The Oval Sphere vs. the Flat Canvas

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ABSTRACT

3D cinema is heading towards self-sufficient maturity both technically and aesthetically. In this paper, I will undertake a comparative analysis of the distinctions between 3D and 2D cinema based on a correlation between techniques of production and perceptual physiologies. Moreover, with reference to Siegfried Kracauer's classic remark about cinematic ontology that "the nature of film is the redemption of physical reality" (1961), I will argue for 3D's greater ability to retrieve "physical reality" than 2D cinema through ontological comparisons between the two media. I will further elicit aesthetic values for 3D cinema based on the above argument and illustrate the grounds of artistic differentiation between 3D and 2D visuality and viscerality by comparing the extreme slow motion aesthetics utilised in brutally violent scenes in *Dredd 3D* (2012) with those in the 2D film *Killing Them Softly* (2012).

Index Terms — 3D visuality, 3D stereoscopic aesthetics, Siegfried Kracauer, binocular vision, volumetric, (re)constructed physical reality, plasticity, scalability, viscerality.

1. INTRODUCTION

As a basis for the ontological comparison between 3D and 2D cinema, I will begin by probing the principles of binocular vision on which the design of stereoscopic 3D cinema bases its unique parallel-camera production mode, which differs from 2D cinema's single-camera monocular perceptual apparatus. Because its parallel-camera production model is analogous to human binocular vision, 3D cinema begs a return to Kracauer's remark about classical film ontology, namely that cinema is "the redemption of physical reality". Consequently, I will aim to legitimise digital 3D cinema on the basis of visual physiology and stereoscopic illusionary mechanisms as well as interrogate its advantages in constructing spatial visuality in terms of cinematic aesthetics.

2. RECONSTRUCTION OF PHYSICAL REALITY

Before considering Kracauer's claim in depth, I would like to examine stereoscopic perception from a physiological point of view. The stereoscope, which is usually called Three-Dimensional Cinema, is a visual technological mechanism based on *stereopsis*, caused by the human physiognomy of binocular disparity which permits depth perception. As Bruce Goldstein states, "The creation of depth perception based on binocular disparity involves two stages. First, **binocular disparity**, the difference in the images on the two eyes, is determined, and then this difference is transformed into the perception of depth. This perception of depth that results from the information provided by binocular disparity is called stereopsis"[1]. In optometric terms, Stereopsis is defined as "the binocular perception of depth upon retinal disparity. This results from the brain being presented with two slightly dissimilar retinal images. For stereopsis to be manifest, the images must be imaged on non-corresponding retinal points…" [2]. Despite the uncommon optometric discourse, several points here are instrumental to my argument. First of all, stereopsis is elicited by two slightly different retinal images because our eyes are horizontally separated; secondly, this binocular disparity causes the impression of depth arising in the pathway from the eyes to the brain; thirdly, stereopsis is achieved through the convergence of the two images into a single vision by sensory fusional mechanisms in a particular range before our eyes. Biophysicist Jerry Nelson points out that, "There are many cues to depth, but stereoscopic depth is phenomenologically special and can be elicited almost exclusively by the cue of retinal disparity. Retinal disparities are small positional displacements between otherwise well-matched visual images" [3]. Media theorist Herbert Zettl follows suit by extracting "two additional binocular depth cues", convergence and accommodation, as the essential technical measurements in 3D filmmaking [4]. Like the physiological sight apparatus, the stereoscopic cinema image produces the "illusion of depth" by capturing two slightly different images and then aligning them based on principle of human stereoscopic vision.

In reality, besides binocular depth cues there are many other depth cues, such as monocular pictorial cues, which also contribute to our perception of depth by providing overlapping information and working together with binocular depth cues [5]. However, monocular pictorial cues, such as linear perspective, atmospheric perspective, relative size, and occlusion, "do not produce the same vivid phenomenological experience as does retinal disparity, probably because the neural substrate for stereopsis is different from the substrate for these cognitive cues… Only disparity cues are considered further" [6]. Therefore, stereopsis "does increase the vividness of depth—near objects are seen more vividly in front of far ones when seen with two eyes than with one" [7]. Since 3D stereoscopic cinema simulates the process of human stereopsis, "parallax shifts" in 3D – or the distinction between near and far objects – depend on one of Zettl's key terms, Convergence. Convergence in turn is decided by two technical paradigms: Interocular Distance (IoD) and Point of Convergence (POC).

Interocular Distance (IoD) refers to the distance between two cameras positioned in parallel to one another, whose placement roughly resembles the two eyes of human beings about 2.5 inches apart; when manipulated to increase the IoD, the illusion of depth will be accentuated, and vice versa. Point of Convergence (POC) signifies the point at which two dislocated images caught by the two cameras align to fuse into a single vision, which in optometry is referred to as a single vision achieved through sensory fusion [8]. On the 3D film set, the POC can be changed so that people or objects appear either "behind" a 3D screen (also called a "window"), which is called positive parallax, on the window (zero parallax), or in front of the window (negative

parallax) [9]. The exact POC will be determined by the two side-by-side cameras' inward angle, or the angle at which they pivot toward one another, and the adjusted IoD. By turning the two cameras inward and locating the POC in front of the filmed people and objects, the images captured by the cameras will be confined in the positive parallax behind the 3D screen; on the other hand, by straightening the inward angle of the two cameras and situating the POC behind the main events, they will appear to take place in the negative parallax, that is, in front of the 3D screen. If the two cameras are fully straightened to make them completely parallel with each other, then the people and objects captured will all be in the negative parallax, which generates the signature 3D "protrusion effect" by making actions or objects appear to move along the Z-axis towards the audience. This "protrusion effect" can be further accentuated by pulling apart the two parallel cameras and subsequently increasing the IoD. Although the "protrusion effect" is not now as shocking as in its early days, when 3D excited audiences in the early 1950s, the protrusion technique is still the most distinctive and exclusive 3D visual effect and is often capable of scaring the audience out of their seats in theatres. For example, when an arrow or an ax is thrown quickly into the audience's face from the depths, viewers will physiologically react to this abrupt threat much more overwhelmingly than when seeing it in 2D cinema. In this case, the 3D viewing experience better simulates our perception of an actual impending danger and stimulates our physical reactions. This correlates precisely with and results from the uniqueness of stereoscopic 3D cinema's capturing device.

Accommodation, another binocular depth cue, refers to the lens of the eyes constantly changing focus so that we can clearly see objects at different distances, near and far [10]. "The eye's lens is relatively thin when fixating on a faraway object, but it gets thicker when focusing on the closer object. In concert with convergence, accommodation aids the brain in estimating distance" [11]. According to Goldstein, however, accommodation is effective only at distances of less than 2 meters [12]. This indirectly explains why it is so important in 3D filmmaking, because its effectiveness in reinforcing the stereo illusion is limited to the shot scales ranging from an extreme close-up to a long shot. On the other hand, as Zettl points out, "this autofocus mechanism of our eyes can also cause trouble when watching 3D images on screen" [13], if certain techniques popular from conventional 2D filmmaking such as shallow focus, rapid change of depth-of-field, or rapid change of POC are over employed [14]. Nevertheless, in the following section, I will argue that by exploiting the advantages of the stereoscopic technique and sometimes intentionally making use of its pitfalls, 3D cinema may substantiate Kracauer's statement that the nature of cinema is "the redemption of physical reality" in a more precise phenomenological way than traditional 2D cinema does. In other words, 3D cinema conjures physical reality through an elastic yet thorough stereo illusion, which better approximates our stereoptic access to the three-dimensional real world.

In his second film monograph, *Theory of Film: The Redemption of Physical Reality* (1960), Kracauer contended that realism is the core value for cinema based on his premise that cinema is photographic in nature: "All this means that films cling to the surface of things. They seem to be the more cinematic, the less they focus directly on inward life, ideology, and spiritual concerns" [15]. Rereading his texts amidst the current process of digital transformation, we know the photographic nature of cinema is barely changed, because no matter whether capturing images with 2D or 3D cameras, the digital device is still based on the photographic perspectival principle and mechanism. The only difference is that the digital 2D camera simulates monocular perception and the digital 3D camera resembles binocular vision. Even though monocular cues aid in depth perception, as discussed earlier, binocular depth cues bring up a much more vividly phenomenological experience of depth, thereby enhancing our sense of spatiality and directionality through the stereo images that match the 'neural substrate' engaged in our optical processing of reality. Admittedly, Kracauer's theory is based on and targeted at B&W films and he deliberately ignored color films, even though by the time his book was published, color had noticeably become the new standard for most types of movies made for theatrical release worldwide. The reason for this standard transformation is very straightforward, because the "physical reality" we live in is a world full of colors. Despite his focus on B&W films, Kracauer associated "physical reality" with 'life': "…the only reality we are concerned with is actually existing physical reality–the transitory world we live in.

Intentionally or not, he did not explicitly define the term *redemption* in his book; however, if we examine his analysis carefully, we find that in most contexts he uses the term to discuss how film as an art form achieves photographic realism. Therefore, we may understand that *redemption* tends to mean *recovery* or more loosely the *establishment* of life-like realty through filmic means. Thus, if we accept that Kracauer's assumption of cinema's photographic nature still finds a foothold in the digital age while his claim that "films cling to the surface of things" speaks a certain truth, then we can update his notion of recovery by claiming that digital three-dimensional imagery recovers or even recreates "physical reality" by "clinging not to the surface but to the *volume* of things". Since the physical reality around us is a three-dimensional world perceived by our eyes, stereoscopic 3D, which simulates the mechanism of our binocular vision with two-camera capturing configuration, can emphasise spatial depth more vividly, thereby recreating three-dimensional physical reality with a greater resemblance to stereo illusions. Furthermore, even though generally regarded as an inferior cinematic tool used merely to engender spectacle, from Kracauer's perspective 3D becomes "more cinematic" because of its potency to recover the three-dimensional "volumes of things" with "less focus directly on inward life, ideology, and spiritual concerns", at least to date. In fact, through its amalgamation with digital technology, 3D has not just contributed to recovering what Kracauer termed "physical reality" but has gone a step further to (re)create or (re)construct "physical reality" –

> The motion picture camera has a way of disintegrating familiar objects and bringing to the fore–often just in moving about – previously invisible interrelationships between parts of them. These newly arising complexes lurk behind the things known and cut across their easily identifiable contexts… In rendering physical existence, film tends to reveal configurations of semi-abstract phenomena. Sometimes these textures take on an ornamental character. [16]

I would like to divide Kracauer's above remark into two parts, separated by the ellipsis. It is without doubt that the film camera, "often just in moving about", is much better able to show us visual objects in more detail and with more concrete spatial

relationships than still photography. The mobility of camera and objects disintegrates things but also contributes to the revelation of the "previously invisible interrelationships" of the objects or parts of them. Sometimes, the complexes caused by disintegration make the familiar objects appear dissimilar, even severed from easily recognizable contexts. In the case of 2D and 3D cinema, it is almost unassailable to say that 3D's two-camera device has a much stronger power "of disintegrating familiar objects and bringing to the fore previously invisible interrelationships between parts of them" [17] than 2D's one-camera mechanism. Because 3D's two-camera-mechanism can produce a stereoscopic illusion with dual volumes which is more like the human optical processing of physical reality, it thereby literally disintegrates objects into slightly dissimilar images, sometimes so dissimilar that the objects are brought into the negative parallax in front of the 3D screen. This peculiar visuality incited by binocular disparity happens exclusively in the 3D viewing experience.

Just like in optics, however, human beings' binocular disparity cue is not always "on duty", because monocular cues also help us perceive things and make judgments of spatial distance and depth. Only when our eyes receive particular stimulations that require a strong sense of comparative depths of different objects will the binocular disparity cue be triggered to function. Therefore, in 3D the audience may perceive movements, especially those happening in the negative parallax, in a more tangible way and discern the spatially volumetric depth more intensely. In contrast, 2D's one-camera-mechanism based on the principle of monocular vision can never engender the binocular-disparity visuality of 3D does in terms of recreating or (re)constructing the physical reality. This is easily but very convincingly evidenced by a comparison between the 3D and 2D versions of the exhibitor's logo shown before the beginning of every feature presentation in an Event Cinema theatre.

The 2D logo starts with series of rectangle-shaped red bars coming forward fast from the background, followed by a few obscurely shaped red bars scattering apart; then the scattered pieces move toward the foreground with velocity. Gradually the viewer can recognise the shapes of these bars as rectangles with strong perspectival designs. Finally the very front pieces of bars take a U-turn back and gather with later-coming ones to form the logo word, EVENT. The five letters stand for a few seconds before fading out at an oblique angle, with the letter T relatively bigger than E because it is the closest to the audience and V the biggest due to the design.

In the 3D version, the series of the above movement and graphics are strategically arranged across both spatial volumes and connected seamlessly in order to reinforce the augmented mobile and in-depth visuals for the audience. The initial action of the red bars coming forward actually starts in the positive parallax, and then crosses the 3D window to enter the negative parallax and fly into the audience's face. This is a typical 3D signature shot with "protrusion effect" that accentuates the stereoscopic spatial depth. Shortly after, another scattering of red-bars takes place in the positive parallax behind the 3D screen to emphasise the bars' momentum of breaking up and the irregular movements of the fragmented pieces; then the broken pieces of bars in manifest rectangles advance rapidly across the 3D window and emerge in the negative parallax between the screen and the audience. The foremost pieces of bars, however, reduce their velocity when arriving half way in the negative parallax and then recede mildly, instead of protruding straight ahead into the eyes of the audience. These receding bars conjoin with more crossover red bars and together they configure the word EVENT right in the middle of the space between the 3D window and the audience; meanwhile, the still advancing red bars cease to cross the window. In so doing, the logo is arrested with a very accentuated and pronounced stereoscopic look, swaying slightly in a location not too close to the audience. Here, the amplified three-dimensional demonstration of the cinema logo is compelling enough to showcase the trademark; on the other hand, it gives the audience a more concrete dimensionality and sense of spatiality of the visual entity. The feeling is like in reality when we see a swaying banner with interesting words in front of a huge window or stage curtain; we naturally expect to see something happen behind the window or the curtain. This two-stage cross-parallax movement and graphical display in 3D version is sophisticatedly designed to induce a sense of the redemption of physical reality in the stereoscopic pattern. This process is precisely what Kracauer described as "disintegrating familiar objects and bringing them to the fore", represented by red bars fragmenting into pieces and flying forward from behind the 3D screen. Then the process continues with disclosing "the previously invisible interrelationships between parts of them" when the moving red bars gradually unveil their rectangle shape and then crystallise into the stereo cinema logo transparently close to the audience. The visual tactic occurs in accordance with physiological habits that determine distance: "Johnston et al. (1994) studied stereo and motion cues, and found that stereo cues were more heavily weighted at near distances, but motion cues were more heavily weighted at far distances"[18]. In this instance of 3D graphic manipulation, the disintegration and movement in the positive parallax, the fragmented bars moving across the 3D window, and the transformation and settlement of the cinema logo in the negative parallax are deployed in a continuously stereoscopic visual entity. Not only does it serve as an allegory of Kracauer's affirmation that the nature of cinema is the redemption of physical reality, but it also recreates and reconstructs physical reality in a more virtualised sense.

By contrast, the 2D version of this EVENT logo presentation appears plain and opaque in terms of space and texture, although the image content of both presentations is exactly the same. Moreover, since there are no dual-parallax depth references along the Z-axis in the 2D screen, the bars advancing from the background to the camera are not as stunning as they are in the 3D version. For the same reason, the final "three-dimensional" EVENT logo forged by monocular design cues is not as eye-catching as in the 3D version, even though it approximates depth using shadows and relative sizes for the slanting letter layout. In summary, compared with this 2D design of a three-dimensional presentation, the stereoscopic 3D version is much more volumetrically acute and transparent in terms of both dimensionality and directionality. Miriam Ross suggests employing "hyperhaptic" to describe this kind of 3D visuality: "there is a distinct visual regime produced by stereoscopic moving images. Stereoscopic film's abundance of depth planes (even considering the camera's limitations), and the way in which it often incites other sensory perceptions, bring into play its hyperhaptic mode" [19].

In the following sections, I will investigate 2D and 3D aesthetic and artistic comparisons in-depth by integrating case studies chosen for both phenomenological and metaphorical reasons. In addition, I will demonstrate how filmmakers have increasingly shifted their creative energies to the "positive parallax" while simultaneously making more efficient use of the "negative parallax" with fewer such intrusions. I have called this aesthetic

trend as "aesthetics of recession" in contemporary digital 3D filmmaking. The development of the "aesthetics of recession" has allowed filmmakers to achieve a more effective exploration of 3D's potential as a narrative tool, rather than merely serving as a vehicle for cinematic spectacle. In fact, by opportunely utilising the protrusion effect in the "negative parallax", 3D filmmakers can rejuvenate the long hyped 3D "trademark," causing it to become more visually potent and profound than problematic "eye-poking" trickery. In this chapter, however, I will concentrate my discussions on one aspect of the "aesthetics of recession"– spectacular visuality–which refers to 3D's robust effectiveness with sensationally graphic demonstrations.

3. OVAL SPHERE WITH IMBALANCED VOLUMETRIC DUALITY VS. FLAT PAINTING CANVAS

To set a metaphorical framework for my argument, 2D and 3D filmmaking can be distinguished by a comparison between a flat painting canvas on the one hand and an oval-shaped sphere on the other hand with a window inserted between the positive volume (positive parallax) and negative volume (negative parallax). The inserted window, nonetheless, does not equally divide the dual volumes in this oval sphere but rather grants infinite depth to the positive volume behind the window while retaining limited swell for the negative volume in front of the window. Because this oval sphere is crystalline and transparent, the imbalanced 3D window position suggests boundlessly spatial scalability and plasticity in the positive volume while investing the shallow negative volume with more fragility, vulnerability and intensity. Compared with 2D's planar canvas, not only is the space along the depth of the Z-axis unlimited, but the space along both the horizontal X-axis and vertical Y-axis is sometimes also expanded and heightened. Therefore, 3D's volumetric duality provides endless potential for filmmakers to explore spatial elasticity and expandability. With reference to Kracauer's claim that "films cling to the surface of things", for 3D, as I suggested earlier, this claim should be modestly revised to state that "stereoscopic cinemas cling to the *volumes* of things" because "3-D is the only format to suggest the impossibility of a stable surface for the moving images" [20]. Moreover, if the nature of 2D cinema is the "redemption of physical reality", then Kracauer's phrase would more precisely fit the nature of 3D by slightly changing it to the "*recreation* or *reconstruction* of physical reality". I will substantiate this claim by comparing Ang Lee's recent 3D success, *Life of Pi* (2012), a film about an Indian boy and a Bengal tiger struggling to survive with each other on the boundless ocean, with Wolfgang Peterson's 2D counterpart, *The Perfect Storm* (2000), which is based on a real-life story of five Bostonian fishermen killed by an extraordinary storm in 1990.

I would like to use the climactic storm scenes in both *Life of Pi* (2012) and *The Perfect Storm* (2000) for a parallel analysis of the spatiality configured in a planar 2D "canvas" vs. the oval 3D oval sphere with its dual volumetric "plasticity". Both scenes successfully manifest the ferocity and strength of nature by employing digital special effects to recreate the storms with live action sequences (both were shot in a water tank) but with different emphases of 2D and 3D functionalities in spatial fabrication. The two films' main stories both take place on a boat floating on the sea and both climactic scenes show a cruel confrontation between the main characters and a powerful natural storm. In *The Perfect Storm*, the fishing-boat is named *Andrea-Gail* with five fishermen onboard; in *Life of Pi*, it is a lifeboat on which an Indian boy Pi and a Bengal Tiger named Richard Parker survive the sinking of a passenger ship. As a typical Hollywood disaster-genre blockbuster, *The Perfect Storm* follows the traditional rules of balanced integration of narrative and spectacle in order to tell a believable story based on a true event. *Life of Pi* does the same in this sense. However, since *Life of Pi* is more of a character-driven drama and director Ang Lee attempts to express some profoundly metaphysical messages related to belief and spirit through this simple survival story, he portrays the storm in this climactic scene as an alive and influential character that delivers spiritual revelations to the protagonist Pi. Moreover, Lee illustrates Pi's and the tiger's dramatic responses to the revealing storm in order to make the audience sympathise and identify with Pi and thereby be further open to thinking about the allegorical issues expressed through the story. Thus, a fundamental difference exists between the two films' portrayal of both the storm and the main characters with different notions and strategies that accentuate the differing spatial configurations in 2D and 3D filmmaking.

In *The Perfect Storm*, the characterisation of the storm is only sketchy and panoramic, portrayed primarily to demonstrate the storm's destructive power and to characterise it as "a mobile agent that devastates the environment of the human figures" [21]. As Wood delineates, "Once the *Andrea-Gail* has sunk, the power of the sea and of nature as an elemental force is triumphant, whilst the human figure of Bobby (one of the *Andrea-Gail*'s crew) is small, insignificant and finally lost as he recedes into the distance of the shot. Through these scenes the multiple elements of *The Perfect Storm* come together into a single timespace" [22]. Inside this timespace, despite close-ups and medium shots to display crews battling the water in the sword-boat, it is in fact the mostly digitally-generated wide and long shots of nature's power, in which human and boat figures are dwarfed as tiny dots on the swell of the massive waves, which evoke awe and intensity in the audience. Although the waves are at a distance and without much detail, the audience is still awed by the momentum and huge size of the water swell because of the contrast between the human-sized figures (boat and fishermen) and the natural environment. By emphasising this compositional contrast of object sizes, the magnificence of the natural forces is stressed in this striking and convincing spectacle.

By contrast, there are few extreme long shots synthesized with digital special effects in the climactic "storm revelation" scene of *Life of Pi*, although one appears at the very beginning of the scene before the storm comes and others are inserted into the middle of the scene. In 3D, extreme long shots often make the main objects become disproportionally small, which is why they are not commonly used when capturing 3D images. Nonetheless, by exhibiting a disproportionally tiny figure of Pi and the tiger on the lifeboat floating on the colossal ocean in an extreme long shot, Lee increases the immense contrast between the two finite, living creatures (Pi and the tiger) and infinite nature (the endless water). In the deep-focused extreme long shot that introduces the impending storm, the contrast is not only enhanced through compositional size, like in *The Perfect Storm*, but also reinforced through the particular "shrink effect" for long shots that characterises stereoscopic imagery. This is an eminent instance of Lee innovatively turning a 3D disadvantage into a creative advantage. Furthermore, along with above "shrink effect", by arranging Pi and the tiger on the lifeboat far back in the positive parallax with deep focus, Lee exploits the dual volumetric spatiality in stereoscopic cinema and intentionally enlarges the spatial distance between the objects and the audience, thereby

underlining the insubstantiality of the surviving figures compared with the surrounding endless sea. Similarly, the inserted extreme long shots are intercut with closer shots of Pi and the tiger, overtly underscoring the powerlessness and incompetence of the struggling and terrified pair during the confrontation with Nature's brute force – the storm, which is characterized by Lee as the messenger or the delivery vehicle to carry out God's will or guidance for Pi.

(Figure. 1) *Life of Pi* (Directied by Ang Lee, 2012). Dual volumetric spatiality intentionally enlarges the spatial distance between the objects and the audience in order to underline the insubstantiality of the surviving figures compared with the surrounding endless sea. (Courtesy of 20th Century Fox)

In the entire "storm revelation" scene, Lee relegates Pi to both physical and mental torture from the storm and then anguished, desperate questioning of this brutal messenger, before Pi finally discovers that it "is so beautiful" and drags the frightened tiger out of the tent to bear witness to the message with him. Through the above actions, Pi attempts to communicate with God in this extremely catastrophic circumstance and eventually realises his catharsis by fearlessly contemplating the messenger–the storm–with his tiger companion. Later, Lee separates the exhausted pair at each end of the lifeboat under the shield, meditating, before Pi moves to the tiger, hugging him and trying to comprehend the meaning delivered by this brutal catastrophe messenger. Most shots in this scene are close-ups and medium close-ups to show Pi's and Richard Parker's facial or flailing reactions to the storm, especially when shots of Pi peeking out from underneath the canvas are, cross-cut with the frightened and confused expressions on the tiger's face.

It is worth noting that Pi's close-ups are deployed slightly in the negative parallax in front of the 3D window as Pi madly shouts at the storm. In so doing, Lee highlights Pi's own psychological dread of and desperation with the storm. Moreover, by deploying stereoscopic cinema's disadvantageous "intrusion effect" on the viewer in the negative parallax, he cunningly transmits Pi's immense physical pain and psychological frenzy to the audience through the trans-sensory identification with Pi. Once again, by turning a 3D "problematic" trickery into a creative merit, Lee exploits it in an artistically appropriate fashion.

For the later segment inside the lifeboat, Lee adopts close-ups and medium close-ups to single out each character before a final two-shot shows the two huddling together in one frame. Every close-up or medium close-up for either Pi or Richard Parker shows their exhausted and tortured expressions, amalgamated with 3D's volumetric spatiality to emphasise the claustrophobic feeling inside the narrow lifeboat covered by the canvas. Unlike the strategy for previous close-ups of Pi outside the lifeboat, here both he and the tiger are placed in the positive parallax behind the 3D window; however, the spatially enhanced volumetric emptiness –

(Figure. 2) *Life of Pi* (Directied by Ang Lee, 2012). Pi's close-up is deployed slightly in the negative parallax in front of the 3D window as Pi madly shouts at the storm; so that the audience may feel Pi's immense physical pain and psychological frenzy through the trans-sensory identification with the character. (Courtesy of 20th Century Fox)

between the character and the audience palpably increases the psychological claustrophobia for the audience. Indeed, here close-up does not bring the usual sense of intimacy as it does in 2D media. Drawing on Joshua Meyrowitz and Paul Messaris's Para-proxemics theories, Zettl states, "Even the same close-up may have a completely opposite psychological effect when shown in 3D instead of 2D" [23]. The above example demonstrates how Ang Lee uses 3D tactics deliberately counter to our perceptual habits, thereby manipulating the intrinsic traits of stereoscopic cinema with both its advantages and disadvantages. These 3D traits such as volumetric duality, imbalanced spatiality in the positive parallax and the negative parallax, elasticity of the positive parallax and fragility of the negative parallax, and so on, inspire creative filmmakers to recreate "physical reality" and construct cinematic spectacles in innovative ways. When interviewed during the 2103 *3D Creative Summit* in London, Ang Lee remarked, "For over a hundred years, we (our eyes) have compensated for the lack of volume in 2D, so we actually see 3D in 2D media…I think when you pick up something that actually has volume, the whole rules of the game should be gradually changed…we're in the transitional time…to the new illusion of cinema" [24].

4. VISCERALITY AND PALPABILITY: STEREOSCOPIC CONTRIBUTION TO SLOW-MOTION VIOLENCE AESTHETICS

In this section, I will compare two killing scenes in *Dredd3D* (2012) and its 2D counterpart *Killing Them Softly* (2012) in order to argue that 3D, in combination with extreme slow-motion technique, offers greater perceptual authenticity to enhance the violence of bloodshed. In both films, the two filmmakers adopt a similar technique—extreme slow-motion—to stress bloody and violent killing scenes; however, I would argue that integration with 3D in *Dredd3D* makes the brutal effect more graphically striking, more psychologically unbearable and more metaphysically realistic

in terms of the dimensional and directional authenticity of blood flow and bullet trajectory. In *Dredd 3D* (2012), Judge Dredd and rookie judge Anderson, who is on her first training day, go for a mission together and storm into a drug dealer's apartment in Peach Tree Tower, where they kill the two drug users who try to grab their guns in resistance. In *Killing Them Softly* (2012), mob hit-man Jackie Cogan sits in his car and kills his target Markie, who has mishandled a gambling racket, sitting in another car stopped at an intersection in the rain.

The aesthetics of slow-motion violence have existed ever since the late 1960s New Hollywood Movement, with Arthur Penn's ground-breaking climactic ambush scene of the two infamous outlaws in *Bonnie and Clyde* (1968) and Sam Peckinpah's exemplary slow-motion violent film, *The Wild Bunch* (1969). When comparing these two films, Stephen Prince contends,

> …slow-motion images derive their poetic force from the metaphysical paradox of the body's continued animate reactions during a moment of diminished or extinguished consciousness. Slow motion intensifies this paradox by prolonging it. It is not just the moment of violent death which is extended, but the mysteries inherent in that twilit zone between consciousness and autonomic impulse, that awful moment when a personality ceases to inhabit a body that is still in motion. [25]

During the 1990s, Hong Kong filmmaker John Woo borrowed this slow-motion violence aesthetic from Hollywood and developed it by incorporating dissolve-in-succession editing into the brutal gun fire scenes in his gangster movies to give these violent killing scenes a more poetic and beautiful look. Since the start of the new century, slow-motion violence aesthetics has been utilised ubiquitously in both Hollywood blockbusters and other commercial movies made around the world which involve gore, bloodshed, blood-splashing and explosives. Most filmmakers adopting this aesthetics still retain the extremely fast camera speed and the dissolve-in-succession editing strategy in order, as Prince comments on Peckinpah's films, to "emphasize the brutality of physical violence while also giving it a graceful beauty" [26]. Prince acclaims Peckinpah as "the exponent of slow-motion violence"; as he further points out, "The contradiction between the aesthetic beauty of the visual spectacle and the emotional and physical pain that Peckinpah also dramatized as part of his screen violence is a complex and important one…" [27]. In my two comparative cases here both filmmakers use the techniques of extreme slow-motion and dissolve-in-succession montage; however, they have different soundtrack design tactics to emphasise the "beautifully violent effect". More importantly, they employ the same slow-motion violence aesthetics with two different kinds of media. I would argue that because of stereoscopic 3D cinema's advantage of directionality and dimensionality, 3D's integration with classic cinematic techniques such as extremely slow motion, special effects and surrounding soundtrack has greater visceral and tactile ability to accentuate graphic violence than conventional 2D media.

In *Dredd 3D*, the story is set in a futuristic dystopian mega-city in America where organised crimes spread out at every corner, so that the law enforce, armed judges, must react to criminals mercilessly at every crime scene to serve justice. Extreme slow motion technique is employed in all gun fighting scenes throughout the film. In the exemplified scene under discussion where Judge Dredd and Rookie Anderson storm into an apartment and both point their machine guns at two teenager drug users, they shoot and finally kill them as the latter fumble to pull out their handguns. This series of actions is mostly deployed in the positive parallax in order to display the intensity of the shooting with a lot of gun fire and bullets filling the screen. Intriguingly, however, the filmmaker does not use a single three-dimensional shot that lets the bullets fly into the audience along the Z-axis; instead, all of the bullets fly horizontally across the positive parallax space behind the 3D window.

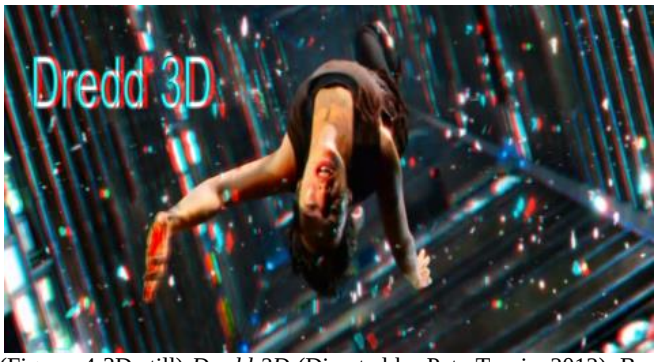
To emphasise the brutality of killing, a few close-ups, which are intercut with normal-speed shots of the two officers firing their guns, show the belly of one young drug user being shot. With the extreme slow motion effect we can perceive the process of the bullet burrowing into his skin, the blood spurting out and his skin breaking up while the bullet moves through his body. Because the stereo effect underscores the spatial depth plasticity, even though these actions are all displayed in the positive parallax, they function as sensationally visceral and psychologically unbearable when the bloody violence can be observed this closely and broken down nearly frame by frame. The trajectory of the crawling bullet inside the human body and the splashing blood spots, as well as the motion and direction of the cracking skin, is so compellingly authentic that the audience feels the visceral pain and psychological cruelty in a shockingly hyperhaptic (Ross) sense. Moreover, in the last couple of shots, with a few blood spots splattering forward and across the 3D window flying into the negative parallax in a super slow velocity, the bloodshed violence of this scene is climactically augmented by this restrained "protrusion effect" adoption, so that the brutal viscerality generated by 3D's volumetric duality is reinforced. In short, the striking effects in *Dredd 3D* take place mainly in the positive parallax, with only a couple of shots "protruding" into the negative parallax in order to enhance the dimensional elasticity and directional scalability in stereo space. Because the swell in front of the 3D window in the negative parallax is fragile and sensitive as an uncomfortable zone for the viewer, the economic application of the "protrusion effect" actually makes it more visually and haptically stunning.

(Figure. 3) *Dredd 3D* (Directed by Pete Travis, 2012). The trajectory of splashing blood spots and the crawling bullet inside the human body, as well as the motion and direction of the cracking skin, is so compellingly authentic that the audience feels the visceral pain and psychological cruelty in a shockingly palpable sense. (Courtesy of Entertainment Film Distributors & Lionsgate)

It is also worth noting that in *Dredd 3D* there are several long shots interspersed periodically during the entire scene to show the volumetrically spatial locale – Peach Tree Tower apartment. The long shots not only display the two judges storming into the apartment and the two drug-users' first reaction of fumbling for guns their pockets, but they also exhibit the two resisting drug-users falling through the air very slowly after being shot. These extreme slow-motion long shots of drug-users falling take on a palpable effect in stereo mode as they resemble sculptural entities dropping in such a dynamically authentic direction that we can envision their soon-to-be-destroyed status but can do nothing to help. This effect occurs not only because, according to Prince, "slow motion is especially powerful when it correlates with a character's loss of physical volition" [28]. It is also because the enhanced volumetric spatiality and the bodies' falling directionality simply make "the awful moment when a personality ceases to inhabit a body that is still in motion" [29] more sensible and palpable.

In the counterpart scene of the 2D film *Killing Them Softly*, the enforcer Jackie Cogan (Brad Pitt), working for the mob, sits in a car and kills his target MarkieTrattman (Ray Liotta), who sits in another car stopping at an intersection, with a handgun. Both extreme slow-motion and dissolve-in-succession, which are typical Violence Aesthetic techniques, are used here, similarly to *Dredd 3D*. Aside from strategic soundtrack differences (soft pop music for *Killing Them Softly*, oddly intensified and sustained high-pitch sound for *Dredd 3D*), the deployment of visual techniques in the two films is exactly the same. Instead of the super-slow display of the trajectory of a bullet moving inside the drug-user's body in *Dredd 3D*, the extreme slow-motion in *Killing Them Softly* is concentrated on showing the trajectory of bullets advancing through the air and the postures of empty shells "dancing". Different from the dimly reddish and overly-saturated neon lit apartment of a dystopia mega-city in *Dredd 3D*, the annoying sound of wipers on Markie's car window and the splashing water-drops of the suffocating rains intensify the dramatic violence set of contemporary society in *Killing Them Softly*. Furthermore, the basic dual-angle shot/reverse shot camerawork and editing principles are consistently executed in both cases. The extreme slow-motion shots for the killed and the killers are intercut with each other throughout both sequences, except that the last shot in the *Killing Them Softly* sequence provides a fresh perspective from outside the front window of Markie's car to confirm his demise and conclude the entire scene.

Notwithstanding that the camerawork and editing tactics adhere to the same philosophy, the shot scales for the two scenes are slightly different. In *Killing Them Softly*, close-ups and medium close-ups are dominant mainly because of the confined spaces for both the killer and the target, who remain inside their cars throughout the scene. However in *Dredd 3D*, a few long shots are inserted from time to time in order to exhibit the volumetrically-abundant space in the apartment. Secondly, the imagery used in the two sequences is quite different, especially for the targets being killed. In *Killing Them Softly*, the shots of Markie manifest his body struggling to survive, trembling, shaking, and the agony expressed on his face when abruptly being shot in his own car at an intersection. These shots in slow-motion close-ups are edited together through dissolve-in-succession. Because there are only two shot/reverse shot angles offered and the shot scale is simply of close-ups, the scene overall gives the audience a sense of formal and stylish aesthetics rather than a psychologically and physically engaged feeling. In *Dredd 3D*, on the other hand, the slow-motion close-up imagery magnifies how a bullet drills into a human body and travels through it with an overt trajectory, how the broken skin shatters, and where the gore splatters and the bloody spots splash directionally with dimension, instead of the target's painful facial expression and tortured body language. These stereoscopic, nearly frame-by-frame breakdowns of the human body being torn in detail provide the audience with an opportunity to closely gaze at the graphically violent event as though through a microscope. Stephen Prince asserted that: "Stereoscopic cinema gives us a glimpse into a world whose volumetric properties exceed our own in terms of their dynamic range, their vividness, and their infinite scalability. Rather than mimicking natural sight, it offers a heightening of vision, a glimpse through the looking glass into an immersive domain…" [30]



(Figure. 4 3D still) *Dredd 3D* (Directed by Pete Travis, 2012). By amalgamating with extreme slow-motion technique, the stereoscopic, nearly frame-by-frame breakdowns of the human body dropping or being torn in detail allow the audience to closely gaze at the graphical violence and palpably feel the tortured viscerality. (Courtesy of Entertainment Film Distributors & Lionsgate)

5. CONCLUSION

Based on the above comparative analysis of the graphic violence scenes in *Dredd 3D* and *Killing Them Softly*, we may draw a conclusion that both the visual and psychological effects in *Dredd 3D* on the audience are more sensationally visceral because of the palpability and plasticity of spatial reconstruction in stereoscopic cinema.Ultimately, all these aesthetic and phenomenological distinctions between 3D and 2D cinema can be figuratively distinguished by the two respective metaphors for the pair that are allegorized by an oval sphere with imbalanced dual volumes for the former and the a flat canvas for latter.

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