

From ‘Dimensional Effects’¹ to Stereoscopic Hyperrealism: The Transformation of Digital 3D Cinematic Aesthetics

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Abstract—This paper will give an outline of the short history of stereoscopic 3D cinema from its commercial breakthrough in the early 1950s all the way up to digital 3D’s current resurgence. Based on this historical retrospect, I will illustrate the transformation of 3D cinematic aesthetics from previously exploiting the protrusion effect to establishing the mature Aesthetics of Recession in its current digital resurgence. Furthermore, I will crystallize a recently debated technical issue, High Frame Rate (HFR) digital capture technique, to discuss the new 3D realism – immersive stereoscopic hyperrealism.

Index Terms—Stereoscopic 3D Cinema, 3D Cinematic Aesthetics, Aesthetics of Recession, Stereoscopic Hyperrealism, Immersion, Protrusion Effect

I. INTRODUCTION

In this paper, I will first outline the short history of stereoscopic 3D cinema from its first commercial breakthrough in the early 1950s all the way up to digital 3D’s current resurgence. 3D cinema’s periodic volatility embodied a very short-lived, initial boom in the early 1950s, followed by a more diffuse second wave during the 1970s, and another intense but brief one in the early 1980s. Despite the fact that 3D technologies developed noticeably between each of these ‘booms’, in each case their success was limited by the failure to integrate them with other emergent cinematic technologies. However, by integrating with digital technologies, 3D cinema’s current resurgence has maintained its momentum over the past ten years, so that 3D screening has become entrenched in cinemas worldwide, alongside the conventional 2D format.

Beyond the historical retrospect of 3D cinema, this paper will also analyse the transformation of 3D cinematic aesthetics from exploiting the Protrusion/Emergence Effect during the previous 3D booms to establishing the more mature and sustainable Aesthetics of Recession in the current 3D revival. This paper will eventually explore a currently debatable technical development, High Frame Rate (HFR) digital capture, in order to demonstrate the unique 3D realism – the immersive stereoscopic hyperrealism.

II. THE HISTORY OF COMMERCIAL 3D CINEMA

On December 25th, 1952, the first commercially released 3D feature movie, *Bwana Devil* (Arch Oboler) had its first public screening. As a surprising box office success, it sparked the first boom of 3D filmmaking in the US. The following two years saw the release of 46 3D features, including Columbia Pictures’ *Man in the Dark* (Lew Landers, 1953) and *Gun Fury* (Raoul Walsh, 1953), Warner Bros.’ *House of Wax* (Andre de Toth, 1953) and *Dial M for Murder* (Alfred Hitchcock, 1954). This first 3D movie wave was short-lived, however, lasting less than two years. It was overtaken by the dispersal of widescreen technology, which was promoted on the basis that ‘you see without glasses’. As Ray Zone notes, “[m]any films photographed in 3-D, like Alfred Hitchcock’s *Dial M for Murder*, were released flat in 1954” (2012, 35)[1]. According to Scott Higgins, there was a longer but more diffuse second wave of 3D filmmaking from 1972 to 1978, which “was dominated by exploitation fare like *The Chamber Maids* (1972) and *Blonde Emmanuelle* (1978)” (196)[2]. The third wave of 3D was more commonly recognised by film critics and signaled by the box office sensation of the low budget spaghetti Western *Comin’ at Ya* (Ferdinando Baldi) in 1981, followed by *Friday the 13th Part 3* (Steve Miner) in 1982 and peaking in 1983 with *Jaws 3D* (Joe Alves) and *Amityville 3* (Richard Fleischer). However, once again, this wave faded from the audience’s view long before 3D could become a norm. Accordingly, William Paul defines 3D in his seminal 1993 essay, “The Aesthetics of Emergence”, as “a kind of sport, an unexpected and always doomed mutation that by its very perversions defines the norms of the normative Hollywood style” (321)[3]. 3D’s current, fourth, wave was revived in 2004 by *The Polar Express* (Robert Zemeckis), which was also the first feature-length IMAX 3D movie, and later became firmly entrenched by the worldwide success of *Avatar* (James Cameron) in 2009. Ten years later at the time of this writing, this 3D resurgence is still ongoing, fortified by its integration with digital production, post-production, and exhibition technologies.

Notwithstanding the development of new stereoscopic technologies and techniques, the basic principles underlying 3D cinema have remained constant. In general, two parameters decide stereo dimensionality in stereography: interaxial (used as a noun in 3D terminology), also known as Interocular Distance (IoD), and convergence:

IoD, also called the “interaxial”, refers to the

1, ‘Dimensional Effects’ was the term commonly used by Hollywood 3D filmmakers for filming ‘protrusion effect’ shots in the early 1950s during the first 3D boom.

distance between the two cameras recording a 3D scene. Pulling the lenses apart increases the volume of space and the roundness of represented objects. Convergence refers to the point at which the two images are perceived to fuse into a single representation. Images that appear to converge behind the screen surface are said to have positive parallax. Representations that appear to converge in front of the screen have negative parallax, so-called because the left and right images have crossed one another. (Higgins 198)[4]

In 3D's previous waves, the common "protrusion effect" was reinforced by the illusion of movement towards the audience in the negative parallax space. As Zone comments:

The 1950s 3-D boom was built on dual-camera and projector technology. The 1980s 3-D cycle was built on single-camera and projector technology. Both of these formats exploited optical convergence, or toeing in, of the camera axes to produce negative parallax, with off-the-screen imagery coming out into the audience space. It was this visual effect that was the hallmark of the era of convergence, both as a promotional device and aesthetic leitmotif. (2012: 1-2)[5]

The dual-camera system is based on two separate cameras, of which both the interaxial and toe-in angle are adjustable to produce different degrees of "protrusion effect"; while the single-camera system has two lenses, of which both the interaxial and toe-in angle can be altered in order to increase or decrease the three-dimensional effect. To magnify a 'protrusion effect', the usual way is to simply increase the IoD – the distance between the cameras – or widen the toe-in angle of the two cameras, or do both. Although Zone claims that as early as during the first 3D boom, '[w]ithin the course of a year, Hollywood 3-D filmmakers had begun to make a more conservative and natural use of 3-D in film narrative' (61)[6], the 'protrusion effect' had been commonly exploited throughout the pre-digital 3D waves.

However, Paul points out that this out-of-the-screen 3D signature effect, which he calls the 'emergence effect', disrupts the classical style of Hollywood storytelling: '...paradoxically, moving beyond the frame demands some notion that there *is* a frame to move beyond: emergence depends on a sense of violation for its effect. Perversely, by its insistence on the emergence effect, 3D, the process that most closely approximated the reality of our binocular vision, made us think about how that reality is constructed' (335-336)[7]. Philip Sandifer also notes the main problem with 3D's so-called 'immersive delusion' derived from the 'protrusion/emergence effect':

...the objects in a 3-D film always exist not only in relation to diegetic space but also in relation to the actual viewer and the theatre in which the film is being watched. Rather than being immersive, 3-D film is profoundly bound up in an act of spectatorship whereby the theater,

instead of disappearing, is even more conspicuously visible. (69)[8]

In a footnote to his essay, Sandifer claims, 'Since this essay was written in 2008, the landscape of 3-D films has changed, most notably with the box office success of *Avatar* and the subsequent clear establishment of the third 3-D era, of which this article merely notes the imminent arrival' (62)[9]. Sandifer's analysis thus does not account for more recent developments.

If we observe 3D films made in recent years carefully, we may notice that not only 'the landscape of 3-D films has changed' but also the landscapes *inside* 3D films have changed enormously. By saying this, I mean that more and more 3D filmmakers have purposely avoided the 'protrusion effect', which used to be the most commonly 'exploited' trademark of 3D in previous booms. Paul asks: 'Without emergence, what was 3D? But with emergence, what kinds of films could you make?' (331)[10]. As increasing numbers of innovative filmmakers have taken up the tools of 3D filmmaking, they have explored the creative potential of the 'positive parallax' space, which refers to the space behind the screen, rather than merely repeating the clichéd 'eye-poking' effect associated with the 'negative parallax' space in front of the screen. More often, they experiment with this new dimension of 'positive parallax' space to develop narrative and characterisation. In *Avatar*, James Cameron intentionally avoided using the "protrusion effect" for the simple stimulation of the audience's eyes; he preferred to take advantage of the unlimited behind-the-screen space to illustrate the fantastical planet of Pandora by integrating 3D devices with longer-duration shots and camera movement (Higgins 198-199[11]; S Rose 210, 217-219[12]; Jockenhövel 9-10)[13]. Henry Selick used the same approach in his stop-motion 3D animation film *Coraline* (2009). These two landmark 3D films set new production norms for later digital 3D works, norms that are still followed by most digital 3D filmmakers today.

If we borrow Zone's phrase characterising the 1950s and 1980s 3D booms as 'the era of convergence', the ongoing digital 3D resurgence may be called a 'new era of convergence', which does not mean optical convergence, but refers instead to a strategic convergence in which filmmakers exploit both the negative parallax and positive parallax space. Instead of merely sticking to the 'aesthetic leitmotif' of spatial protrusion, contemporary 3D filmmakers have found more sophisticated ways of deploying 'negative parallax' effects. During 3D's 'new era of convergence', there is more of an emphasis on the positive parallax space, but also a strategic use of the negative parallax space, for the purposes of both narrative and spectacle. Certainly, the 'protrusion effect' is still one of the most powerful visual for producing spectacle; however, other 'negative parallax' effects may also contribute to narrative objectives by cooperating with primary 'positive parallax' tactics.

III. TRANSFORMING 3D AESTHETICS: FROM EMERGENCE TO RECESSION

Because of its ups and downs in the past six decades, the recent return of 3D cinema faces an uncertain destiny, meeting with scepticism from both academia and the movie industry. John Belton points out the basic dilemma of digital 3D cinema:

If it is ever to become a norm, it must cease
Calling attention to itself... Yet, if 3D is to
be 3D, it must necessarily exploit the
phenomenon of emergence, violating the
segregation of spaces that lies at the core
of the experience of classic cinema. Digital
cinema may have found its missing novelty
phase in digital 3D, but it now finds itself
trapped within that phase, like a fly in amber,
unable to complete its innovation and diffusion.
(194)[14]

Obviously, relying on the 'phenomenon of emergence' (also above mentioned as the 'protrusion effect', 'effect of emergence', 'pop-out' or 'poking-eye' effect) alone cannot convince audiences and critics to believe that digital 3D has been genuinely different from its predecessors and more than a novelty. Retrospectively, concerning the 1950s 3D boom, Zone admits, "It's not surprising... there has been little perception on the part of film critics, as well as filmmakers, as to the artistic and narrative possibilities for stereo cinema" (2012: 59-60)[15]. He further comments: "The stereographic spectacle can have the unintended effect for the film storyteller of propelling the audience out of the narrative by calling attention to three-dimensional technology. At risk is the willing suspension of disbelief, that tenuous construct by which film storytelling is driven forward" (60)[16]. Sandifer concludes: "In the end, 3-D film is a medium of demos and, as a result, of gimmicks... This is the point of the technology: to re-establish movie theatres not as places where one can consume a visual narrative, but as places of spectacle and wonder" (78)[17]. For this very reason, both cinema theorists and 3D film practitioners are very concerned about the number of 3D films made during the early stage of this current revival that have exploited poking-eye visual tricks for audiences who are already numb to it (Belton, 187-195[18]; S Rose, 210-212, 219[19]). James Cameron articulates this concern in his dismissal of the cheesy 3D approach used in the horror film *Piranha 3D* (Alexandre Aja, 2010) (Higgins 197-198)[20].

As one of the 3D optimists and advocates, back in 2005, Cameron said: 'I think digital 3D offers an opportunity to do something as profound for today's moviegoing audiences as the introduction of color and sound. This is the next big thing, and I think people are going to respond to these really high quality 3D images' (Cameron in Belton: 191)[21]. Towards the end of 2011, in a *New York Times* article entitled "A Year of Disappointment at the Movie Box Office", the writer reported that "[r]evenue, for instance, has been propped up by a glut of 3-D films, which cost \$3 to \$5 more per ticket. Studios made 40 pictures in 3-D in the last 12 months, up from 24 last year, according to BoxOfficeMojo.com, a movie database" (Barnes

2011)[22]. Not only have the numbers of 3D films increased steadily on a yearly basis since 2009, but more and more internationally renowned filmmakers have also tried their hand at 3D filmmaking e.g. Wim Wenders, Werner Herzog, Steven Spielberg, Martin Scorsese, Ridley Scott, Ang Lee, Peter Jackson, Alfonso Cuarón, etc. Meanwhile, filmmakers around the world have begun to follow suit with commercial 3D films in countries such as France, Britain, Germany, Belgium, Poland, Argentina, India, and China (including Hong Kong), to name a few.

Although 3D has been used extensively within popular cinema over the past decade, it still tends to be recognized less as a vehicle for narrative than as a 'cinema of attractions', a phrase that Tom Gunning first used to refer to the early film style that "dominate[d] cinema until about 1906-1907" (64)[23]. According to Gunning, this cinema "bases itself on... its ability to *show* something... this is a cinema that displays its visibility, willing to rupture a self-enclosed fictional world for a chance to solicit the attention of the spectator" (64)[24]. He goes on to suggest that "the cinema of attractions does not disappear with the dominance of narrative, but rather goes underground, both into certain avant-garde practices and as a component of narrative films, more evident in some genres (e.g., the musical) than in others" (64)[25]. Attractions manifest themselves in all sorts of spectacular displays: from fantasy worlds in science fiction to intense battles in boxing films, furious chases in car-racing films, and elaborate performances in dance or music-related films, and technologically advanced weapons and devices in the James Bond films, examples of cinematic spectacle still appear as segments within contemporary film narratives. Moreover, spectacular segments in contemporary Hollywood blockbuster films seem to recur with more frequency and intensity than before.

Comparing the narrative paradigms of the one single rising curve in classic Hollywood period with the multiple ups-and-downs roller-coaster model for contemporary Hollywood blockbusters (Fig. 1, 2), Geoff King shows the greater intensity and frequency of spectacular segments in the latter. He further comments, 'Spectacular moments here are both larger and more frequent, fragmenting the narrative. Narrative, in this (roller-coaster) model, becomes attenuate, its short segments cut off from one another and serving as little more than the glue that holds together a series of spectacular displays' (187)[26]. The roller-coaster structural model explicitly reveals the increasing importance of spectacle in contemporary Hollywood productions; however, Hollywood has never neglected the narrative impetus. According to King, although the 'narrative dimension might not be drawn to our attention as much as the spectacular display... Traditional Hollywood narrative devices are designed usually to make a film flow effortlessly, rather than to claim attention in their own right' (King 202)[27]. These narrative devices serve as the 'glue' to connect spectacular activities or exhibitions together and lay them out with interwoven narrative sequences. As a matter of

fact, '[m]any spectacular blockbusters display carefully honed narrative structures designed not just unceremoniously to unload a series of great dollops of action-spectacle but to engage viewers and to increase the impact of the action and spectacle by locating it in relation to character and plot' (202)[28]. Therefore, the contemporary tactic of handling narrative and spectacle is much more complex and balanced than often acknowledged. Narrative and spectacle are not simply opposed to one another; rather they can be seen as interlocking or entwined. Hence, even the most overtly spectacular segments or devices tend to have some bearing on narrative motivations and events. In other words, the harmonious distribution and entwining of the narrative and spectacular components in contemporary Hollywood blockbusters are as important as storytelling itself, whether in the conventional 2D or stereoscopic 3D format.

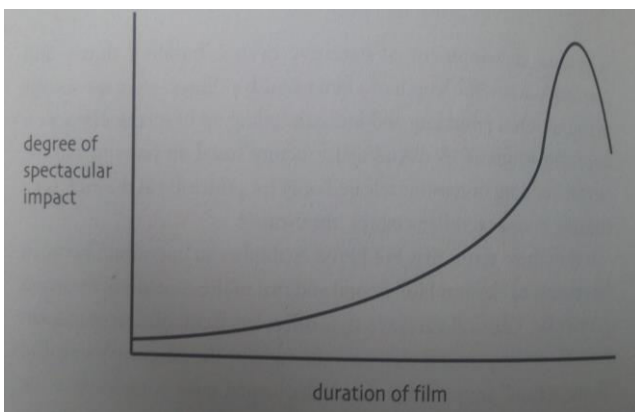


Figure 1 Classic Hollywood narrative paradigm of a so-called 'rising action' through a single rising curve that accumulates unsolved dramatic and suspenseful elements all the way up to the plot climax to be resolved. (Geoff King 2002, 186)

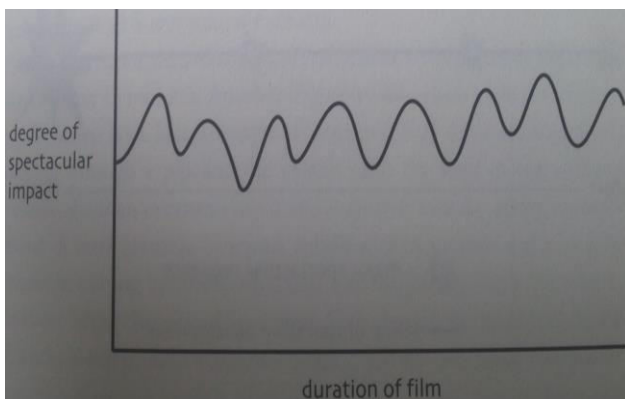


Figure 2 The Roller-coaster model of narrative structures for contemporary Hollywood blockbusters that fragments narrative as glue to hold together more frequent and intensive spectacular displays. (Geoff King 2002, 187)

As a technological device, 3D has been long regarded as just another tool to produce eye-catching cinematic spectacle. Referring to the 1950s 3D boom, Zone notes: "...we should not be surprised to find that 3-D movies were considered within the industry primarily as a means of generating box-office revenue and, more generally within the larger culture, as a spectacle that merely

generated visual shock in the audience" (60)[29]. In this respect, 3D can be compared with earlier technological innovations such as sound and colour, each of which was seen initially as a cinematic 'attraction' technique before becoming fully integrated into narrative filmmaking. Jesko Jockenhövel offers a useful comparison between early colour film in the 1930/40s and digital 3D nowadays: "Although it is certainly true that color served nonrealistic purposes from the 1930s until the 1950s and 1960s, I would argue that even before that, and especially in regard to traditions of pre-cinematic exhibitions and representations such as advertisements, in popular literature and newspaper supplements, color was always connected to the idea of spectacle rather than realistic traditions" (5)[30]. He then quotes Edward Buscombe to support his argument:

color [...] was able to satisfy needs which realism could not. Were this not so, it is hard to see how, given its unrealistic connotations, it could have been introduced at all. Since the 1930s, however, color has become progressively absorbed back into realism, with the result that the audience's need for spectacle and for technological wonders has had to be satisfied by a succession of further technological developments: wide-screen, 3D, Sensurround and so on. (Buscombe cited in Jockenhövel 5)[31]

Based on Jockenhövel's arguments, it is likely for a new technology to serve as spectacle or cinematic wonder at the beginning, particularly when it is favoured by certain genres, such as sound being mainly employed in musicals in the late 1920s, colour being primarily favoured by musical and fantasy films in the late 1940s and early 1950s, and widescreen being initially adopted in historical epics and war movies in the early/mid 1950s.

For 3D, however, the case is somewhat different because it has already passed through a few short-lived or diffused waves and is undergoing another round of resurgence, which is the longest to date by far. Nevertheless, Jockenhövel suggests: "It should be no surprise therefore that 3D is mainly applied to genres of fantasy, where it is used to create parallel or fantastic worlds and stunning visuals. In this way it influences genres and may even change and develop them in new directions by forming visuals that were not possible before" (12)[32]. His suggestion emphasises that 3D's spectacular contribution to fantasy film genres rests on its capability of "forming visuals that were not possible before". However, it seems that 3D may provide more than "fantastic worlds and stunning visuals", which exclusively belong to the spectacle category, to contemporary filmmaking; because 3D's stereoscopic spatiality means that sometimes a shift in parallax can turn this old 'novelty' into a new vehicle for complex and innovative storytelling.

To some extent, the new 3D cinema's narrative potential is based upon filmmakers' increasing use of the positive parallax space. Jockenhövel notes that James Cameron in *Avatar* (2009) and Henry Selick in *Coraline* (2009) both restrain the 'emergence effect' by

intentionally decreasing the interaxial and hence diminishing the negative parallax effect in front of the screen, while in some scenes they both purposely increase the interaxial in order to stress the ‘dimensional effects’ in the positive parallax space behind the screen.[33] Belton and Higgins also pay attention to this fundamental strategic shift and applaud these two filmmakers’ self-restraint and willingness to employ the technology in an innovative fashion: “Selick explains that he was inspired by *The Wizard of Oz*’s (1939) shift from sepia to Technicolor: ‘and so I thought in a more subtle way 3D would actually enhance the story with Coraline discovering what appears to be a better world’” (Selick cited in Higgins 205) [34].

As innovative filmmakers such as James Cameron, Henry Selick, Ang Lee, and Martin Scorsese have taken up 3D filmmaking, digital 3D technology has had a fundamental impact on both cinematic attractions and narrative aesthetics. In particular, the trend of shifting emphasis into the positive parallax space while making strategic use of the negative parallax space has distinguished the current 3D boom from the previous waves by appearing to suggest new narrative possibilities. Higgins calls it ‘a sustainable aesthetic’: ‘The depth-oriented stereo space of *Coraline* may help point forward to a more sustainable 3D, which in previous waves, has crashed on the rocks of protrusion’ (206)[35]. Inspired by his notion, I refer to this aesthetic trend of employing a ‘receding strategy’ to explore the positive parallax space in digital 3D films as the ‘Aesthetics of Recession’, which discloses itself through filmmakers’ effective explorations of both cinematic spectacle and visual storytelling in the positive parallax space.

Although the ‘Aesthetics of Recession’ can be seen as opposing the ‘protrusion effect’ rooted in the negative parallax space, the two are not completely against each other. On the contrary, the ‘Aesthetics of Recession’ may permeate from the positive parallax space via the 3D screen into the negative parallax space. By integrating itself with the protrusion effect, the ‘Aesthetics of Recession’ not only turns this once ‘exploited’ visual gimmick into a productive ‘dimensional effect’ for narrative, it also enhances the probability of establishing a new kind of stereoscopic 3D cinema language. Such a language needs to be understood in relation to the integration of 3D techniques with digital special effects, CGI and digital animation; indeed, the imbrication of these technologies informs and underpins much of my discussion in the following section.

IV. STEREOSCOPIC NARRATIVE AND 3D REALISMS

Based on previous examples of sound and colour, new technologies often serve spectacle first and then narrative (Buscombe, 1992[36]; O’Brien, 2005[37]; Jockenhövel, 2012)[38]; or, as Ross states: ‘The situation is further complicated by the way in which new technologies often enter as attractions first and realist mode later’ (2015, 80)[39]. In this aspect, David Bordwell’s approach to classical Hollywood narrative formula and storytelling theories is very useful to examine 3D’s progressive

evolution. Bordwell follows Russian Formalism and develops four types of motivations for formal elements: compositional, realistic, artistic and transtextual motivation (1986, 18)[40]. According to Bordwell, compositional and realistic motivations indicate a greater interest in narrational goals, while artistic and transtextual motivations are devoted to style and genre distinctions. If a cinematic technique is employed mainly for compositional or realistic motivation, it may be regarded as a powerful narrative device; whereas a technique is merely used for artistic or transtextual purpose, it tends to be viewed as a formal component to define an artistic style ‘foregrounded to an unusual degree’ or as a ‘generic enhancer’ to signify a certain genre. According to Bordwell’s above ‘four types of motivations for formal elements’, Jockenhövel suggests ‘two possibilities’ for 3D: firstly, ‘signifies luxury or spectacle’; secondly, ‘operates as a celebration of technology’. Both motivational tendencies point to a small range of genres such as fantasy, action, and horror (12-13)[41].

However, if we compare the films that favoured 3D in previous booms and those produced in the current resurgence, we see that the scale of genres has already widened substantially. For example, most 3D films made during the first boom in the early 1950s are horrors, with a few exceptions such as Hitchcock’s *Dial M for Murder*, which is a suspense drama, and *Kiss Me Kate* (George Sidney, 1953), a musical. During the second and third 3D booms of the 1970s and early 1980s, 3D was used for more genres such as comedy, thriller, Western, even adult porn (*Blonde Emmanuelle*, Stephen Gibson, 1978), and horror. By the time of Jockenhövel’s writing (2011), there had been already more genres covered in the new 3D wave than in the earlier ones altogether; these include fantasy, adventure, action, martial art, science fiction, historical drama, as well as many 3D animations. Since 2012, with more and more eminent filmmakers taking up 3D filmmaking, more diverse genres have been produced in 3D. Whereas 3D was a strong predictor of genre in the first 3D boom, since then its association with specific genres has been gradually less evident. In Bordwell’s terms, 3D is now associated not only with ‘artistic’ flourishes and ‘transtextual’ markers of genre, but is increasingly driven by compositional and realistic motivations that serve narrational goals. At the same time, however, 3D’s effectiveness at producing spectacle has been enhanced and amplified, by integrating it with digital technologies (such as CGI and digital compositing).

3D has also been deployed alongside high frame rate (HFR) capture and multi-channel sound, and has also been rendered via new conversion processes (which can produce 3D images out of 2D source material). To return again to Bordwell’s taxonomy of motivations, much of the discussion of such technologies revolves around questions of ‘realism’. For Julie Turnock, ‘cinematic realism is a historically changeable style and set of codes that producers have long promised can provide impossibly vivid experiences’ (31)[42]. Historically, the

meaning of 'cinematic realism' is so complex and its connotations so overlapping that M Ross thus comments:

Any discussion of realism is complicated by the fluid, permeable and changeable nature of the term. Although scholars have emphasised realism in the cinema both as an attempt to realistically portray the pro-filmic and as an artistic convention... public and press discussion concerning cinema, particularly 3D cinema, frequently conflates realism, realistic presentation, illusionism, naturalism, and other interlinked terms. (76)[43]

Moreover, discussions of realism are often shaped by the experiential, psychological, and cognitive reactions of individual audience members or writers. In the case of 3D, physiological factors play an important role, as evidenced by the varying responses to 3D glasses. If a viewer is discomforted by wearing a pair of 3D glasses, the 'reality' of the diegetic world is easily broken for her/him, thus undermining any kind of cinematic realism. With this variability in mind, M Ross goes on to set up the framework of what she calls the 'new realisms' of stereoscopic 3D cinema: 'For this reason, my own discussion of 3D cinema is cognisant of these overlapping terms and tries to drive a path through their different uses in order to productively understand how conceptual understandings of realism help viewers find meaning in the way in which stereoscopic visual fields operate' (76)[44]. In my following discussion, I will take into account Ross's 'reception-oriented' understanding of 'cinematic realism' but will primarily frame these multivalent 3D 'realisms' within three modes: realistic presentational style, narrative authenticity or verisimilitude, and narrational and spectacular immersion.

Although Ross does not explicitly give a definition of what she proposes as the 'new realisms' of stereoscopic 3D cinema, her following statement provides a helpful perspective:

I have outlined the way that stereoscopy's tactile and deep space qualities, and the embodied relations they produce, change our sense of depth in cinema, creating viewing relationships which cannot be found elsewhere. The common ways of perceiving these relationships, developed through frameworks of spectacular attractions and enhanced realism, often seem contradictory but equally point to the fluid, interchangeable viewing states involved in 3D cinema, where viewers are often immersed in and aware of the optical illusion produced in front of them. (93)[45]

Ross's notion of the 3D field screen, which is 'an evolution of the traditional and haptic [2D] screens' (23)[46], is very important for us to understand how the stereoscopic space is constructed within a spatial duality with multiple volumetric depth planes, and how these elements, as a whole, play out for stereoscopic storytelling. The uniqueness of the 3D field screen not only has the tendency to move the objects towards the

audience and engulf them spatially, but also tends to bring the audience into the visual field, even though they are often 'aware of the optical illusion produced in front of them'. The key term 'immersion', 'a reoccurring term that is used and overlapped with discussion of realism' in 3D cinema (89)[47], is rarely adopted to describe realism, naturalism, or realistic representation in 2D media presentation, because such immersion seems to work independently of the codes and conventions of realism. However, 'immersion' may be looked at as one mode of the stereoscopic 'new realisms' that Ross proposes.

Drawing on Ross's notion of stereoscopic 'new realisms', I will outline three reception-effect-based modes of 'cinematic realism' in the 3D context. The first 3D realism can refer to the use of naturalistic and unobtrusive styles/methods, mainly represented by *Pina* (2010), *Cave of Forgotten Dreams* (2010), and other 3D documentaries such as *U2 3D* (2007), *Katy Perry: Part of Me* (2012) and *Swan Lake 3D* (2012), which are largely presentational, showing artists' live performances on stage. Secondly, 3D realism can mean the narrative authenticity, to which 3D techniques can contribute by assisting in the construction of dramatic space, a feature illustrated by the fact that many 3D films made in this current wave are within the drama genre. *Hugo* (2011), *Life of Pi* (2012), and *The Great Gatsby* (2013) are thus representative works. In most cases, this mode of '3D realism' is what Hollywood filmmakers are referring to when they discuss realism. It describes the lifelikeness impression they attempt to produce through their storytelling. At last, the third mode of 3D realism is defined by 'immersion', which may be divided into two categories: narrative immersion and spectacular immersion. Each category may imply the audience's immersion in illusionary locales and events, which are impossible to reach or experience in the real world, yet with a different emphasis on narrative verisimilitude and spectacular pleasure, respectively.

Nonetheless, as we discussed earlier, since spectacle and narrative segments in contemporary filmmaking, especially Hollywood blockbuster films, are more and more intertwined and interlocking, narrative immersion and spectacular immersion are often interwoven with each other. For example, the outer-space weightlessness and fight for survival in *Gravity* (2013), the epic historical events in *Exodus: Gods and Kings* (2014), and the improbable adventures in the projected theme park of *Jurassic World* (2015) all belong to this mode of 3D realism. Narrative is communicated via the experience of immersive spectacle. At the same time, the immersive mode sometimes points to sensationalism, which can be viewed as the extreme of realism, such as the extreme visceral graphics of violence in *Dredd 3D* (2012) and the erotic sensual sex scenes in *Love 3D* (Gaspar Noé, 2015), although this sort of sensational imagery is still fairly uncommon in 3D.

3D immersion is often associated with situations or activities that we may never have experienced in reality but we which still feel extremely credible and involving: the form of 'realism' we are discussing here might

therefore be seen as a type of ‘stereoscopic hyper-realism’. This distinctive hyper-realism depends not on rapid editing or an array of different camera angles (which is often how 2D cinema attempts to create immersive effects in the era of ‘post-continuity’ aesthetics), but rather combines 3D’s depth effects with the use of deep focus, long takes, and the careful integration of digital special effects. The stereoscopic hyper-realistic mode can combine narrative and spectacular immersion. Although Ross puts realism and immersion into two different modes¹, she recognises, ‘it is possible to combine a variety of 3D visual fields without hampering audience investment in their realist attempts. In particular, immersion in their visual fields can operate as a process where viewers are both drawn towards the film and find the film coming towards them’ (93)[48].

Many of the other technical developments that have occurred alongside 3D are, to a great extent, enhancing its association with an immersive, ‘hyper-realistic’ aesthetic. However, recent responses to some of these techniques have illustrated the boundaries between different types of realism. It seems that technology can make cinematic illusion too real to be realistic, as evidence by the deadlock of High Frame Rate (HFR) capture technique’s amalgamation with digital 3D cinema, which has been exemplified by Peter Jackson’s experimental practice in *The Hobbit* trilogy (2012-2014).

Simply put, HFR defines the filming or digital imagery capturing technique that records at 48 frames per second (fps) or even higher, rather than the customary 24 frame-per-second cinematic standard. Not a completely new cinematic technique like 3D, Turnock notes: ‘High frame rate filmmaking, from a studio-era special effects technique to “the future of cinema” in the 1970s and 1980s, as well as its current resurgence in *The Hobbit: An Unexpected Journey* (Jackson, 2012), has been promoted as a way to “improve” and enhance the cinematic experience’ (30)[49]. As the 3D Camera Supervisor on the first episode *The Hobbit: An Unexpected Journey*, Gareth Daley talks about his 277 shooting days working with HFR: ‘It was a very natural filmmaking process. There is talk of even going up to 120fps. Who knows where it will stop but projection technology is only just catching up in terms of the flexibility of what they can project at...However, you are talking double the frame rate we have seen in the past 80 years so it’s a huge step’ (2012)[50]. During their two years filming *The Hobbit: Episode 1*, the crew used 48 RED EPIC cameras on 17 3ality Technica rigs. Ex-Red Camera Company Chief Ted Schilowitz comments as follows on the union of HFR and 3D:

At this point, 48 fps is a design choice for the 3D experience. The higher the frame rate, the more natural the 3D experience will be in terms of any kind of flickering and problems that we

have with lower frame rates in 2D, so it’s a technology choice. I think we have yet to determine what the high frame rate 2D experience will be. I think that is something that will be established over time as people tune themselves to a higher frame rate experience and start looking for movies that don’t look like old fashioned movies. I think we are on an interesting cusp.” (2012)[51]

Schilowitz exhorts people to ‘be open minded’ to this technology: ‘Pictures at home now can rival cinema so cinema has to be better and that’s what Peter is looking at with 48 frames and Cameron with 60 frames. We want bigger, more immersive experiences when we go out to pay for a movie. It needs to be more like a ride than a movie and that’s what people want’ (2012)[52]. Nonetheless, not all the people out there want the ‘immersive experiences’ that Schilowitz talks about, at least not those presented via HFR effects in *The Hobbit (Episode 1)*.

Posted online, photographer Vincent Laforet’s well-known article criticising the first episode *The Hobbit*’s HFR adoption represents the main critical points from HFR naysayers e.g. not cinematic but ‘*Monday Night Football*’, BAD reality TV show or video game viewing experience, all the magic no longer under the spell, difficult to engage with the narrative and characters (Laforet 2012)[53]. Turnock also points out HFR’s ‘aesthetically displeasing effect in which the diegesis looks too much like a film set or real event, rather than a fully realized imaginative world’ (44)[54]. But she predicts HFR’s ‘perhaps longevity’ and concludes: ‘HFR shows the extent to which many are deeply resistant to the media conversion, and how we are used to, and in many cases emotionally invested in, cinema’s particular pane of glass’ (49-50)[55]. In fact, the above-mentioned ‘artifacts’ have substantially reduced and the quality of resulting immersive hyperrealism has improved in *The Hobbit: Episodes 2 & 3*. More importantly, HFR adopted in *The Hobbit* trilogy has genuinely increased movement smoothness by getting rid of imagery strobing and judder during action sequences, which used to be one of the most bothersome for the audience in viewing 3D films. It is thus fair to say that after years of technological modification and refinement, digital HFR capture technique, at the very least, complements one of stereoscopy’s ‘new realisms’.

V. CONCLUSION

In summary, this paper has been focusing on the technical retrospect of stereoscopic 3D cinema and the transformation of stereoscopic cinematic aesthetics for over six decades since its initial commercial distribution. Building on my discussion of the three modes of ‘3D realism’ and digital High Frame Rate capture technique, I have elaborated my discussion on the immersive hyper-realistic mode and shown how it is integrated within 3D narrative cinema and orchestrated according to the increasing dominance of the new ‘Aesthetics of Recession’.

² However, Ross makes her analysis of ‘Stereoscopic realism’ and ‘Immersion’ in the same chapter under the title ‘New Realisms’ in *3D Cinema: Optical Illusions and Tactile Experiences*. (Palgrave Macmillan, 2015)

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