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PORTO

# SHAPING VISUAL NARRATIVES: CAMERA STRUCTURE IN ANIMATION

Dissertation presented to Universidade Católica Portuguesa  
for obtaining the Masters degree for Sound and Image

Diego Martinez Garcia

Porto, September 2023

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Specialized in Animation

Diego Martinez Garcia

Under the supervision of

Sahra Kunz

Porto, September 2023

*To my supporting parents.*

I extend my heartfelt gratitude to my advisor, Sahra Kunz, for her unwavering guidance and motivation during the course of this research. I am profoundly thankful to my friends and family for their steadfast support throughout this endeavor. I also acknowledge Universidade Católica Portuguesa for providing invaluable resources and the esteemed faculty of Escola das Artes for their contributions. This work is dedicated to my parents, whose unwavering support has been my driving force.

*Diego Martinez Garcia, September 2023*

## Abstract

### Shaping Visual Narratives: Camera Structure in Animation

This dissertation delves into the role and impact of camera structure in animated films, exploring elements such as camera effects, lens choices, depth of field, lighting, and animation techniques. Employing a qualitative research design with an exploratory approach, the study analyzes existing literature and case studies to understand how camera structure influences the meaning and visual style of animated narratives. The key findings highlight the significance of camera structure: it defines a film's unique visual identity, shaping aesthetics and visual style, conveys emotions, enhances audience engagement, serves as storytelling devices, guides attention, and conveys essential information, impacting the level of realism or fantasy, adding layers of meaning and symbolism to elevate storytelling, and establishing a unified visual language for enhanced audience immersion and narrative comprehension. The dissertation concludes by emphasizing the transformative convergence of animation and live-action cinematography, transcending traditional boundaries. This paradigm shift underscores the importance of cinematic language, where techniques become instruments for narrative expression, offering new horizons for storytelling and artistic exploration.

*Keywords: Camera Structure, Animation, Visual Style, Narrative, Cinematic Language.*

## Resumo

### Moldando Narrativas Visuais: Estrutura de Câmera na Animação

Esta dissertação explora o papel e o impacto da estrutura de câmera em filmes de animação, investigando elementos como efeitos de câmera, escolhas de lentes, profundidade de campo, iluminação e técnicas de animação. Empregando um desenho de pesquisa qualitativa com abordagem exploratória, o estudo analisa literatura existente e estudos de caso para compreender como a estrutura de câmera influencia o significado e o estilo visual das narrativas animadas. Os principais resultados destacam a importância da estrutura de câmera: ela define a identidade visual única de um filme, moldando estética e estilo visual, transmite emoções, aprimora o envolvimento da audiência, atua como dispositivo de narração, guia a atenção e comunica informações essenciais, impacta o nível de realismo ou fantasia, adiciona camadas de significado e simbolismo para elevar a narrativa, além de estabelecer uma linguagem visual unificada para maior imersão do público e compreensão da narrativa. A dissertação conclui enfatizando a convergência transformadora entre a animação e a cinematografia de ação ao vivo, transcendendo fronteiras tradicionais. Essa mudança de paradigma destaca a importância da linguagem cinematográfica, onde as técnicas se tornam instrumentos de expressão narrativa, oferecendo novos horizontes para a narrativa e exploração artística.

*Palavras-chave: Estrutura de Câmera, Animação, Estilo Visual, Narrativa, Linguagem Cinematográfica.*

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## Figure 1

*Love, Death & Robots - Three Robots: Exit Strategies (2022)*



*Shallow depth of field, framing and lens effects suggesting a relationship between the distant, yet appearing close through possibly using a telephotolens - out of focus building, the directly lit, sharp skull and the surrounding nature.*

## 1. Introduction

### 1.1. Object

Animated films have emerged as a medium that pushes the boundaries of what is possible in terms of visual expression. To approximate the stories shown to a *cinematic visual style* - all the techniques and methods of filmmaking that we use to add layers of meaning to the content (Brown, 2011, p. 14) - the incorporation of *camera effects* - all of those effects that the imaging camera and lens system has on the captured image (Wright 2017, ch. 11) - have gained ever more increasing popularity, with films such as *Toy Story 4* (2019) and *Spiderman: Into the Spiderverse* (2018) showcasing a range of possibilities to immerse viewers in these fantastical worlds. In such a way, this dissertation aims to explore the potential of the introduction of camera effects in animated films to enhance viewer immersion. Specifically, we will examine how incorporating camera effects can add meaning, credibility, and visual style to images. We will also investigate how the im-

plementation of a *camera structure* - the strategic use of the camera to tell a story not only with beautifully composed shots but also with compositions that carry meaning (Lin, 2009) - can enhance viewer immersion in animated films by creating a sense of cohesion familiarity with the already established grammar of real-world cameras, while exploring the expressive potential that is enabled by animation to create unique visuals limited only by imagination.

To achieve these goals, we will analyze what originates camera effects and the symbolic meaning they add to images, and observe how they manifest in animated films. We will also examine how these effects can be used to enhance viewer immersion, while exploring the expressive potential of visual artifacts in creating unique visual styles and atmospheres for animated films.

### 1.2. Scope

The scope of this research is to comprehensively investigate the intricate role of camera structure, encompassing camera effects, lens choices, depth of field, lighting, and animation techniques, in shaping the meaning and visual style of animated films. This study delves into both real-world cinematography and its translation into animation.

The primary objectives are as follows:

**Analyzing Camera Structure:** This study explores the multifaceted components of camera structure within the context of animated filmmaking. It emphasizes their collective impact on the visual language of the medium.

**Understanding Real-World Cinematography:** The research provides a thorough understanding of how real-world cameras behave, their technical nuances, and their role in shaping images in live-action cinematography. This knowledge serves as the foundation for translating cinematic principles into animation.

**Translating Cinematic Principles into Animation:** Building on the knowledge of real-world cinematography, the dissertation investigates how these principles and be-

haviors can be effectively translated into the realm of animation. It explores how animation techniques can replicate and adapt real-world camera behaviors to create compelling visual narratives.

**Aesthetic Significance:** This study examines how camera structure, including visual effects and technical choices, plays a pivotal role in establishing the overall visual aesthetics of animated films. It investigates how these elements impact viewers' perceptions of space, perspective, and visual style.

**Emotional Storytelling:** The research analyzes how camera techniques, such as depth of field and lighting, convey emotional depth within animated narratives. It highlights their role in focusing attention, setting mood, and enhancing emotional resonance.

**Narrative Impact:** This study investigates how camera structure functions as a storytelling tool, with a focus on framing, composition, and camera angles. It explores how these elements guide audience attention, emphasize character dynamics, and contribute to narrative progression.

**Realism vs. Expressionism:** The dissertation explores the dichotomy between realistic and expressive images in animated films. It assesses how camera techniques, combined with animation styles, determine the film's appearance, contributing to its unique visual identity.

**Symbolism and Visual Language:** The research assesses how camera structure can be harnessed to symbolize themes and character development. It examines the role of visual effects and selective focus in adding layers of meaning to animated scenes.

**Cohesive Visual Language:** This study emphasizes the importance of maintaining a cohesive visual language throughout animated films. It highlights how consistency in camera techniques and effects contributes to the overall meaning and aesthetic coherence.

Through this comprehensive exploration, this dissertation seeks to illuminate the significant role camera structure plays in animated filmmaking, bridging the gap between real-world cinematography and animation to enhance viewer immersion and storytelling impact.

### 1.3. Significance

This dissertation's significance lies in its comprehensive exploration of camera structure and its multifaceted contributions to animated filmmaking. By dissecting the interplay of camera effects, lens choices, depth of field, lighting, and animation techniques, this study sheds light on how these elements collectively shape the visual style, emotional resonance, and narrative depth of animated films. Furthermore, it highlights the critical role of camera structure in bridging the gap between real-world cinematic conventions and the boundless creativity of animation.

### 1.4. Research Question

What is the role and impact of camera structure, including camera effects, lenses, depth of field, and animation techniques, in shaping meaning and visual style in animated films?

Our aim is to dissect the functional aspects of camera structure in animated filmmaking and elucidate its substantial impact on the art of visual storytelling. In essence, we are delving into the mechanics of how camera structure influences the conveyance of meaning, evocation of emotions, and creation of a distinctive visual identity.

This investigation serves a practical purpose. By unraveling the intricacies of camera structure, we empower filmmakers, animators, and visual storytellers to make informed creative choices. Moreover, this inquiry transcends the boundaries of animation, offering valuable insights that can benefit various visual arts disciplines. As technology continues to blur the lines between live-action and animation, our research becomes increasingly pertinent, guiding practitioners in harnessing camera structure to its fullest potential.

## Figure 2

*Arcane - Season 1 - Episode 1 (2021)*



*Tone of the scene is created by a combination of the light-colored production design, The contrasting, yet bright lighting and the over-exposure of the exterior, accentuating the godrays seen on the window suggesting something fantastical*

## 2. Methodology

### 2.1. Research Design

This study employs a qualitative research design with an exploratory approach that relies primarily on the analysis of existing literature and case studies. The choice of research design is driven by the need to delve deeply into the multifaceted phenomenon of camera structure in animated films, with a focus on gaining a comprehensive understanding of its role and impact on visual narratives.

**Qualitative Research and Literature Review:** Qualitative research methods are integrated into the study to facilitate an in-depth exploration and interpretation of existing literature, enabling a nuanced examination of camera structure within animated cinema. This approach is particularly suitable for investigating complex and multifaceted phenomena.

**Case Studies:** Multiple case studies, each representing a different animated film, serve as the primary source of empirical data for this research. These case studies are selected to allow for an in-depth examination of the phenomenon within its real-life context. By studying a range of animated films, we can explore how camera structure varies and influences various aspects of visual storytelling.

**Exploratory Approach:** The research adopts an exploratory stance, aiming to generate insights and hypotheses about the role of camera structure in animated films. This approach is well-suited for a topic that has not been extensively explored in the existing literature, allowing for the discovery of new perspectives and dimensions.

**Multifaceted Analysis:** The research design incorporates a multifaceted analysis of camera structure, encompassing various elements such as camera effects, lens choices, depth of field, lighting, and animation techniques. This holistic analysis enables a comprehensive examination of the topic using existing literature and case studies as primary sources.

**Comparative Analysis:** In addition to examining individual cases, this study incorporates a comparative analysis, where different animated films are compared to observe patterns and variations in the utilization of camera structure. This comparative aspect enhances the depth and richness of the case study design.

**Interdisciplinary Approach:** Recognizing the interconnectedness of animation and cinematography, this research takes an interdisciplinary approach. It acknowledges the relevance of both fields in understanding the topic and seeks to bridge the gap between them by synthesizing insights from existing literature and case studies.

In summary, the qualitative research design with an exploratory approach, supplemented by a comprehensive literature review and multiple case studies, serves as the foundational framework for this research. This methodology aims to contribute to the broader understanding of camera structure in animated films, utilizing existing literature and case studies as the primary sources of analysis and insight.

## 2.2. Study Limitations

In any comprehensive research endeavor, it is essential to acknowledge the inherent limitations that may influence the study's scope and findings. This section delves into the specific constraints and considerations that have shaped the course of this investigation into the role of camera structure in animated films. While our study has strived for depth and rigor, it is crucial to recognize the parameters within which it operates. These limitations encompass the selection of case studies, the focus on specific animation types, generalizability concerns, and the absence of direct participant interactions, among others. By candidly addressing these limitations, we aim to provide a transparent context for the research findings and underscore the opportunities for future exploration in this dynamic field.

**Limited Case Studies:** This study acknowledges that a relatively small number of case studies were examined. While these cases were carefully selected to highlight the use of camera structure and its narrative impact, the limited number of cases may have constrained the depth and breadth of our findings.

**Scope of Animation Techniques:** The focus of this study primarily revolved around 3D CGI animation. While this choice allowed for a detailed exploration of camera structure in this specific context, it should be acknowledged that other forms of animation, such as 2D animation and stop-motion, were not extensively covered. Therefore, the findings may not fully represent the broader spectrum of animation styles.

**Generalizability:** Recognizing the limitation of drawing conclusions from a limited number of case studies, we acknowledge that the findings may be specific to the films analyzed. These findings may not universally apply to all animated films, especially considering the diversity of cinematic approaches. However, our primary focus was on understanding the cinematic impact of camera structure rather than the technical processes of shot creation.

**Focus on Case Selection:** The deliberate selection of case studies aimed to clearly identify the use of camera structure and its narrative impact. This focus on specific films, which deliberately introduced camera effects and emphasized cinematography, may introduce a bias towards films that place a higher importance on these elements. It is important to note that our intention was not to delegitimize films that do not heavily emphasize camera structure but to comprehend how its presence or absence impacts the final visual result.

**Single Researcher Perspective:** This study represents the perspective of a single researcher. While this approach provides a coherent analysis, it may lack the diverse viewpoints and insights that could arise from multiple researchers collaborating on the research.

**Technology and Methodological Advancements:** The field of animation is continuously evolving, and technological advancements can influence the application of camera structure techniques. Since the completion of this study, new technologies and research methodologies may have emerged, which could further enhance our understanding of the topic.

**Publication Bias:** Acknowledging the potential for publication bias in the selection of literature sources, we recognize that some relevant sources - such as *The Filmmaker's Eye: The Language of the Lens* - may not have been directly included in the study. This limitation underscores the importance of considering a broader range of literature in future research.

**Limited Participant Interaction:** This study did not involve direct interactions with human participants. As a result, the depth of insights gained, particularly regarding the creative decision-making processes of filmmakers, may be limited. Interviews and access to objective production data could have provided deeper insights, but such materials were not available for this study.

**Subjectivity in Analysis:** While efforts were made to minimize subjectivity in the interpretation of data and case study findings, there is inherent subjectivity in qualitative analysis. Steps were taken to mitigate subjectivity, including expert consultations and rigorous analysis procedures.

**Availability of Film Data:** Some case studies may have faced limitations in data availability, particularly concerning objective production data. Access to such data could have offered valuable insights into the technical aspects of camera structure, but it was not accessible for this study.

In conclusion, while these limitations exist, they do not diminish the value of this study in exploring the cinematic impact of camera structure in animated films. These limitations provide opportunities for future research to build upon and further enhance our understanding of this evolving field.

### 2.3. Assumptions

In the course of conducting this study on the role of camera structure in animated films, certain assumptions have underpinned our research design and approach. These assumptions, while not exhaustive, provide the foundational principles that have guided our exploration of the topic. It is essential to explicitly outline these assumptions to contextualize the study and understand the perspectives from which our research has been framed.

**Cinematic Impact of Camera Structure:** We operate under the assumption that camera structure, encompassing camera effects, lens choices, depth of field, lighting, and animation techniques, is a pivotal element in shaping the visual and narrative aspects of animated films. This core premise forms the foundation of our investigation.

**Narrative Influence:** An assumption central to this study is that variations in camera structure elements have a direct and deliberate impact on the narrative and visual style of animated films. We presume that the choices made in camera structure are intentional and contribute significantly to the overall cinematic experience.

**Varied Application:** It is assumed that different animated films employ camera structure elements in diverse ways. We acknowledge the creative flexibility of filmmakers in adapting camera techniques to suit the unique requirements of each film.

**Relevance of Case Studies:** Our selection of specific case studies assumes that these films provide valuable insights into the role of camera structure. We assume that the chosen cases are representative and illustrative of the broader trends and principles.

**Interconnectedness of Animation and Cinematography:** The study operates under the assumption that animation and live-action cinematography share common principles and techniques, highlighting the interconnected nature of these two disciplines. This assumption underpins our efforts to bridge the gap between animation and cinematography.

**Subjective Interpretation:** Recognizing the subjective nature of qualitative analysis, we assume that interpretations of camera structure and its effects on animated films may vary among researchers.

**Continued Relevance:** This study assumes that insights gained from the analysis of existing literature and case studies remain relevant and applicable to the understanding of camera structure in animated films. We acknowledge the enduring importance of established principles and practices.

**Limitations of Data:** We assume that the data available, including interviews, articles, and case study films, are representative of the broader landscape of animated cinema. We recognize the potential limitations in data availability and strive to extract meaningful insights from the sources at hand.

**Ongoing Evolution:** The study assumes that while the field of animation is continuously evolving, fundamental principles related to camera structure and cinematography remain foundational. We acknowledge the potential for future advancements but seek to provide insights based on the current state of the field.

By explicitly outlining these assumptions, we aim to provide transparency regarding the perspectives and foundations of our research, allowing readers to critically engage with the study's context and findings.

#### 2.4. Method

In this dissertation, a multifaceted approach was adopted to explore the role of camera structure in animated films comprehensively. The research design and methods chosen were aimed at achieving a deep and nuanced understanding of the subject matter. The methods applied can be categorized into two main components: Literature Review and Case Study Analysis.

**Literature Review:** The study commenced with an extensive review of existing literature with emphasis on live-action cinematography, to later translate this knowledge to the subject of camera structure and animation. A broad array of sources such as books - with an emphasis on *Cinematography: Theory and Practice* by Blain Brown and *The Filmmaker's Eye: The Language of the Lens* by Gustavo Mercado to lay a solid understanding of cinematography, interviews with filmmakers such as Vittorio Storaro and Patrick Lin to gain industry insights, and publications such as Pixar's early research papers and articles to gain further insights on the different objects of our study.

**Case Study Analysis:** The empirical component of this study relied on a qualitative case study approach. A deliberate and systematic selection of animated films was made, each serving as a distinct case study. The selection criteria emphasized the presence of notable camera structure elements within the chosen films, ensuring that they represented a diverse spectrum of animation styles, genres, and storytelling approaches.

**Data Collection:** Data collection for the case studies involved a comprehensive analysis of the selected films. Various elements of camera structure, including camera effects, lens choices, depth of field, lighting, and animation techniques, were meticulously examined. This process entailed a comprehensive viewing of the films, frame-by-frame analysis - enabled by the high-quality reference images provided by *Shotdeck*, and insights from industry professionals provided by interviews, articles and blogs.

**Comparative Analysis:** A crucial aspect of the case study analysis was the comparative examination of multiple films. By comparing and contrasting the utilization of camera structure across different cases, patterns, and variations in the application of camera techniques were discerned. This comparative approach enriched the depth and breadth of the study's findings enabling it to identify common patterns in visually contrasting films.

**Synthesis of Findings:** The findings from both the literature review and the case study analysis were synthesized to form a cohesive narrative. This synthesis facilitated the development of a nuanced understanding of how camera structure elements contribute to the visual and narrative aspects of animated films.

**Interdisciplinary Approach:** The research adopted an interdisciplinary approach, recognizing the interconnectedness of animation and cinematography. This approach allowed for the bridging of gaps between these two disciplines and a holistic examination of the subject matter.

It is important to note that while this research did not involve human participants, it relied on existing literature, published interviews with filmmakers, and the detailed analysis of animated films to gain insights into the role of camera structure. Furthermore, steps were taken throughout the research process to minimize subjectivity in the interpretation of data, including consultations of industry references and an abstraction of subjective meaning, limiting our observations to what is visible on the frame.

By employing this multifaceted research methodology, this dissertation aims to contribute to the evolving discourse surrounding camera structure in animated cinema, providing a comprehensive examination of its impact on visual narratives.

**Figure 3**

*Cinema Paradiso (1988)*



*This visually captivating composition skillfully accentuates the emotional depth and profound connection shared between the man and the projector.*

### **3. Camera Behaviour and Imaging Systems**

*The instance of the electric light may prove illuminating in this connection. Electric light is pure information. It is a medium without a message, as it were, unless it is used to spell out some verbal ad or name. This fact, characteristic of all media, means that the "content" of any medium is always another medium.*

*(McLuhan, 1964)*

This chapter delves into the intricacies of cameras, providing a comprehensive breakdown of the physical properties and interplay of different camera components that contribute to the final image. This knowledge is indispensable in bringing photorealistic elements to animated films, since different camera effects such as lens distortion and aberrations, motion blur, and light flares are consequences of the physical behavior of real-world cameras with the potential to either worsen or improve an image.

This chapter aims to provide a comprehensive breakdown of how different camera components work together to compose an image and the visual artifacts each of those components produce. The literature review will highlight the intricate relationships between various camera elements and their impact on the final image, providing a foundation for understanding the complex interplay of light, optics, and technology in real-world cameras.

### 3.1. Camera Components and Their Functions

*[...] what I discovered through them was that my total expression wasn't just with light. The light was the main thing; it was the start. The lenses, the camera, the negative stock, the positive stock-any single element that would affect the final positive image-that's what my expression was about. When I discovered that, I really understood cinematography.*

*(Schaefer, Salvato, & Storaro, 1982, p.16)*

The purpose of this chapter is to provide a comprehensive introduction to the fundamental components of a camera, such as the lens, shutter, and sensor, and their respective functions in the process of capturing and creating images, with the aim of establishing a foundation for understanding their complex interplay that contributes to the creation of a final image in the context of photography. By delving into the intricacies of each component, we can gain a deeper understanding of the complex interplay between the various elements that make up a camera system.

Photography relies on the visible spectrum of light, which is the segment of the electromagnetic spectrum that the human eye can view, and encompasses wavelengths from 380 to 700 nanometers, capturing every color and shade we see (National Aeronautics and Space Administration, 2010). Our eyes perceive this color using a combination of three different color-sensing cells - L, M and S cells named after long, medium and short wavelengths, each of which has peak sensitivity for a different region in the visible spec-

### Figure 4

*Apocalypse Now (1979)*



*High-contrast lighting and an enigmatic, sketchy tone, often accompanied by deliberate underexposure, are hallmarks of Vittorio Storaro's ambitious cinematographic style in Apocalypse Now.*

trum (Baudin, Angueyra, Sinha, Rieke, 2019). In fact, color is actually a sensation, just like taste and smell, and the human eye's sensitivity to color is a powerful tool for evoking emotions in the viewer (McHugh, 2018, p.14). Overall, a comprehensive understanding of light behavior and its interaction with optics and camera elements is essential in understanding how camera effects are formed.

The first component in a photographic system that light interacts with is the *lens*, effectively taking an angle of view plus a subject of focus and projecting it onto the camera's film or sensor. Lenses can influence the viewer's sense of scale and depth, control the angle of view or isolate a subject from its background. Lenses have more of an impact on image quality than anything else on a photographic system, being effectively the brush that paints the captured image (McHugh, 2018, p.15).

If the lens is the brush, then the digital sensor or analog film can be thought of as the canvas where light will be projected and captured by photosensitive materials. (McHugh, 2018, p.17). This act of light falling onto a photosensitive material can be re-

**Figure 5**

*City of God (2002)*



*The hard, high-contrast, sunny lighting adds drama to the scene, conveying romantic tension.*

ferred to as exposure, where the sensitivity of the photosensitive material and amount of light that reaches the sensor determines an image's brightness (Peterson, 2010, p.16), that is determined by the configuration of the aperture - how much light passes through the lens, shutter speed - for how long the sensor or film is going to be exposed to light, and ASA or ISO - how sensitive to light the photosensitive materials are (McHugh, 2018, p.25).

A camera is more than just a device for recording images; it is a complex instrument that photographers and cinematographers use to shape and capture light as a means of expression. Understanding how each component interacts with light and how it impacts that final frame is essential in creating visually compelling and powerful cinematic images. Through a thorough understanding of the fundamental components of a camera system, filmmakers can take control of their craft and express their unique artistic vision in a way that truly resonates with their audience. With this knowledge, live action filmmakers and photographers can explore and experiment with different combinations of camera components and set-ups to create unique and distinctive visual styles, and even push the boundaries of traditional cinematography to create new forms of visual storytelling.

**Figure 6**

*Citizen Kane (1941)*



*The deep focus in this shot allows for eloquent staging and blocking. It establishes a relationship between the characters by grouping the couple in the foreground, in contrast to the standing man who looks directly at them, with the child highlighted and framed by the window.*

### 3.2. The Lens

*Part of the problem with lenses, of course, lies in the problem with vision itself.*

*Do we like what we see? Do we understand what we see? Do we trust what we see?*

*How much should we see, and who should decide? What does it even mean to see?*

*(Cohen, 2014, p.248 - 249)*

The use of lenses in filmmaking is not just about capturing images, but also about the ways in which we can shape and distort reality through our choice of lens, being one of the prime tools in the cinematic language to add layers of meaning, nuance and emotional context to shots and scenes that go beyond the objective content of the frame (Mercado, 2019, p.14). As Cohen (2014) notes, there are complex questions to consider when it comes to seeing and understanding the world around us. The lenses of a camera, with their groupings of curved and spaced lenses, manipulate the light entering the camera, resulting in unique image characteristics. While lens designs can correct many aberrations, none can be entirely free from them. Therefore, understanding the optical properties and

**Figure 7**

*High and Low (1963)*



*Smooth metallic surfaces often exhibit specular reflections, which appear as overexposed spots on the car's surface.*

construction of lenses is essential in choosing the right lens for a particular shot. Even the slightest variation in a lens's design can affect the image's overall look and feel (Price, 1976, p.72), making it critical to understand the technical aspects of lenses.

This chapter will delve into the fundamental concepts of optical properties and lens construction, exploring how different lenses and their unique designs can produce specific visual effects. We will also discuss common lens aberrations and effects that can result from lens design and manufacturing. Finally, we will examine various types of lenses and lens selection techniques, including prime lenses, zoom lenses, and specialty lenses, to provide a comprehensive understanding of the role lenses play in creating a filmmaker's unique visual style.

### **Optics**

Understanding the optical properties of lenses is essential in choosing the right lens for a particular shot. Every lens has a unique design, which affects how light is shaped to reach and interact with the sensor (Price, 1976, p.72).

**Figure 8**

*A Beautiful Mind (2001)*



*Light refracts through the glass material, generating a pattern on the table known as caustics.*

In order to grasp the fundamentals of optics, it is essential to have a basic understanding of the behavior of light. Most objects in the world do not emit visible light, but instead reflect natural or artificial light, being classified into two main types: specular reflection and diffuse reflection. Specular reflection occurs when light is reflected from a smooth surface at a definite angle, whereas diffuse reflection happens when rough surfaces tend to reflect light in all directions. In our daily life, diffuse reflection is much more common than specular reflection (Ray, 2002, p.18). On the other hand, refraction - or bending of the visible light occurs as light passes from one medium to another when there is a difference in the index of refraction between the two materials, which is defined as the relative speed at which light moves through a material with respect to its speed in a vacuum - and it is the means in which allows lenses to focus light beams onto a single point, being one of the most important characteristics of lenses. (Brown, 2011, p.270 - 271).

**Figure 9**

*Grand Budapest Hotel (2014)*



*Chromatic aberration subtly washes and distorts the colors in the shot, imparting a painterly aesthetic.*

The refractive index varies with the frequency of radiation, causing dispersion, which can cause image aberrations such as chromatic aberration and monochromatic aberrations - defined mathematically by Ludwig Seidel in 1856 – such as spherical aberration, coma, astigmatism, curvature of field and distortion (Price, 1976, p.75).

Chromatic aberration is an optical phenomenon that occurs when white light is dispersed into its constituent colors by a prism. In a vacuum, all wavelengths of light travel at the same speed. However, in a medium such as glass, the speed of light is reduced, and shorter wavelengths are slowed down more than longer wavelengths. This causes the path of the light to be refracted or bent when it passes through a surface that separates two media with different refractive indices, deviating from a line perpendicular to the interface between them, resulting in a distorted image with color fringes or halos around the edges (Mercado, 2019, p.52).

Spherical aberration is a phenomenon that occurs because lens surfaces are sections of spheres, causing light passing through the edge of a lens to come to a focus at a different point than light passing through the center of the lens. The number of spherical aberrations on a lens impacts how it renders out of focus objects, or boke (Mireles, 2022).

**Figure 10**

*The Favourite (2018)*



*Fisheye lenses in the film create a distinctive visual style, conveying parts of the story through deliberate distortion.*

Distortion is an aberration that results in the appearance of curved objects being projected onto a flat surface or vice versa. It is similar to the distortion that makes Greenland appear larger on maps made using Mercator's projection. This is directly correlated to the lens focal length - the distance from the optical center of the lens to the plane in which the rays are brought to a focus (Price, 1976 p.75) - which determines the lenses field of view, how wide or long it is, with longer lenses compressing space and wider lenses expanding and distorting and expanding space (Brown, 2011, p.7).

Some lenses have noticeable vignetting or light fall-off, where the edges of the frame are less exposed than the center. This can be caused either by a physical object blocking the light from entering the lens, such as a filter or lens hood, or the inevitable obstruction of light at the aperture (Ray, 2002, p.132-134). This has a darkening effect on the image and is commonly used as a device to focus the viewer's attention towards the center of the screen.

### Figure 11

*Black Swan (2010)*



*Lightflares create subjective tension on the shot, the spotlight is both glorious yet intruding and menacing.*

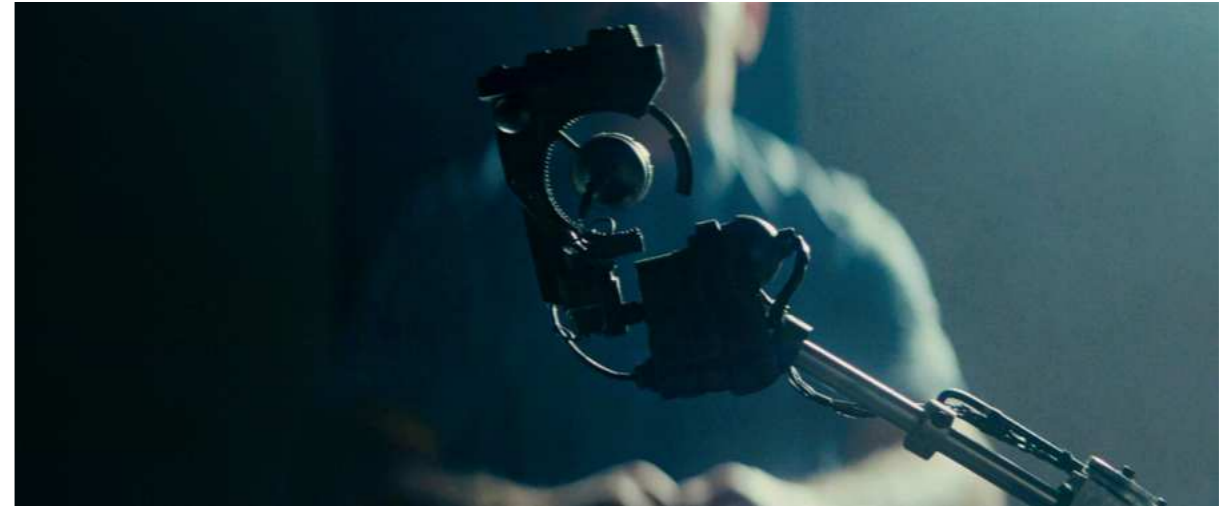
Lens flares or glare are milky streaks of light that run over the whole image caused from light rays being reflected within the lens before hitting the film or image sensor. All lenses reproduce flares to some extent, making their appearance a norm in film (Pekkarinen & Balzer, 2019). Historically, flares have been seen as unwanted artifacts, resulting in the development of tools such as matte boxes and lens shades which help minimize and control unwanted flares. When used deliberately, flares become a useful storytelling device for cinematographers, which helps set a desired mood or tone to the image (Brown, 2011, p.64).

#### **Depth of Field and Focus**

Depth of field is the distance range in an image that appears acceptably sharp and is affected by camera type, aperture, and focusing distance. The transition between sharp and blurry is not sudden but rather gradual. Even if the human eye or camera resolution cannot perceive it, objects immediately in front or behind the focusing distance start to lose their sharpness. The concept of depth of field is not defined by a specific point of transition from sharpness to blurriness, but rather by the circle of confusion, which determines the extent to which a point can be blurred before it is perceived as unsharp. When

### Figure 12

*Blade Runner (1982)*



*The gadget is in sharp focus, while the man behind, is out of focus accentuating mystery. This establishes a narrative connection between them, since in future shots it will reveal what the man really is, a replicant.*

the circle of confusion becomes noticeable to our eyes, the region is considered outside the depth of field and is no longer acceptably sharp (Ray, 2002, p. 215 - 216).

Depth of field only refers to the objects that are acceptably sharp, it does not describe what happens to objects in regions that are out of focus, they are referred to as bokeh, from the Japanese word meaning "blur". Focal length does not impact the behavior of the lens bokeh, but the lens construction itself determines this, meaning that two different lenses of the same focal length will produce distinct bokeh (McHough, 2018, p. 47).

Depth of field is affected by several factors, such as the focal length of the lens, aperture, image magnification or object distance, format, and circle of confusion. A shorter focal length of the lens results in a greater depth of field, whereas a smaller aperture increases the depth of field. Depth of field decreases as the object distance from the image plane decreases. Additionally, larger formats such as 35mm or Imax have less depth of field compared to smaller formats such as 16mm or 2/3" CCD. The circle of confusion chosen for a particular situation also affects the depth of field (Brown, 2011, p.275).

Many techniques in photography such as adjusting the focal length, framing the shot, and manipulating lighting are all aimed at replicating the mental processes of focus and attention. The human eye perceives the world as in focus, but this is due to the interaction between the eye and the brain. The human eye is like a wide-angle lens with an f/2 aperture, capturing a broad view in focus in bright settings. However, our focus constantly shifts unconsciously. Our mental focus, controlled by the brain's attention, sets the eye apart from a camera. Cameras, in contrast, record everything without conscious focus. They simulate the collaboration between the eye and brain, replicating how we perceive the world around us (Brown, 2011, p. 272).

*There's something intoxicating about lenses. They attract light, drink it in, swish it around, and savor it. They slow light down, diffusing it, focusing it, bending it this way or that. (It depends on whether the lens is concave, convex, or something in between.) Lenses need light, they rely on it; it gives them purpose and meaning, a reason to get up in the morning. Yet they never hold onto it, they're not attached to light; they're more like Kung Fu or maybe Aikido: they just let light pass through, giving it new direction along the way (Cohen, p. 246, 2014).*

### Language of the Lens

The lens primary goal is to bend light so it may be captured, but this alone does not stand up to the possibilities lenses offer, allowing for the creation of expressively eloquent and memorable images (Mercado, 2019, pg. 7), being possibly one of - it not the most - powerful tool in cinematography offering its physical properties, such as depth of field, focal length, and aperture, as tools to convey emotion and meaning. By manipulating these properties, filmmakers can control what the audience sees, how they see it, and how they feel about it. This technique has been used throughout the history of cinema and continues to be a key component in cinematic storytelling (Brown, 2011, p.54).

At the core of framing a shot is the act of choosing what will be seen by the audience. This involves deciding what to include and what to exclude. The initial step is deter-

### Figure 13

*Malcolm X (1992)*



*In this shot, Malcolm stands between Elijah's portrait, giving the sense that Elijah closely oversees his actions. It symbolizes Elijah's strong influence on Malcolm and their eventual split, leading to Malcolm leaving the Nation of Islam (Mercado, 2019, p.81).*

mining the camera's position in relation to the subject, but there is still another decision to be made regarding how much of the view to capture, which is accomplished through selecting a lens - a wider lens captures a bigger field of view, while tighter lenses focus on a narrower portion of space (Mercado, 2019, p.55).

Focal length is important because it affects how the lens projects the three-dimensional world onto a two-dimensional plane. Lenses in the normal range are able to represent the depth relationships between objects in a way that is similar to human vision (Brown, 2011, p.54). When using a lens wider than the normal range, the perception of depth is magnified, creating an illusion of greater space between objects than what actually exists. This magnified sense of depth can have psychological effects, making movement towards or away from the lens more pronounced and causing distant objects to appear much smaller. This effect can enhance the viewer's feeling of presence in the scene, a common goal for filmmakers (Mercado, 2019, p.55). However, as the lens widens further,

**Figure 14**

*The Royal Tenenbaums (2001)*



*The use of a wide-angle lens in this closeup introduces facial distortion and accentuates the spatial qualities of the bathroom, which is a confined and visually minimalist interior setting. This shot brings us into immediate proximity with the character, creating a sense of unease as we become intimately connected to their experience.*

there can be distortion of nearby objects, making it necessary to use a longer focal length lens for portraits or head shots to avoid perspective distortion (Brown, 2011, p.54).

This is because the wider the lens used for a close-up shot is, the closer the camera must be to fill the frame, causing a significant difference in distance between the nose and eyes, resulting in distortion. Wide lenses have a greater depth-of-field at a given distance and f/stop. This means that the amount of the scene that is in focus is increased. The depth-of-field of a lens is inversely proportional to the square of its focal length (Brown, 2011, p. 55). It is important to note that the psychological effects of depth-of-field are relevant to the use of lenses (Mercado, 2019, p.99).

Long focal length lenses, also known as telephoto lenses, have characteristics that are opposite to those of wide lenses. They tend to compress the space, have less depth-of-field, and reduce the emphasis on movements towards or away from the camera. The compression of space that long focal length lenses create can be utilized to achieve various perceptual goals. These lenses can create a sense of tightness and constriction in the

**Figure 15**

*The Last Emperor (1987)*



*Spatial compression places the background character close to the main subject, yet intentional blur adds an abstract quality, implying a subjective sense of closeness.*

depicted space, make distant objects appear closer, and intensify the action and movement in a scene (Mercado, 2019, p.57). Furthermore, their capacity to reduce the perceived distance can be employed to manipulate the psychological space and achieve the desired composition.

The quality of having less depth-of-field in long focal length lenses can be employed for selective focus shots, which can isolate the subject. As previously mentioned, a shallow depth-of-field can highlight the subject. The crucial aspect is that focus can be utilized as a means of storytelling (Brown, 2011, p. 56 - 58).

One of the first choices a director of photography must make when designing a shot is whether it is going to be shot on a spherical or anamorphic lens. Spherical lenses, as the name suggests, have their surfaces shaped like a slice of a sphere. When a lens is correctly made, their symmetrical nature causes all parallel rays of light to properly bend toward and intersect at the focal point, forming a coherent image (Huntley, 1993, pg.300).

**Figure 16**

*Inglourious Basterds (2009)*



*The lens flare streak implies a link between the character and the light source. The framing indicates her anticipation, not just observing what is present but also anticipating what lies ahead.*

An anamorphic optical system, on the other hand, behaves differently, having different magnifications in the horizontal and vertical dimensions of the captured image (Kodak, 2007, p.190). It is composed of an asymmetrical concave cylindrical lens hollowed out of its front surface, which bends light in such a way that the captured image is one that is squeezed horizontally - giving the lens a wider field of view on the horizontal axis - while maintaining vertical consistency. To reverse this process, the captured image is later stretched horizontally resulting in wider images with shallower depth of field, whose aspect ratio is relative to the squeeze factor of the lens, resulting in a horizontal dimension that is greater than the vertical (Huntley, 1993, pg.300).

Because of the difference of magnifications between the horizontal and vertical axis, the lens essentially works with two sets of focal lengths. This causes it to behave differently to spherical lenses, offering not only the possibility of wider film formats - such as Cinemascope ranging from 2.35:1 to 2.66:1 - but also unique image qualities that can have a meaningful impact on the overall aesthetic of the image (Maxwell, 2015, pg.98). One of these qualities is the perception of depth it offers, essentially working with the field of view of a wide lens and the shallow depth of field of a telephoto lens.

Furthermore, the process of squeezing light onto a sensor also has a significant impact on how bokeh is rendered. Whereas in spherical lenses, bokeh is rendered in a circular shape, due to the difference of depth of field between the horizontal and vertical axis, bokeh distorts to an oval shape (Märting, 2015, pg.20).

Another recognizable characteristic of anamorphic lenses is its distortion, which gives a sense of roundness to the image. Towards the edges of the frame distortion is greater, resulting in more lens aberrations than spherical lenses - which are easier to correct for these defects (Bruyère, 2015, pg.25).

Finally, one of the most recognizable image artifacts an anamorphic lens produces is its unique horizontal flares. There are several factors involved on why anamorphic lenses produce flares, which include: the cylindrical elements on the front of the lens that reflect light differently on the horizontal and vertical axis; even though light is distorted on anamorphic systems, there are still light paths that render common flares, but when later stretched, they deform; and the blue coatings of the lens, that tint the flares blue (RED, n.d.).

*Again, we are not talking about the physical lens, what concerns us here is how various lenses render images in different ways. This is a powerful tool of visual storytelling — the ability of optics to alter our perception of the physical world. Every lens has a “personality” — a flavor and an inflection it adds to the image.*  
(Brown, 2011, pg.6)

The lens is the camera component that has the biggest influence on the visual style of the captured image. Every lens has unique properties that affect the image in a particular way, the unique artifacts that lenses produce leaves their mark on the image, making lens choice one of the most, if not the most important decision a cinematographer has to make in production. The chosen lens will mark its fingerprint on every image it captures, being a powerful tool for designing cinematic shots.

### Figure 17

*Blade Runner 2049 (2017)*



*Clear, unobtrusive images immerse viewers in the world, grounding them in a believable setting that doesn't distract from the action.*

*"I think that lens flares can work really well under certain circumstances. Personally, I am trying to get rid of them most of the time. I don't like artifacts that draw attention to the surface of the image."*

*(Deakins, n.d.)*

*"One of the things I love about older glass is the flaring. These lenses have the feel of an older lens. But all the technicians on the set love them because they're close focusing, they're fast, and they're the same stop and the same size, and they're a proper set. Vantage has given us a few extra paintbrushes with these lenses. The image wasn't perfect – but it had character."*

*(Fraser, 2015)*

Over the years, lens manufacturers have been trying to correct for these defects, where more modern lenses have corrected or minimized many of the discussed artifacts. This opens up the choice for cinematographers to take the decision of whether to work with "flawed" vintage lenses that adds texture to the image or "perfected" modern lenses that attempt to correct the flaws of the lens to produce non-distracting, clean images.

### Figure 18

*Dune (2021)*



*Textured imagery employs the camera's physical properties to approximate subjective experiences of characters, enhancing viewer immersion.*

As lens manufacturer Peter Märtin explains:

*We realized that these so-called defects are tools used by cinematographers to subtly communicate a certain feeling or mood to the audience. For example, some of these older lenses, prized for beauty work, deliver a low contrast image with creamy skin tones. With today's glossy digital formats, the right lens can add a certain authenticity or aesthetic to the image by way of these traits, which in many cases were originally limitations – flares, reflections, certain contrast and color characteristics and more – that are put to use by cinematographers as storytelling tools.*

*(Martin, 2015, pg.24)*

In conclusion, lenses play a captivating and influential role in the world of cinematography. These optical tools possess the remarkable ability to shape visual storytelling and evoke emotions within the audience. Through the skillful manipulation of lens properties such as depth of field, focal length, and aperture, filmmakers can exercise precise control over what the audience sees and how they perceive it.

The selection of lenses becomes a pivotal decision in the creative process, as it determines the visual style and narrative impact of each shot. Wide lenses expand the field of view, creating a heightened sense of presence and depth that draws viewers into the cinematic world. On the other hand, long focal length lenses compress space, intensifying the emotions and actions depicted on screen, adding a unique visual perspective (Mercado, 2019, p.56 - 59).

Moreover, the choice between spherical and anamorphic lenses adds another layer of artistic expression. Spherical lenses provide a familiar representation of reality, closely resembling human vision. In contrast, anamorphic lenses introduce distinctive artifacts, expand aspect ratios, and convey a sense of depth that transports viewers into a different visual realm.

It is important to acknowledge that each lens carries its own distinct characteristics, contributing a particular flavor and visual impact to the captured image. Whether cinematographers opt for vintage lenses with their unique qualities or modern lenses that produce clean and precise images, these lens characteristics can be harnessed as storytelling tools.

Ultimately, cinematographers wield the language of the lens to leave their artistic mark on every frame, enhancing the overall cinematic experience. The lens becomes an instrument through which they express their creative vision, immersing viewers in captivating narratives and eliciting emotional responses.

Wide lenses expand the field of view, while long focal length lenses compress space, intensifying emotions. The choice between spherical and anamorphic lenses adds another layer of artistic expression. Each lens possesses unique characteristics that contribute to the overall visual impact. Cinematographers utilize the language of the lens to leave their artistic mark on every frame, creating captivating narratives that resonate with viewers (Mercado, 2019, pg.7 - 11).

## Figures 19 & 20

*The Lighthouse* (2019)



*The overexposure present on the shots amplifies the film's cosmic horror themes through high-contrast lighting, creating memorable yet unsettling imagery.*

### 3.3. Exposure

Alongside the lens, another fundamental aspect of cinematic language that greatly impacts visual storytelling is exposure. Exposure refers to the control of light entering the camera and striking the image sensor or film. Just as lenses shape the way we see the world through their unique properties, exposure allows cinematographers to manipulate the brightness, contrast, and tone of a scene (Peterson, 2010, pg.16).

In the following section, we will delve into the key components of exposure, exploring the interplay between aperture, shutter speed, and ISO sensitivity. We will discuss how these factors work together to determine the overall exposure level and how cinematographers can utilize them to craft compelling visuals. Additionally, we will examine the concept of dynamic range and the idea of correct exposure in successfully rendering both shadow and highlight detail.

Furthermore, we will explore various exposure techniques and strategies employed by cinematographers to achieve specific aesthetic goals. From the use of natural light to artificial lighting setups, from high-key lighting to low-key lighting, each approach offers distinct opportunities for shaping the tone of a scene.

**Figure 21**

*Batman (1966)*



*The early Batman films had even exposure and lower lighting contrast, establishing a light and comedic tone.*

### ***The Exposure Triangle***

In the realm of photography, achieving the desired exposure is a fundamental pursuit that greatly influences the visual outcome of an image. This pursuit is intricately tied to the relationship between the luminosity of the subject being captured and three key camera settings: the aperture size, the shutter speed, and the film or sensor sensitivity, commonly measured in ASA or ISO values. Together, these settings form what is known as the exposure triangle (Peterson, 2010, pg. 21 - 25).

At its core, the exposure triangle encompasses the delicate balance between light and darkness within a photograph. By understanding the interplay between these three settings, photographers gain the ability to control the overall exposure and manipulate the brightness, contrast, and tone of a scene. This control empowers cinematographers to effectively convey their artistic vision and convey the desired mood and atmosphere in their images.

The aperture size, representing the opening through which light enters the camera, determines the amount of light that reaches the film or sensor. A larger aperture (represented by a lower f-number) allows more light to enter, resulting in a brighter im-

**Figure 22**

*The Batman (2022)*



*Recent Batman films use low-key lighting and selective exposure, deliberately underexposing parts of shots to create a deeper and more dramatic visual style.*

age, while a smaller aperture (higher f-number) restricts the amount of light, leading to a darker image (Brown, 2011, pg.182). By manipulating the aperture, we can selectively focus attention on specific subjects or, as discussed previously, create a broader depth of field, influencing the overall visual impact of the rendered images.

The second component of the exposure triangle is the shutter angle - or more commonly known as shutter speed - which controls the duration for which the camera's shutter remains open. A longer exposure time allows more light to reach the film or sensor, resulting in a brighter image, while a shorter exposure time limits the amount of light, resulting in a darker image (Brown, 2011, pg.183). By manipulating the shutter speed, we can either freeze motion or add motion blur, which can impact the viewer's perception of movement (McHough, pg.28).

Lastly, the film or sensor sensitivity, measured in ASA or ISO values, determines how receptive the medium is to light. Higher sensitivity values (e.g., higher ISO) make the film or sensor more responsive to light, resulting in a brighter image, while lower sensitivity values (e.g., lower ISO) make the medium less responsive, leading to a darker image.

This setting allows photographers to adapt to different lighting conditions, balancing the exposure based on the available light sources and desired artistic effects, with the compromise that higher values add noise to the image (Brown, 2011, pg.183).

Understanding the relationship between these three settings within the exposure triangle grants cinematographers the power to control the overall exposure which becomes one of the cinematographers main tools to control the tone of a scene - how dark or bright the image is, having one of the most obvious impacts to the mood of a scene.

**Figure 23**

*The Blue Umbrella (2013)*



*This shot uses a common focusing technique to group the characters together while effectively separating them from the sea of umbrellas around them.*

#### **4. Animation, Camera Structure and Virtual Imaging Systems**

The similarity between live-action and computer animation in terms of sensibility is striking, argues Pixar's director of photography Patrick Linn (2016). Both mediums share the fundamental goal of conveying a narrative visually. The techniques employed to achieve this goal are remarkably consistent, irrespective of whether it is a live-action or animated production. This consistency can be observed in various aspects, such as camera setup, choice of lenses, and camera angles. For instance, when the objective is to portray a character as a hero, a low-angle shot is often utilized. This technique is equally applicable in both live-action and animation. In essence, the core principles of cinematic language remain constant across these two mediums (Sarto and Linn, 2017).

In the following section of this dissertation, we will delve into the evolution of cinematic language discussed earlier. We will examine how, in the present day, with the evolution of technology that facilitates the production of photorealistic imagery, animators now have access to tools that can model virtual reproductions of real-world cameras.

**Figure 24**

*Inside Out (2015)*



*The shot not only utilizes cinematography techniques that are grounded to real-world cinematography, but also models real world lenses giving it a photoreal visual style.*

In the following chapters, our focus will center on understanding the influence of photorealistic artifacts, both in their presence and absence, on the overall image. We aim to explore how these elements imbue meaning and symbolism, and how their role has evolved over the years. Our primary concern lies in understanding the narrative impacts and symbolic nuances that camera artifacts contribute to the resulting image.

#### **4.1. A Common Language**

Cinematic language, as we define it here, refers to the rich array of visual tools that filmmakers employ to imbue storytelling with depth and nuance (Brown, 2011 pg. 8). These tools encompass a spectrum of techniques, from camera angles and lighting to framing and composition, all of which play a pivotal role in conveying narrative, emotion, and symbolism within a film.

Patrick Linn's insightful perspective underscores a fascinating convergence between the worlds of animated and live-action filmmaking. Regardless of the medium, the

**Figure 25**

*Love, Death & Robots - The Witness (2019)*



*A highly stylized image is anchored by photorealistic elements, including bloom, reflection, exposure, and lighting. It also incorporates visual storytelling through camera placement and lens modeling, creating a captivating visual composition.*

fundamental principles of cinematic language remain remarkably consistent. These principles are akin to a universal vocabulary that storytellers use to communicate with their audiences.

However, it is the relentless march of technology, particularly the evolution of computer graphics, that has ushered in a profound transformation in the realm of animation. As computers have grown more powerful and sophisticated, animators have gained the ability to easily replicate real-world cameras with astonishing accuracy (Robertson, 2015). This means that in today's 3D animation, virtual cameras can mimic the physical behaviors of their real-life counterparts, offering not only an unprecedented level of realism, but also the ease of access to the storytelling devices physical cameras provide.

In particular, our observations will home in on the role of photorealistic artifacts — visual cues produced by light phenomena — and their profound contributions to add layers of meaning and symbolism to visually enhance the narrative impact of animation.

**Figure 26**

*Toy Story (1995)*



*The warm sunlight against the cool room design forms a dynamic composition, yet the overall effect is somewhat diminished due to limited dynamic range in exposure.*

We will pay some special attention on how the character “Woody” is portrayed, by comparing how both films visually portray the character, we can have a clear comparison of the technological discrepancies of over 20 years of technological development and observe how the visual language has evolved.

It is important to note that we are particularly talking about computer generated imagery, and its ease of access, cinematic language has always been the backbone of traditional animated films and it is present in 2D analogue animation, but it’s less mature counterpart, digital animation, has evolved a lot giving new possibilities not only on digital animation but also enhancing analogue animation, we will discuss this further later.

#### **4.3. ToyStory (1995, 2019)**

In the realm of animation, “Toy Story” marked a significant turning point when it was released in 1995. It was a pioneering venture, introducing 3D computer-generated imagery (CGI) to the world of feature-length animation, before this film 3D rendered im-

**Figure 27**

*Toy Story (1995)*



*The shot strategically positions the background directly behind the character, effectively mitigating the negative effects of lighting and depth of field limitations.*

ages were measured in seconds (Henne, Hickel, Johnson, & Konishi, 1996, pg. 463). One notable constraint was the limited cinematographic freedom on the image’s tone due to the early state of CGI technology, which resulted in a dimmer, low contrast color palette. Instead, the film primarily relied on art direction and character appeal to overcome this limitation (Henne, Hickel, Johnson, & Konishi, 1996, pg.464 - 466). Additionally, due to limited depth of field technology, the shots are mostly in deep focus, with simple backgrounds, being a solution to the lack of camera effects, making their absence on the shots much less noticeable. These creative solutions allowed “Toy Story” to deliver a compelling visual narrative despite the technological constraints of its time.

In 2019, Pixar once again captivated audiences with “Toy Story 4”, marking a significant milestone in animation. With over two decades of dedication to computer graphics research and hardware technology advancement, Pixar’s latest offering stood as a testament to the medium’s evolution (The Walt Disney Company, 2019). In this era, “Toy Story

4” seamlessly harnessed the full range of cinematic language devices, including photorealistic elements, as expressive visual storytelling devices, benefiting from years of innovation (Pennington, 2019). This achievement exemplified how the animation landscape had evolved, providing storytellers with unprecedented visual tools.

*“It’s a wide-screen format that gives us a different look for the film. We want to give the audience a more cinematic experience.”*

*(Patrick Lin, 2019)*

One of the first things that can be noticed is the switch of aspect ratio, from 1.85:1 to a wider format of 2.39:1, which not only widens the frame, but also creates a larger depth of field (The Walt Disney Company, 2019). This ratio is the most common on real-life anamorphic lenses, being one of the elements studied and replicated on the film, alongside their distortion, lens breathing and *bokeh* to capture the look of the iconic Cooke lenses (Pennington, 2019).

In animated filmmaking - specially 3D, the role of the Director of Photography (DP) is as crucial as it is in live action. Just as in live action, the DP in animation faces choices regarding lenses and camera movements that best suit the narrative. A notable shift occurred at Pixar with the film “Inside Out” (2015), where, for the first time, virtual lenses were meticulously modeled after actual lenses, a groundbreaking development led by the same DP, Lin. This shift paved the way for innovative techniques in cinematography within the animated realm (Robertson, 2015).

“Inside Out” also marked another significant first for Pixar: the use of a motion-capture camera in feature animation scenes. While this concept had been experimented with earlier on the short film “Blue Umbrella” (2013), which Lin also contributed to as the DP, it was in “Inside Out” that it was fully realized. Lin’s inventive approach extended to incorporating Cooke spherical lenses into his virtual camera package for “Toy Story 4”. This choice was more than a technical decision; it served as a narrative tool to emphasize the film’s central theme of change. Woody’s resistance to change and Bo Peep’s embrace of

## Figure 28

*Toy Story 4 (2019)*



*Exposing for the highlights, the scene darkens, including the character Woody, making more evident the rain that pours over him being accentuated by the bokeh from out-of-focus raindrops. Combined with the camera’s placement at the same level as the toy, these elements collaboratively create an emotionally charged image, forging an intimate connection between the viewer and the character. This immersive experience enables us to enter the character’s world and empathize with their emotions.*

it is mirrored in the cinematography. Spherical lenses were employed to convey Woody’s emotional struggle, while anamorphic lenses added depth of field and distortions when Bo Peep came into the frame. These techniques, guided by Lin’s vision, exemplify how cinematography in animated films has evolved to effectively communicate complex themes and emotions. (Pennington, 2019)

Toy Story 4 introduced an innovative approach to lighting, particularly within the carnival environment, where Jean-Claude Kalache served as the second Director of Photography (DOP) with a focus on lighting. Having previously contributed to projects such as UP (2009), Coco (2017), and the short film Bao (2018), Kalache and his team faced the unique challenge of rebalancing lighting for every shot within the carnival setting. Their method emulated the practices employed on live-action sets (Seymour, 2019).

The key to this approach was meticulous standardization. For each lightbulb in the carnival and antique mall, they carefully determined their intensity and colour temperature - measured in *Kelvins* which determines how cool (blue, green) or warm

**Figure 29**

*Toy Story 4 (2019)*



*In this shot, the lighting is practical and meticulously calibrated to the bulb, emitting light that forms a dynamic composition of shadows and highlights.*

(yellow, orange) the light is. This marked a departure from traditional lighting methods that involved adding gaffed or practical lights after filming.

By pre-establishing the lighting parameters, the lighting team was able to manipulate the exposure settings within the rendering software Katana to create the desired daytime or nighttime atmosphere (Seymour, 2019), effectively integrating the set itself as a fundamental component of the lighting scheme. This streamlined workflow resulted in a more efficient and powerful process, with the set playing a pivotal role in shaping the cinematic lighting effects throughout the film (Tu, Babb, Chang, Reeves, 2019).

The inclusion of simulated dust, cobwebs and fine debris, originally intended for select scenes, but eventually applied throughout the entire antique store (The Walt Disney Company, 2019), significantly enhances the overall storytelling and ambiance. In Toy Story 4, this heightened realism not only makes the images more photoreal with pleasing bokeh from the dust, but also accentuates the miniature scale of the toy world. It is essential to recognize that viewers naturally glean substantial information about these environments through subtle nuances. In the domain of computer graphics, the conspicuous absence of such elements becomes increasingly evident as modern rendering techniques

**Figure 30**

*Toy Story 4 (2019)*



*Both Gabby Gabby and Forky are sharply in focus, being a moment of self revelation. This evokes discomfort because it defies the conventional expectation of elements at varying distances being in focus simultaneously.*

aim for comprehensive fidelity across each frame. With ongoing technological advancements encompassing innovative techniques, automation, and procedural approaches, there is a growing expectation that the capability to seamlessly incorporate these intricate details will meet the increasing demand (Chang & Luoh, 2019).

One of the most visually impressive moments in the entire film occurs during the interaction between *Gabby Gabby* and *Forky*. In this scene, the cinematographers employed a split diopter lens filter, a device that allows the lens to maintain two distinct focal planes simultaneously. What makes this choice particularly noteworthy is that they could have easily manipulated the depth of field digitally. However, they opted for the tangible authenticity of a practical effect to create a sense of realism and unease, making it appear as though the shot were captured by an actual camera operator rather than, in Patrick Lin's words, "a toy camera operated by a toy cameraman" (Kadner, 2019).

Camera structure, as articulated by cinematographer Patrick Lin, is a fundamental concept in his filmmaking. It represents the systematic organization of various visual elements within a film to create a coherent and supportive framework for the story and its characters. Lin's perspective underscores the pivotal role that cinematography plays in

**Figure 31**

*Toy Story (1995)*



*This shot effectively employs a basic form of motion blur to convey a sense of speed, showcasing a successful though rudimentary approach to this cinematic technique.*

conveying narrative and emotion in animated films, as evidenced by the evolution of “Toy Story” and “Toy Story 4”. These two films, separated by a span of two decades and starkly contrasting technological limitations, exemplify how camera structure can be effectively harnessed to enhance visual storytelling.

In “Toy Story” (1995), a pioneering venture into 3D computer-generated imagery (CGI), the film faced early constraints, such as a limited color palette, simplified backgrounds, and restricted cinematographic freedom. Despite these challenges, the filmmakers leaned into character-driven storytelling and art direction, skillfully using lighting as a narrative tool. Through creative solutions, they delivered a compelling visual narrative within the limitations of early CGI technology.

Fast forward to “Toy Story 4” (2019), a testament to over two decades of dedication to computer graphics research and technological advancement. This film seamlessly embraced a wide array of cinematic language devices, from advanced photorealistic

**Figure 32**

*Toy Story 4 (2019)*



*From the meticulous fur simulation that captures highlights to the subtle dust particles adding texture to the carpet's edges, this shot pays exceptional attention to even the smallest details, enriching the environment with depth and storytelling. These details establish the scale of the world, define the sharp overhead lighting on the ground, and contribute to the image's brightness. Collectively, these elements imbue the cat with a sense of majesty and grandeur.*

elements to the choice of different lenses for conveying complex emotions and themes. A wider aspect ratio, various lenses, and innovative lighting techniques contributed to a more cinematic experience, emphasizing narrative themes and character arcs. The meticulous attention to detail enriched the visual storytelling, immersing the audience in a photorealistic miniature world.

In summary, the concept of camera structure, comprising camera language, visual intensity progressions, and scale progressions, serves as a versatile tool that spans technological eras in animation. It provides a framework for organizing visual elements cohesively to support storytelling and character development. “Toy Story” and “Toy Story 4” serve as instructive examples of how this concept can be applied in distinct ways, reflecting the evolution of animation technology’s impact on the medium.

**Figure 33**

*The Lego Movie (2014)*



*The combination of bloom and cinematic framing, along with the high contrast resulting from the overexposure of light emanating from the toy lantern, adds a layer of believability and realism to the lantern within the scene.*

#### **4.4. The Lego Movie (2014)**

Directed by Phil Lord and Chris Miller, “The Lego Movie” (2014) is a testament to the creative possibilities within animation (Scott, 2014). Drawing inspiration from the world of “brickfilms” – stop-motion Lego short films that emerged on the internet in early 2000s - this film breathes life into the familiar plastic bricks that have been a source of joy for generations (Lego, n.d.). We are particularly interested in the unique challenges presented towards the cinematography of the film, specifically how they overcame the issues with scale, emotion, light and photography.

In addressing the challenge of scale within the cinematography of “The Lego Movie”, several meticulous strategies were employed. Firstly, a lens perspective mirroring that of Lego-scale was adopted, utilizing virtual lenses serving as proxies for real-world counterparts. This approach allowed for the creation of visuals that authentically captured the essence of the miniature Lego world. Moreover, the implementation of accurate depth of field (DOF) calculations aligned with the physics governing these virtual lenses, ensuring a faithful representation of scale (Welsh, n.d.).

**Figure 34**

*The Lego Movie (2014)*



*The selective use of depth of field in this shot establishes a strong connection between the viewer and the character. Additionally, the light tone of the scene adds a sense of humor to the composition.*

In the pursuit of authenticity, imperfections were explored as well. Notably, deliberate overshoots of focus pulls, and camera movements were deliberately retained. While a generally shallow depth of field necessitated precise focus pulls, these calculated imperfections, strategically preserved in camera movements, added to the film’s charm by mimicking the real-world quirks of capturing miniature scenes with a camera, albeit on a Lego-scale canvas (Welsh, n.d.).

“The Lego Movie” embarked on a meticulous exploration of depth of field (DOF) and lens effects to attain a high degree of photorealism. Virtual cameras were configured to replicate real-world lenses, with precise calibration ensuring accurate DOF calculations based on object distances. This attention to detail was vital in establishing a convincing sense of scale and perspective within the Lego universe. Additionally, the film creatively departed from strict physical accuracy when narrative emphasis demanded selective focus, showcasing the filmmakers' adept use of cinematic techniques. Lens effects, such as lens breathing, chromatic aberration, and anamorphic distortion, were authentically

### Figure 35

*The Lego Movie (2014)*



*The explosion appears convincing despite being constructed from plastic toy bricks due to intentional overexposure.*

emulated to replicate the idiosyncrasies of traditional photography. The integration of lens flares further contributed to the film's photographic fidelity, enhancing the visual authenticity of the Lego world (Welsh, n.d.).

In its pursuit of photorealism, "The Lego Movie" faced the challenge of replicating the interaction of light with Lego elements, taking into account textures and light transmission properties. The filmmakers judiciously employed overexposure to convey the impression of film exposure and illuminate bright light sources realistically. While adhering to photorealistic principles, the film embraced creative departures from strict physical accuracy to emphasize specific narrative elements, a feat difficult to achieve in traditional photography (Welsh, n.d.).

To control depth of field and incorporate lens effects authentically, a specialized LegoLens kit was introduced, enabling precise manipulation of these cinematic attributes. Furthermore, lens flares, meticulously integrated to mimic real-world lens behaviors, elevated the overall photographic authenticity of scenes, contributing to the film's immersive portrayal of the Lego universe (Welsh, n.d.).

### Figure 36

*The Lego Movie (2014)*



*The accumulation of lens artifacts imparts a divine quality to the image. The glints and glares on the character's head from the specular surface, the hazy godrays streaming through the stone windows, and the anamorphic bokeh generated by the out-of-focus background characters all contribute to this sacred aesthetic.*

In summary, "The Lego Movie" explores lighting and photography, leveraging techniques that encompass overexposure, enhanced photorealism, lens effects, and depth of field. These efforts were instrumental in crafting a cinematic experience that authentically captured the essence of a Lego world, meticulously constructed and expertly illuminated and photographed.

**Figure 35**

*Spider-Man: Into the Spider-Verse (2018)*



*Despite its departure from realism, the film remains grounded and believable by repurposing various elements from cinematic language and reinterpreting real-world phenomena to create its unique narrative world.*

#### **4.5. Spider-Man: Into the Spider-Verse (2018)**

Despite its stark contrast with the photorealism observed in "Toy Story 4" and "The Lego Movie", "Spider-Man: Into the Spider-Verse" (2018) also harnesses a meticulously designed camera structure, reimagining the behavior of real-world cameras to shape the visual narrative towards an expressive comic book-inspired, non-photoreal appearance, prioritizing design and emotion over accuracy and realism (Seymour, 2018).

In this segment, we embark on an exploration of the film's visual style and animation techniques. Our focus will be on how the filmmakers adeptly integrated elements such as half-toning, blur elimination, and expressive imperfections (Seymour, 2018). These elements serve as prime examples of how "Spider-Man: Into the Spider-Verse", while diverging from photorealism, also aligns with Patrick Lin's concept of camera structure, profoundly influencing the film's visual storytelling.

**Figure 36**

*Spider-Man: Into the Spider-Verse (2018)*



*The framing in this shot positions Miles, dressed as Spiderman, in front of a backdrop of cards at the graveyard. This arrangement creates the illusion that Miles is delivering a speech to the cards left by people in honor of the deceased Spiderman, symbolizing his transition into the new Spiderman role.*

The incorporation of comic book techniques in "Spider-Man: Into the Spider-Verse" is a testament to the film's artistic innovation. Much like cinematographers manipulate settings within the exposure triangle to control the overall exposure of a scene, the film's visual style deliberately manipulates color, shapes, and artistic elements to reimagine how a camera behaves (Sony Pictures Imageworks, n.d.). These deliberate choices in the film's visual design mirror a cinematographer's use of exposure settings and lighting to influence the tone and visual style of a cinematic scene, "Spider-Man: Into the Spider-Verse" strategically incorporates comic book techniques, such as half-toning and line hatching on highlights and shadows, being very much like the tools in a cinematographer's kit, they contribute to shaping the tone of a scene while also defining the film's visual style by having the juxtaposition of graphical comic book elements with the classic cinematic language (Seymour, 2018). These artistic choices underscore the film's capacity to expressively influence the tone and mood of each scene, showcasing a nuanced interplay between cinematic techniques and visual storytelling.

### Figure 37

*Spider-Man: Into the Spider-Verse (2018)*



*The buildings in the image exhibit chromatic aberration effects, while the majority of the composition is textured with crosshatched and dotted patterns, effectively conveying variations in light and dark values, the lights bloom through sharp gradients.*

Building upon the film's creative interpretation of tone and exposure, "Spider-Man: Into the Spider-Verse" extends its innovative visual storytelling with a creative reinterpretation of depth of field. While traditional cinematography often relies on lens blur to manage camera focus and depth of field, this film takes a distinct approach. It deliberately avoids the conventional use of lens blur, instead drawing inspiration from comic book offset printing and instead of blurring elements that are out of focus, heavy chromatic aberration is applied. This approach introduces a unique out-of-focus effect that resonates with the imperfections inherent in comic book aesthetics (Sony Pictures Imageworks, n.d.). This seamless integration of cinematic techniques not only bolsters the film's adherence to comic book artistry but also enhances its capacity to shape the tone and mood of each scene, offering a fresh perspective on virtual cinematography.

In addition to its distinctive use of comic book techniques and innovative approach to cinematography, "Spider-Man: Into the Spider-Verse" further distinguishes itself through its elimination of motion blur - instead relying on techniques closer to the ones seen in 2D animation - and varying frame rates, contributing to a more controlled and stylized visual experience (Solomon, 2018). This deliberate choice extends to the an-

### Figure 38

*Spider-Man: Into the Spider-Verse (2018)*



*In this shot, motion blur is conveyed through the smearing of elements within the frame, achieved by duplicating them while maintaining sharpness, diverging from the conventional approach to motion blur.*

imation process itself, where the film oscillates between being animated on twos - 12 images per second, most commonly seen in analogue animation - and on ones - 24 images per second. This approach imparts a deliberate rhythm to the movements, adding to the film's unique visual signature (Sony Pictures Imageworks, n.d.). By judiciously varying the rhythms of animation between ones and twos, the film achieves dynamic and engaging motion sequences. In this way, "Spider-Man: Into the Spider-Verse" not only subverts conventional animation norms but also reinforces its commitment to an artistic vision that intricately shapes the cinematic language into a unique one, only possible in the universe the narrative takes part in.

In summary, "Spider-Man: Into the Spider-Verse" showcases a creative fusion of animation techniques and camera structure. Through its use of comic book-inspired visuals and innovative cinematography, the film expressively conveys emotion and narrative. Overall, the film exemplifies the potential of visual storytelling in animation, demonstrating the power of artistic innovation and a well-designed camera structure to captivate audiences.

**Figure 39**

*The Mitchells vs. the Machines (2021)*



*The camcorder interface puts in a video context a painterly and highly stylized image.*

#### **4.6. The Mitchells v Machines (2021)**

In "The Mitchells vs. The Machines" (2021), the film's visual style effectively incorporates elements that reflect camera structures in a manner consistent with the ideas presented. These cinematic choices enhance the storytelling experience and convey the film's thematic nuances.

The portrayal of the Mitchell family is characterized by an intentionally imperfect visual quality that resembles hand-held camera work. While not achieved through traditional cameras, this approach simulates the authenticity of amateur footage, adding an organic and relatable dimension to the family's depiction. It enables the audience to connect with the characters on a more personal level, emphasizing the film's underlying themes of family dynamics and individual quirks (Baughan, 2022).

Conversely, the robots are presented with clean and precise visuals that align with the mechanical and orderly nature of their characters. The film's visual composition mirrors the precision and symmetry typically associated with robotic aesthetics, effectively underscoring the narrative tension between human imperfection and robotic precision (Baughan, 2022).

**Figure 40**

*The Mitchells vs. the Machines (2021)*



*The order and greatness seen on the robos is accentuated not only by the clean framing, but also the flares from their rockets makes them look powerful.*

Additionally, the film seamlessly combines 2D animation with 3D elements, providing insight into how the protagonist, Katie, perceives her world, through Katievision. This blend of animation techniques mirrors Katie's creative and artistic outlook, contributing to the film's exploration of individuality and self-expression (McNamara, 2022).

Furthermore, the film employs creative techniques that emulate the look and feel of handheld cameras and cell phone footage, despite not using traditional camera equipment. This simulation introduces a sense of nostalgia and immersion, allowing the audience to feel part of the adventure and emphasizing the act of capturing moments on personal devices.

In summary, "The Mitchells vs. The Machines" incorporates cinematic choices that echo camera structures in alignment with the presented ideas. These simulated camera techniques enrich the narrative, amplify character dynamics, and immerse the audience in the film's thematic exploration and overarching theme of the road trip.

**Figure 41**

*Love, Death & Robots - Night of the Mini Dead (2022)*



*The combination of the tilt-shift effect and various layers of flares and blooms infuses the image with a humorously grandiose quality.*

#### **4.7. Love Death and Robots: Night of the Minidead (2022)**

In the production of "Night of the Minidead" (2022), the creative team faced a unique challenge in terms of camera structure and visual style. Initially, there were discussions about adopting a stylized look or even considering the construction of practical miniature sets. However, a crucial goal was to immerse the audience in a world that felt like a real, albeit scaled-down, apocalypse unfolding before their eyes (Buck, 2022).

To achieve this goal, the decision was made to employ a combination of computer-generated imagery (CG) and live-action photography, which was then enhanced with a tilt-shift effect. This choice in camera structure and visual treatment allowed the filmmakers to create a distinct visual experience. The tilt-shift effect, often used to make real scenes appear miniature, was utilized to lend authenticity to the portrayal of the miniature apocalypse (Frei, 2023).

**Figure 42**

*The Lego Movie (2014)*



*The framing situates us in the perspective of a spectator, creating a distance from the action that amplifies the absurdity and lends legitimacy to the over-the-top storyline.*

By treating the live-action photography with this effect, the production team managed to achieve a unique and visually engaging result. The intention was not to create a whimsical or fantastical world but rather to make the tiny-scale action feel as though it belonged to the realm of a summer blockbuster. This approach emphasized the comedic contrast of the miniature apocalypse with the high-quality visual standards commonly associated with major blockbuster films (Buck, 2022).

In summary, "The Night of the Mini Dead" demonstrates a strategic use of camera structure and visual effects to create a captivating and humorous portrayal of a miniature apocalypse. The decision to blend live-action photography with CG and apply the tilt-shift effect helped achieve the desired balance between authenticity and humor, all while maintaining the visual quality associated with blockbuster films.

#### 4.8. Summary of Observations

Camera structure plays a pivotal role in shaping the visual and narrative aspects of animated films. Through the comprehensive analysis of the camera structure of films above, several key contributions of camera structure have emerged:

**4.8.1. Creating Visual Style:** Camera structure and its effects stand as the driving force behind a film's overall visual style. Choices regarding lenses wield a significant influence, molding perspectives and thereby defining the film's distinct visual identity.

**4.8.2. Conveying Emotion:** Emotions in animated films find their expression through camera effects. Elements like depth of field and lighting serve as silent conveyors of characters' feelings. Shallow focus adeptly directs the viewer's attention, while the interplay of lighting and exposure meticulously crafts the tone for the unfolding narrative.

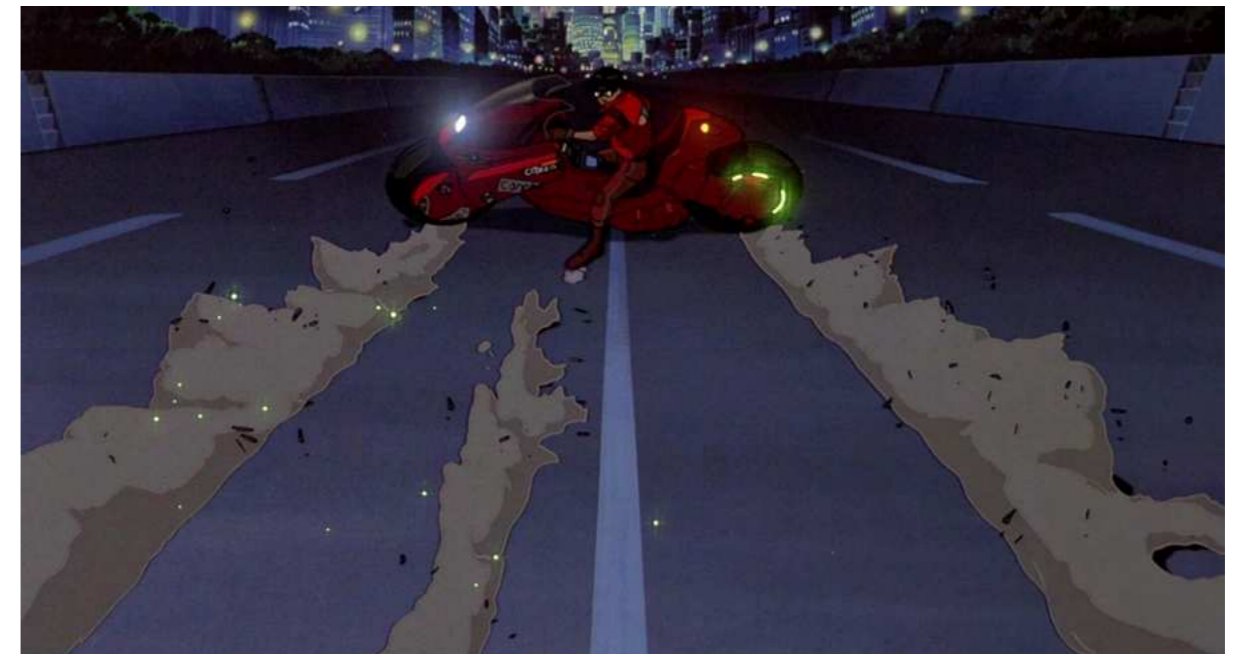
**4.8.3. Shaping Narrative:** Camera techniques are not mere tools; they serve as trusted guides in the art of storytelling. These techniques lend a distinct voice to the narrative by employing various angles to emphasize the traits and motivations of characters, enriching the storytelling tapestry.

**4.8.4. Realism vs. Expressiveness:** The interplay between realistic and expressive images, so central to animated cinema, is aptly influenced by camera structure. Realistic camera movements and effects excel at immersing viewers in a believable world, while more abstract animation styles contribute to a unique and imaginative visual language. Balancing these elements is critical for engaging audiences of all ages.

**4.8.5. Enhancing Symbolism:** Camera structure emerges as a potent tool for infusing deeper meaning into animated narratives. Techniques such as tilt-shift and selective focus introduce layers of symbolism, transforming ordinary scenes into powerful metaphors and thereby enriching the storytelling experience.

#### Figure 43

*Akira (1988)*



*Akira employs analog compositing techniques to introduce photorealistic bloom, enhancing the visual complexity of the scenes.*

**4.8.6. Establishing Cohesion:** One significant revelation that has surfaced in our exploration is the role of camera structure in creating a unified visual language throughout a film. Consistency in the application of camera techniques becomes the linchpin in establishing visual cohesion, enhancing the audience's immersion, and deepening their understanding of the narrative.

In summary, camera structure in animated films is a versatile and indispensable tool. Its various elements contribute not only to the film's visual style but also to the richness of meaning embedded within the narrative. While specific techniques may vary, collectively, they shape the storytelling and aesthetics in the realm of animated cinema, underscoring the profound influence of camera structure in this dynamic art form.

## 5. Conclusion

The study seeks to investigate and understand how camera structure, encompassing camera effects, lens choices, depth of field, lighting, and animation techniques, contributes to the meaning and visual style of animated films.

In essence, the research problem revolves around the role and impact of camera structure in shaping the aesthetic and narrative elements of animated films. It explores how these various aspects of camera structure influence the viewer's perception, emotional engagement, and overall cinematic experience in the context of animated storytelling.

### 5.1. Revisiting the Research Question and Key Findings

**Research Question:** How does camera structure, including camera effects, lens choices, depth of field, lighting, and animation techniques, contribute to the meaning and visual style of animated films?

Camera structure, encompassing camera effects, lens choices, depth of field, lighting, and animation techniques, holds paramount importance in the realm of animated filmmaking. It serves as the cornerstone for crafting compelling narratives and immersive visual experiences. Here is why it is crucial:

*Visual Identity:* Camera structure defines the unique visual identity of an animated film. It determines how the audience perceives the world within the film, influencing its visual style and aesthetics. From lens choices to animation techniques, each element contributes to creating a distinct visual signature for the film.

*Emotional Resonance:* Camera effects, depth of field, and lighting techniques are the tools through which filmmakers infuse emotion into their storytelling. These elements allow them to convey the characters' feelings, set the mood of a scene, and immerse the audience in the narrative. Without them, animated films might lack the emotional depth that makes them memorable.

*Narrative Prowess:* Camera techniques are storytelling devices in their own right. Framing, composition, and camera angles are instrumental in guiding the audience's attention and conveying essential information. Whether it's emphasizing a character's vulnerability or highlighting a crucial plot point, camera structure plays a pivotal role in shaping the narrative.

*Realism vs. Fantasy:* Camera choices dictate the level of realism or fantasy within an animated film. Realistic camera movements and effects create a believable world, while more abstract animation styles contribute to a unique and imaginative visual style. This balance between realism and fantasy is crucial for engaging audiences of all ages.

*Symbolism and Depth:* Camera structure adds layers of meaning and symbolism to animated films. Visual effects such as tilt-shift or selective focus can transform ordinary scenes into powerful metaphors, enriching the storytelling experience. These nuances elevate the film beyond its surface narrative.

*Cohesive Visual Language:* Consistency in camera structure establishes a cohesive visual language throughout the film. It ensures that the chosen techniques and effects align with the film's overarching style and meaning. This cohesion enhances the audience's immersion and understanding of the narrative.

In conclusion, camera structure is not merely a technical aspect of animated filmmaking; it is the creative palette through which filmmakers paint their stories. Its mastery enables them to craft captivating narratives, evoke emotions, and leave a lasting visual imprint on audiences. Understanding the importance of camera structure is essential for both aspiring animators and seasoned filmmakers looking to elevate their craft and deliver impactful animated films.

*Evolution of Research Questions:* Initially, our research primarily addressed the impact of camera effects in animated films. However, as our investigation progressed, we recognized that camera structure encompasses a broader spectrum of elements influencing animation. Consequently, our research questions evolved to encompass a more

comprehensive examination of camera structure's role in animated filmmaking.

**Answers and Findings:** Our initial inquiry into camera effects led us to acknowledge their significance in shaping visual and emotional aspects in animated films. As we extended our focus to camera structure as a whole, we found that it encompasses multiple components, including lenses, depth of field, lighting, and animation techniques. These elements collectively contribute to the creation of images in animated films, enhancing visual style, emotional conveyance, storytelling, realism, symbolism, and visual cohesion.

**Review of Hypothesis:** Our initial hypothesis suggested that intentional use of camera effects could enhance viewer immersion in animated films. In light of our research's evolution towards camera structure, the hypothesis remains valid but in a much broader context, since initially its relevance was underestimated. We now understand that the deliberate application of various camera structure elements, including camera effects, has the potential to enhance viewer immersion by influencing multiple aspects of animated filmmaking, encompassing style, emotion, narrative, and thematic depth.

In summary, our research transitioned from a narrow focus on camera effects to a broader exploration of camera structure's influence on animated films. This expansion provides a more comprehensive perspective on how camera-related elements impact animated filmmaking and reinforces the potential for camera structure to enhance the viewer experience in animated cinema.

**Incorporating Insights from Real-World Cinematography:** Our study on camera structure in animation not only sheds light on its impact within the animated realm but also draws notable parallels with real-world cinematography practices. The understanding of camera structure in animation has been greatly enriched by insights gained from real-life camera mechanisms and cinematographic techniques, as discussed in sources such as "Cinematography: Theory and Practice" by Blain Brown.

For instance, our exploration of camera effects in animated films resonates with the principles of lens choices and depth of field discussed in Brown's work. Just as real-life cinematographers employ specific lenses to manipulate perspective and depth, animators strategically select virtual lenses to achieve similar effects. The visual storytelling techniques employed in live-action films, as exemplified by Vittorio Storaro and other cinematographers in their interviews, have informed our understanding of how camera structure in animation can shape narrative and evoke emotions.

**Bridging the Gap Between Animation and Live-Action:** Furthermore, our study reinforces the notion that camera structure bridges the gap between animation and live-action cinematography. While the tools may differ, the core principles of creating compelling visuals, establishing emotional connections with the audience, and conveying narratives effectively remain consistent. Just as real-life cameras in the hands of skilled cinematographers contribute to the visual language of a live-action film, camera structure elements in animation serve as the virtual counterparts to achieve similar objectives.

By drawing from the lessons of live-action cinematography, as explored in "The Filmmaker's Eye: The Language of the Lens," we've gained insights into how camera structure can contribute to the aesthetics and storytelling of animated films. The principles of composition, framing, and lighting discussed in these works have proven to be valuable references in our analysis of animated filmmaking.

In summary, our research on camera structure in animation has been greatly informed by the principles and practices found in the realm of real-world cameras and live-action cinematography. The overlap between these two domains underscores the universality of visual storytelling principles, emphasizing that whether through the lens of a camera or the virtual constructs of animation, the art of crafting compelling and emotionally resonant visuals remains a shared endeavor.

## 5.2. Implications

**Artistic Innovation:** The study highlights the creative potential of camera structure in animation. Filmmakers can use these techniques to push artistic boundaries and create unique visual styles, enhancing the overall artistic innovation in the medium.

**Enhanced Storytelling:** Understanding the impact of camera structure allows filmmakers to tell more engaging and emotionally resonant stories. By using camera techniques effectively, they can convey complex narratives and characters more effectively.

**Audience Engagement:** As filmmakers become more adept at using camera structure, audiences can expect more immersive and emotionally impactful animated films. This can lead to increased audience engagement and a deeper connection with animated storytelling.

**Academic Inquiry:** The study contributes to the academic understanding of animation as a visual art form. It provides a framework for analyzing and critiquing animated films, fostering further academic inquiry into the medium.

**Industry Advancements:** Filmmakers and animation studios can use the insights from this study to advance the technical and artistic aspects of animation. This can lead to the development of new tools and techniques that improve the quality of animated films.

**Cross-Media Influence:** The principles of camera structure explored in this study can also influence other visual media, such as video games and virtual reality experiences. Understanding how camera structure contributes to storytelling can benefit various forms of visual entertainment.

**Educational Significance:** The study can inform animation education programs, helping aspiring animators and filmmakers develop a deeper understanding of camera structure and its role in the creative process.

**Cultural Impact:** As animated films continue to be a significant part of global popular culture, advancements in camera structure can impact how stories are told and shared

across cultures, potentially leading to a more diverse and inclusive animation landscape.

## 5.3. Addressing Limitations:

While our research has contributed valuable insights into the role of camera structure in animated films, it is important to acknowledge and address certain limitations that have shaped the scope and depth of our study.

**Limited Case Studies:** A noteworthy limitation of our study pertains to the relatively small number of case studies examined. While this limitation may have restricted the depth and breadth of our findings, it is important to note that our primary goal was to establish a framework for the investigation of camera structure's impacts. We strategically selected our case studies to ensure a clear identification of camera structure usage. Through these deliberate choices and comparative analysis, we aimed to discern how different films address unique challenges. To enhance future research, it is advisable to include a larger and more diverse sample of animated films, encompassing various genres, styles, and production methods. This approach would yield a more comprehensive understanding of the role of camera structure in animated filmmaking.

**Focus on 3D CGI Animation:** Our study primarily centered on 3D CGI animation, with limited exploration of other forms of animation. Recognizing this limitation, future research endeavors should consider expanding the scope to encompass various animation forms, including 2D animation, stop-motion animation, and mixed-media projects. This expansion would yield insights into how camera structure functions within each medium, contributing to a more holistic understanding of the subject.

**Sampling Bias:** The selection of case studies in our research could potentially introduce a sampling bias, since we chose films that had success on the box office and had clear use of camera structure. To address this, future studies should strive for a more balanced and diverse selection of films, ensuring a representative sample that captures the broader landscape of animated cinema.

**Subjectivity in Analysis:** Another limitation inherent in our research is the subjectivity associated with the interpretation of camera structure elements and their impact on the viewer. To enhance objectivity, future investigations could consider implementing more standardized or objective evaluation methods to assess the influence of camera choices on the cinematic experience.

**Temporal Limitation:** Our study reflects the state of animated films and camera structure as of September 2023. However, the field of animation is dynamic, with evolving technologies and trends. Future research should consider updating these findings to account for developments that have occurred since our knowledge cutoff date.

In conclusion, while our study has contributed valuable insights, addressing these limitations is essential for advancing the field of camera structure in animated filmmaking. By considering these constraints and conducting further research with a broader scope, the depth and applicability of our findings can be expanded, leading to a more comprehensive understanding of the subject matter.

#### 5.4. Future Research

As our study delves into the intricate world of camera structure in animated films, several avenues for future research emerge, each offering opportunities to expand our understanding and practical application of this subject.

**In Depth Exploration on the Role of Lenses:** One promising avenue is a more in-depth exploration of lenses within the context of animated filmmaking. While our study touched upon the influence of lenses, future research could delve deeper into how different types of lenses impact the visual style and narrative of animated films. The book "The Filmmaker's Eye: The Language of the Lens" provides a solid foundation for such investigations, offering insights into the language of lenses and their creative potential in visual storytelling.

**2D Animation and Stop Motion:** Our study primarily focused on 3D CGI animation, leaving a significant gap in our understanding of camera structure in other anima-

tion forms, notably 2D animation and stop motion. Future research could bridge this gap by exploring how camera structure operates in these distinct mediums. This expansion would enrich our comprehension of the versatile applications of camera structure across animation forms.

**Effective Techniques:** Another area ripe for exploration is the development of effective and approachable techniques for animators to incorporate camera structure elements into their work. While our study identifies the impact of camera structure, future research could provide practical guidance on how animators, particularly those in smaller studios or with limited resources, can readily integrate these elements into their projects. Additionally, considerations related to compositing, the art of combining visual elements, could be explored to enhance the seamless integration of camera effects into animated scenes.

Our study lays the foundation for future investigations in the realm of camera structure in animated filmmaking. These potential research directions promise to expand our knowledge, providing valuable insights into lenses, diverse animation forms, and practical techniques for incorporating camera structure effects. By exploring these avenues, we can further unlock the creative potential of camera structure in animated storytelling, enriching the cinematic experience for both creators and audiences.

#### 5.5. Contributions of the Study

In concluding our exploration of camera structure in animated films, it is essential to acknowledge the multifaceted contributions that have emerged from our research. These contributions span various dimensions and hold significance for both the academic and creative communities within the realm of animation.

**Enhanced Understanding of Camera Structure:** One of the central contributions of this study lies in the enhanced understanding of camera structure in animated films. By dissecting the intricate elements that constitute camera structure, from camera effects to lighting, our research has offered a comprehensive view of how these components co-

alesce to shape the visual and narrative aspects of animated cinema. This expanded comprehension enriches our appreciation of the meticulous craftsmanship involved in the creation of animated worlds.

**Practical Insights for Animators:** Our study extends practical insights to animators and filmmakers. It illuminates how specific camera techniques can be harnessed to convey emotions, amplify storytelling, and craft unified visual narratives. These pragmatic takeaways provide a valuable resource for animators seeking to elevate the impact of their work and enhance the cinematic experience for audiences.

**Cross-Disciplinary Insights:** By bridging the worlds of animation and cinematography, our research introduces cross-disciplinary insights. It underscores the interconnectedness of these two disciplines, demonstrating how principles and techniques from live-action cinematography can be adapted and applied effectively in the unique context of animation. This cross-pollination of ideas broadens our perspective on filmmaking as a whole.

**Reference for Film Analysis:** Our study furnishes a valuable reference for film analysts and critics. It offers a systematic approach to dissecting camera structure in animated films, empowering critics and scholars to conduct more nuanced and insightful analyses. This analytical framework facilitates a deeper exploration of the artistic and narrative dimensions of animated works.

**Education and Training:** The findings of our research hold potential value for educational institutions and training programs in animation and filmmaking. They can serve as a foundational resource for curriculum development, enriching the educational journey of students and aspiring animators. Through these insights, emerging talents can better comprehend the role of camera structure in their craft.

**Awareness of Cinematic Craftsmanship:** Last but not least, our research contributes to a heightened awareness of the meticulous craftsmanship that underlies animated filmmaking. By emphasizing the significance of camera structure, we invite a deeper ap-

preciation of the artistry and skill that animators and filmmakers bring to their projects. This heightened awareness fosters a greater respect for the intricate processes that culminate in the creation of animated cinematic worlds.

In summary, the contributions of this study resonate across a spectrum of stakeholders within the animated filmmaking landscape. These insights offer a foundation for further exploration, creative innovation, and a deeper understanding of the art and science of camera structure in animated cinema.

### 5.6. Concluding Statement

As we conclude this dissertation, we take note of a significant transformation unfolding within the film industry—a transformation where animation and live-action cinematography are converging, ushering in a pivotal shift in the filmmaking landscape.

This shift extends beyond the technical realm; it represents a profound shift in our comprehension of image creation and their interplay. We are now in an era where filmmaking transcends conventional boundaries, with the replication of familiar visual styles and the interconnectedness of images evolving into a unique cinematic language.

In accordance with Marshall McLuhan's renowned maxim, "The medium is the message," our research bears testament to the profound implications of this truth. We have embarked on an exploration of cinematic language—a domain where techniques serve as instruments for narrative expression. In doing so, we unveil new horizons for storytelling and artistic expression.

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