Journal*, *19*, pp.50–67.

Morley, J. (2023). *Academic Phrasebank*. [Online. Accessed On: 28-10-2024]. URL https://www.phrasebank.manchester.ac.uk/

Nelmes, J. (Ed.) (2010). *Analysing the Screenplay*. London: Routledge, 1 edition ed.

Niazkhani, Z., Pirnejad, H., van der Sijs, H., & Aarts, J. (2011). Evaluating the Medication Process in the Context of CPOE use: The Significance of Working Around the System. *International Journal of Medical Informatics*, *80*(7), pp.490–506.

Noake, R. (1998). *Animation Techniques: Planning & Producing Animation with Today's Technologies*. U.S.: Chartwell Books.

Norman, D. A. (1999). *The Invisible Computer: Why Good Products Can Fail, the Personal Computer Is so Complex and Information Appliances Are the Solutions*. Cambridge, Massachuesetts: MIT Press.

Page, S. (2022). Concept Art and Character Design for Feature Animation: Getting started and career development tips: Getting started and career development tips. Conference Presentation. Arts University Bournemouth.

Pallant, C., & Price, S. (2015). *Storyboarding: A Critical History*. Palgrave Studies in Screenwriting. Houndmills, Basingstoke, Hampshire; New York, NY: Palgrave Macmillan.

Patmore, C. (2003). *The Complete Animation Course: The Principles, Practice and Techniques of Successful Animation*. London: Thames & Hudson.

Piers Anthony, R. N. A. (1988). *The Management Control Function*. Boston, Massachusetts: Harvard Business School Press, rev. ed.

Roder, N., Wiesche, M., Schermann, M., & Krcmar, H. (2016). Toward an Ontology of Workarounds: A Literature Review on Existing Concepts. In *2016 49th Hawaii*

International Conference on System Sciences (HICSS), (pp. 5177–5186). Koloa, HI, USA: IEEE.

Roger Allers, J. C., & Stacchi, A. (2007). *Open Season*. [Film]. USA: Sony Pictures.

Roser, C. (2017). *"Faster, Better, Cheaper" in the History of Manufacturing: From the Stone Age to Lean Manufacturing and Beyond*. Boca Raton: CRC Press, Taylor & Francis Group, 1st ed.

Sawyer, S., & Tapia, A. (2006). Always Articulating: Theorizing on Mobile and Wireless Technologies. *The Information Society*, *22*(5), pp.311–323.

Shichijo, N., Hara, T., Sugi, M., & Ota, J. (2014). Modeling the Process of Animation Production. *International Journal of Automation Technology*, *7*(4), 439–450.

Singer, B. (1992). *How to Draw Animation Storyboards: A Step by Step Guide*. Las Vegas, NV: CB Publications/Bill Barry Enterprises.

Sito, T. (2006). *Drawing the Line: The Untold Story of the Animation Unions from Bosko to Bart Simpson*. Lexington, Ky: University Press of Kentucky.

Solomon, C. (1994). *Enchanted Drawings: The History of Animation*. Avenel, N.J: Distributed by Random House Value Pub, new ed.

Southall, J. (1997). Aspects of Contemporary Animation Production in Great Britain: Organization and Production. *Animation Journal*, *5*(2), pp.45–50.

Stabile, C. A., & Harrison, M. (Eds.) (2003). *Prime-Time Animation: Television Animation and American Culture*. London New York, NY: Routledge.

Stahl, M. (2005). Nonproprietary Authorship and the Uses of Autonomy: Artistic Labor in American Film Animation, 1900-2004. *Labor*, *2*(4), pp.87–105.

Stahl, M. (2010). Cultural Labor's "Democratic Deficits": Employment, Autonomy and Alienation in US Film Animation. *Journal for Cultural Research*, *14*(3), pp.271–293.

Stong, D. M. (1995). Exceptions and Exception Handling in Computerized Information Processes. *ACM Transactions on Information Systems*, *13*(2), pp.207–233.

Strawbridge, L. (2021). Re: Research Project. Email to Author (1607262@my.aub.ac.uk).

Strawbridge, L. (2022). Re Research Project. Email to Author (1607262@my.aub.ac.uk).

Tarantini, T. (2011). Pictures that do not Really Exist: Mitigating the Digital Crisis in Traditional Animation Production. *Animation Practice, Process & Production*, *1*(2), pp.249–271.

Tarantini, T. (2021). Re: Initial questions for my research project. Email to Author (1607262@my.aub.ac.uk).

Teevan, M. (2011). Animating by Numbers: Workflow Issues in Shane Acker's 9. *Animation Practice, Process & Production*, *1*(1), pp.83–96.

Tumminello, W. (2005). *Exploring Storyboarding: An in-Depth Guide to the Art and Techniques of Contemporary Storyboarding*. Design Exploration Series. Clifton Park, N.Y: Thomson/Delmar Learning.

United Nations (n.d.). *Energy*. [Online. Accessed On: 02-08-2024]. URL https://www.un.org/sustainabledevelopment/energy/

United Nations (n.d). *Infrastructure and Industrialization*. [Online. Accessed On: 02-08-2024].
URL https://www.un.org/sustainabledevelopment/infrastructure-industrialization/

Varoufakis, Y. (2024). *Technofeudalism – What Killed Capitalism*. Dublin, Ireland: Penguin Random House.

Ward, P. (2000). Defining 'Animation': The Animated Film and the Emergence of the Film Bill. *University of Nottingham*, (pp. 1–11).

Ward, P. (2006). Some Thoughts on Theory-Practice Relationships in Animation Studies. *Animation: An Interdisciplinary Journal*, *1*, pp.229–245.

Wasko, J. (2001). *Understanding Disney: The Manufacture of Fantasy*. Cambridge, UK: Malden, MA: Polity; Blackwell.

Wellins, M. (2005). *Storytelling through Animation*. Charles River Media Graphics Series. Hingham, Mass: Charles River Media, 1st ed ed.

Wells, P. (1998). *Understanding Animation*. London; New York: Routledge.

Wells, P. (2002). *Animation and America*. New Brunswick, N. J: Rutgers Univ. Press, 1st ed.

Wells, P. (2006). *The Fundamentals of Animation by Paul Wells*. London; New York: Bloomsbury Publishing.

Wells, P. (2007). *Scriptwriting: Developing and creating text for a play, film or broadcast*. No. 01 in Basics animation. Lausanne: AVA Books.

Wenger, E. (2008). *Communities of Practice: Learning, Meaning, and Identity*. Learning in Doing : Social, Cognitive, and Computational Perspectives. Cambridge: Cambridge Univ. Press.

Williams, R. (2009). *The Animator's Survival Kit: A Manual of Methods, Principles and Formulas for Classical, Computer, Games, Stop Motion and Internet Animators*. New York, NY: Faber and Faber, american expanded paperback 1st ed.

Winder, C., & Dowlatabadi, Z. (2001). *Producing Animation*. Focal Press Visual Effects & Animation Series. Boston: Focal Press.

Wright, J. (2005). *Animation Writing and Development: From Screen Development to Pitch*. Focal Press Visual Effects and Animation. Amsterdam; Boston: Focal Press.

Index

This index highlights key concepts not listed in the Glossary.