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Rupturing Visions: Towards an Expanded Stereoscopy

This article develops from and expands upon talks I presented at Ars Electronica Festival's Expanded Animation Symposium[1] and Bucheon International Animation Festival's Asia Animation Forum.[2] It investigates the potential of stereoscopic imagery to create engagements and experiences for the audience that go beyond the mere re-creation of three-dimensional space, creating visual ruptures as well as confusion in spatial perception. Through the lens of today's artistic practices, particularly new media arts including digital animation and virtual reality (VR), these broken visions or expanded abstractions are envisaged on one hand as an expression of a new realm of technologically induced sublime, while on the other hand pointing towards the lived abstraction of a future saturated by alienating mass media technologies. The aim of the essay is to explore, through a number of works by selected artists, the artistic potentials and poetic possibilities of *expanded stereoscopy*. It will also bring to light the partial lack of historical contextualization of, and trust in, moving image work by contemporary artists, whose experimental investment in "stereoscopies" provokes the homogeneous moving image space afforded by electronic media technologies, together with accompanying institutional regimes and discourses. Working at the periphery of vision, these artists incite the hegemonic media ecology of "visualities" that dominate our moving image consciousness since at least the mid-nineteenth century. Based on these premises, the hypothesis is that new modes of binocular vision, conditioned by seeking alternative uses of stereoscopy, enable and further expedite ways of seeing which are impossible in the real world. Hence, they truly expand the senses, firstly by re-asserting the subjective, personal viewer and their particular positioning in relation to the screen, and secondly by opening up our thinking about what constitutes the very "real" as in "real world."[3]

Breaking the Hegemony of Stereoscopic Realism

Since the commercial success of James Cameron's stereoscopic film *Avatar*,[4] much film and animation created for cinematic release has embraced stereoscopic vision and the three-dimensional depth it creates for the viewer. The maturation of consumer-level VR technology since 2014 has simultaneously spurred a wave

1 Max Hattler, "Broken Visions in Stereo." Expanded Animation Symposium, Ars Electronica Festival, Linz, Austria, September 8, 2017. Websites: https://ars.electronica.art/aeblog/en/2017/08/04/animation-festival-2017/, https://www.expandedanimation.com (accessed November 20, 2018).

2 Max Hattler, "From Broken Visions to Expanded Abstractions," Asia Animation Forum, Bucheon International Animation Festival, Bucheon, South Korea, October 22, 2017. Website: https://www.biaf.or.kr:47436/2017/en/index_forum_new.php (accessed November 20, 2018).

Max Hattler, "From Broken Visions to Expanded Abstractions," in *Cartoon and Animation Studies,* vol. 49 (2017), pp. 697–712.

3 On systems of reality and alternative reality systems, see Federico Campagna, *Technic and Magic: The Reconstruction of Reality* (London and New York, 2018).

4 *Avatar*. Directed by James Cameron, 2009.

of media productions set within three-dimensional space, ranging from computer games to Google Cardboard-enabled pornographic VR videos, and short film productions such as the first Academy Award-nominated animated VR project, the short film *Pearl*[5] by Patrick Osborne. Despite their different political, economic and cultural conditions, all of these works rely technically and aesthetically on stereoscopic fusion through stereopsis, that is, the perception of depth produced by the brain from left and right images with the amount of binocular parallax that corresponds to our eyes. They aim to emulate, as closely and comfortably as possible, three-dimensional human vision.[6] However, within more experimental moving image practices, and specifically abstract film and experimental animation, a fully rendered three-dimensional space might not always be desirable. The negotiation with, and abundance of, such "total space" links to the attack on the "figurative" and representational more widely, which has been and continues to be exploited to varying degrees in art, film and media histories–among the most prominent being Modernist artists and designers who added their significant contribution to the field. Those visionaries of the visual culture of the twentieth century undermined mimetic or perspectival notions of vision and representation at large. And the emerging imaginary realm aimed at nothing less than the reduction of perceptual depth toward flatness and abstraction; where those new two-dimensional environs on screen resonated with the shifts in social power, together with their institutions and discourses, already at play since the nineteenth century.[7] Within that culture, the legacy of early avant-garde abstract film and animation is arguably engrained in our animation consciousness. We know of artists including Len Lye, Hans Richter, Marcel Duchamp, and Germaine Dulac, for example, whose concerns with visual rhythms or film poetry–"to create a *film poetry* with all the means provided by the transposition of objective reality by the camera"[8]–provided grounds for a growing artistic vocabulary around a dynamic filmic image surface, or painting in time, abstract universal signs in motion, and movement material; which was partly conditioned by investing "the dual nature of the camera as both a tool to record and a medium of expression through which to transform. .... What was

5 *Pearl*. Directed by Patrick Osborne, VR animated film, 5:38 min., USA, 2016.

6 Groundwork in this field has been undertaken firstly by the German physician and physicist Hermann von Helmholtz (1821–1894), who initiated his research on binocular vision when he invented the telestereoscope in 1857. However, major experiments with binocular eye movements, including the horopter, and stereoscopic vision happened in the early 1860s. The challenge of perceiving space was interestingly addressed by Wilhelm Wundt, Helmholtz's assistant between 1858 and 1862. See Guest Editorial, Perception (1994), and also Hermann von Helmholtz, *Treatise on physiological optics*, vol. 3: The perceptions of vision (New York, 1825).

7 Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, 1990).
In this book Crary emphasizes the significance of optical apparatuses, including the stereoscope and precinematic devices, in how they exemplified the production of new physiological knowledge.

8 Hans Richter, *The Struggle for the Film, Towards a Socially Responsible Cinema* (Hampshire, 1986), p. 59.

at stake in avant-garde projects was testing the camera for its possibilities and limits, experiments which sometimes led to the complete separation of the two forms of film-making, like [Richter's] abstract *Rhythm* films and films where the camera records objective reality."[9]

Although these works resonate with me, I also depart from them in my own moving image practice, where I tend to favor two-dimensional flatness and the relative obfuscation of spatial relations it affords. Whether the moving image space is constructed from the "cameraless" digital non-objectivism of computer-generated vector shapes, as in my works *Collision*,[10] *Sync*[11] or *Divisional Articulations,*[12] or is derived from an abstraction of photographed realism, such as in stop-motion films *AANAATT*[13] or *Shift*;[14] in both cases a denial of 3D depth perception usually helps to underline the pursued visual abstraction. The aim of this abstraction is generally a distancing from the everyday, a reduction or removal towards an "abstracted heterotopia":[15] a thinking space from which to reflect upon and critically comment back on reality. To this end, many of my works utilize optical tricks of shifting scales and folding perspectives, spatial conflations and confusions, which would be void or weakened if presented stereoscopically. The work, then, is bolstered by two-dimensionality's inherent denial to immediately visually comprehend what one sees on the screen, what is spatially in front and what is behind.

In late 2015, new media artist and researcher Jeffrey Shaw invited me to create a stereoscopic work for Animamix Biennale 2015–16, an exhibition he co-curated in Hong Kong.[16] I took the Biennale's theme "Directed Towards Knowledge" as a call for challenging and expanding my own knowledge and visual vocabulary of the in/animate, by exploring the artistic potential of stereoscopic imaging: the incentive prompted me to question how stereoscopy, rather than hyper-defining space within three dimensions, might itself be used to achieve a confusion of spatial perception.[17] It appeared pertinent at this stage, to put forward the possibility of a heterotopic, stereoscopic situation; that is, speculatively positing stereoscopy as a heterotopia itself, and as one that is in search of yet unexplored pathways to new knowledge. Or to put it differently, asking in what ways an expanded stereoscopy can be taken as a model for the creation of new knowledge. In addition, my desire was to find resistances to and ruptures in the current, hegemonic media ecology, read as an ever-increasing, all-encompassing, uncanny space of reality, as it were. As such, it seemed urgent to enquire the ways abstract and experimental moving image practices might benefit from stereoscopy both conceptually and aesthetically for opening up "new opportunities for radical abstractions, poetics, disruptions"[18] if used in ways that break with, or go beyond, stereoscopic fusion. If there is something like an alternative stereoscopics that may exceed mass media and the falsely supreme, commercially driven moving image environment, then what must this doubling vision look like? What would it encompass, what affects would become powerful, and what kind of viewer–and subjectivities–would it stage or imply? And I was contemplating that this other stereoscopy, which hovers in the shadows of the dominant regime, must perform the task of a kind of prophet. Of something or someone forecasting in imaginative, revealing, very real yet magic modes.

Given this apparent promise that an expanded stereoscopy holds for the present observer, one can perhaps hypothesize that truly new "visionary" experiences (a reference to Crary) are on the way that dislocate the domineering visual-sensorial-experiential regime. To underline what is at stake here, a few noteworthy works which exemplify a range of non-traditional, expanded artistic approaches to binocular vision will

9 Verina Gfader, *Adventure-Landing* (Berlin, 2012), pp. 60–61.

10 *Collision.* Directed by Max Hattler, Animation, UK / Germany, 2005.

11 *Sync*. Directed by Max Hattler, Animation, Denmark / Holland / UK / Germany, 2010.

12 *Divisional Articulations*. Directed by Max Hattler, Animation, Hong Kong / UK / Germany, 2017.

13 *AANAATT*. Directed by Max Hattler, Animation, UK / Japan / Germany, 2008.

14 *Shift*. Directed by Max Hattler, Animation, UK / Germany, 2012.

15 Based on Michel Foucault's concept of 'heterotopia.' Cf. Michel Foucault, "Des Espaces Autres (Of Other Spaces)," *Architecture, Mouvement, Continuité*, no. 5, 1984, pp. 46–49; translated by Jay Miskowiec in Diacritics 16, no. 1. 1986, pp. 22–27.

16 *POST PiXEL. Animamix Biennale 2015–16*, Run Run Shaw Creative Media Centre, Hong Kong, March 22–April 17, 2016 (Curated by Jeffrey Shaw and Ivy Lin, presented by the Leisure and Cultural Services Department, co-organised by City University of Hong Kong and Hong Kong Visual Arts Centre. Website: https://www.acim.cityu.edu.hk/archive/post-pixel/ (accessed November 20, 2018).

17 Max Hattler, "III=III," in *POST PiXEL, Animamix Biennale 2015–16*, exh. cat. Leisure and Cultural Services Department (Hong Kong, 2016), p. 34.

18 Blake Williams, "3D in the 21st Century. Becoming 3D." Mubi.com, 2015, https://mubi.com/notebook/posts/3d-in-the-21st-century-becoming-3d (accessed October 10, 2018).

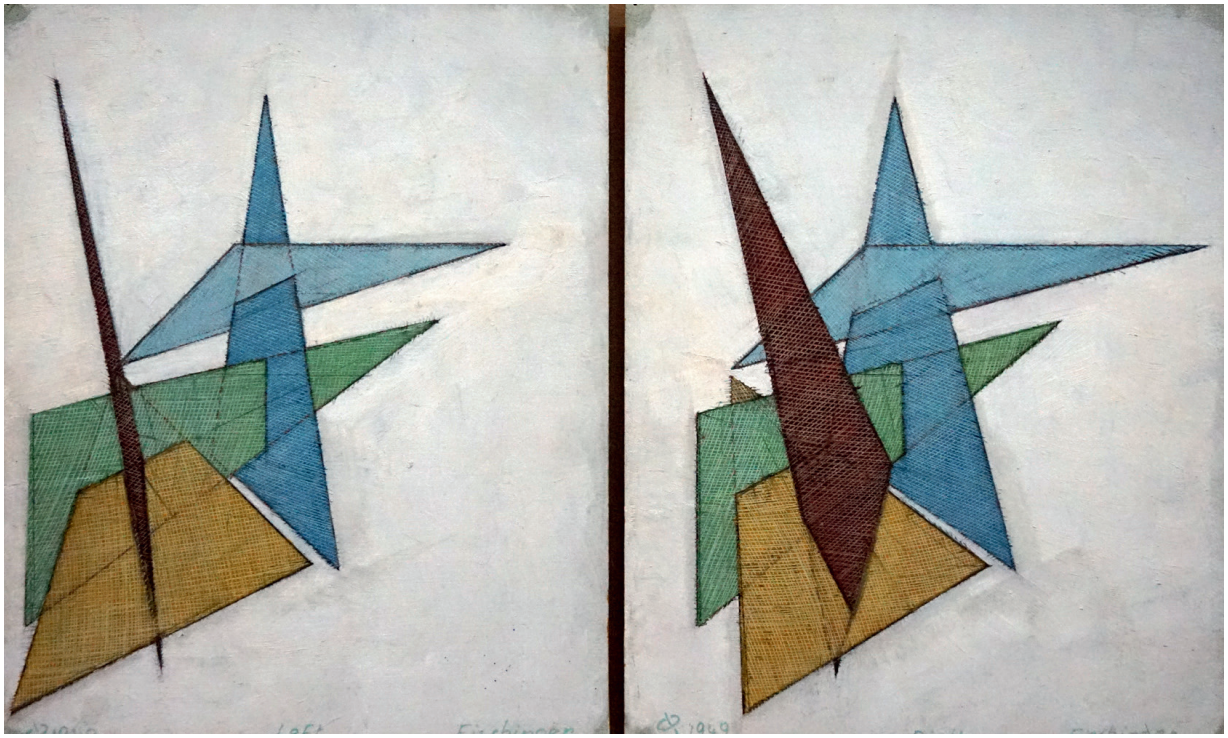

Figure 1: Oskar Fischinger, *Stereo No. 49*, 1949.

be discussed below, followed by a brief introduction of my own moving image work in this area, which started with the creation of stereoscopic animation loop *III=III*[19] for the Animamix Biennale 2015–16. The techniques employed in these works might serve as a toolkit for artists interested in exploring a more experimental, expanded engagement with stereoscopy. And by way of a toolkit for the critic, for a critical reviewer they may open up unknown elements from within the discourses linked to their own investigations in the field.

Tracing the history of avant-garde film and animation, there are few documented examples of experimental stereoscopy. Among the most interesting voices on the topic, William Moritz[20] importantly points to Harry Smith, Hy Hirsh, Norman McLaren, Dwinell Grant and Oskar Fischinger. These artists all delved into the realm of three-dimensional phenomena on screen in the late 1940s and early 1950s, around the time of the first theatrical 3D craze, using various devices and technologies such as coded prisms, oscilloscopic patterns, or visual disparities coming together stereoscopically in unusual ways. What was at stake in these early experiments was always the complex perceptual and cognitive relationship between two separate images or screens as they were experienced simultaneously as a stereoscopic image: right–left at once, but forever split. And within that, we see a first application of the experimental artistic impulse to the domain of stereoscopy, that is, an impulse to transcend established norms, and provoke or stipulate new experiences. While Grant creates three-dimensionally believable interactions between his shifting abstracted forms of stop-motion animation in *Composition 4*[21] *(Stereoscopic Study No. 1)*, Hirsh explores in *Come Closer*[22] what Moritz calls "'realistically' impossible relationships,"[23] as his oscilloscope-drawn objects pass through each other in unpredictable, poetic, rhythmic ways–like an ensemble of dots, lines, and shapes rehearsing and dancing to the music.

19 *III=III*. Directed by Max Hattler, Stereoscopic animation loop, 2:12 min., Hong Kong / Germany, 2016.

20 William Moritz, "Stereoscopic Abstract Film William Moritz's notes for 1999 lecture," https://www.centerforvisualmusic.org/WMlecstereo.pdf (accessed October 12, 2018).

21 *Composition 4*. Directed by Dwinell Grant, 1944–45.

22 *Come Closer*. Directed by Hy Hirsh, 1953.

23 William Moritz, "Stereoscopic Abstract Film William Moritz's notes for 1999 lecture," https://www.centerforvisualmusic.org/WMlecstereo.pdf (accessed October 12, 2018).

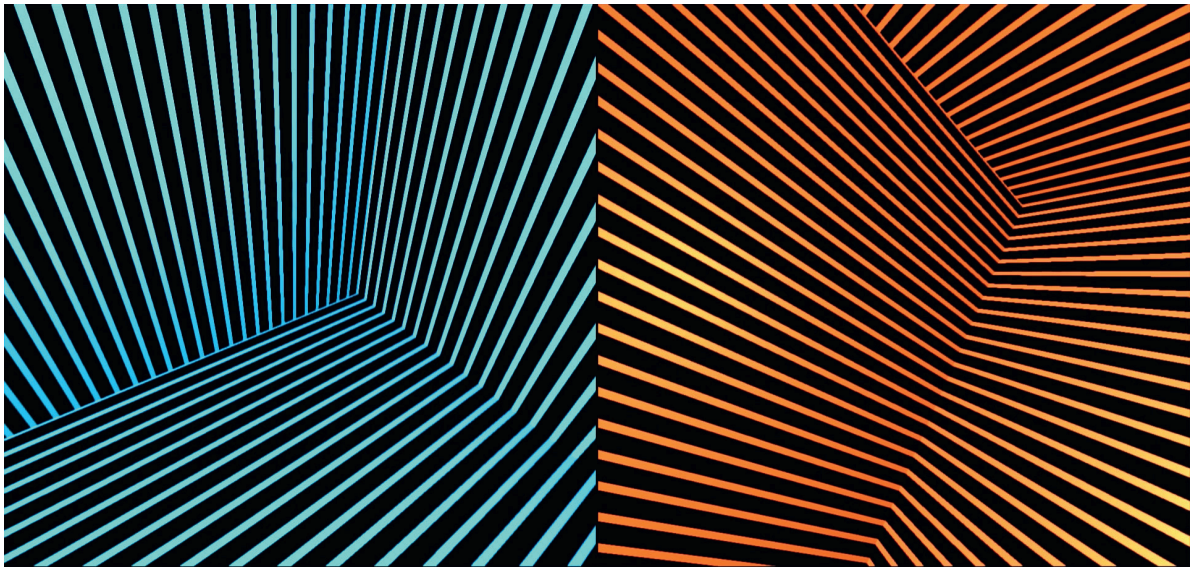

Figure 2: Memo Akten, *Fight*, 2017.

Binocular Rivalry

Fischinger's abstract stereoscopic paintings similarly present the viewer with spatial relations that go beyond the realistic recreation of three-dimensional space. In the late 1940s, straight after completing his film *Motion Painting No. 1*,[24] he spent four years creating a series of side-by-side pairs of paintings designed for 3D free-viewing—without the help of a stereoscope. One such "space painting"[25] is *Stereo No. 49*.[26] Using cross-eye viewing, a well-defined 3D image emerges. Other paintings of the series however seem to present the viewer with differently spaced parallax information within one image pair that goes beyond the "norm" of acceptable parallax difference. In *Circles in Circle*,[27] for example, some objects in left and right images are closer together and easily fusible into a coherent stereoscopic space, while others are so far apart or differently spaced, that they require an active re-adjustment effort on the part of the observer. As such, the presented "illusive painting in the middle,"[28] synthesized by the viewer from left and right images, does not hold together as one stereoscopic construct. Instead, it presents competing yet co-existing versions of spatial depth within itself. As a result, the three-dimensional space shifts and re-aligns as the viewer actively negotiates the "space painting." Such unorthodox use of stereoscopy can lead to surprising artistic outcomes, viewer engagements, and the creation of improbable, paradoxical stereoscopic spaces.

However, when the difference between the images presented to left and right eye is so large that they cannot be fused into a singular image, the viewer experiences an unstable, volatile composite image. This phenomenon of visual perception, where perception alternates between different images presented to each eye, is called binocular rivalry.[29] Gregory Garvey's *Homage to the Square: Stereoscopic Suprematist Composition II*[30] investigates the effects of binocular rivalry. Following a long tradition of "the square" in the arts, from Kazimir Malevich to Joseph Albers, to the later minimalism of Ellsworth Kelly, Garvey's investment in the square picks up this reductionist impulse and celebration of the square as the most elementary formal element of an art striving towards the "supremacy of pure sensa-

24 *Motion Painting No. 1*. Directed by Oskar Fischinger, 1947.

25 Oskar Fischinger, "A Statement About Painting," 1951, https://www.oskarfischinger.org/Fisch1951Painting.htm (accessed October 10, 2018).

26 Oskar Fischinger, *Stereo No. 49*, Oil on cardboard stereo painting, each painting 32.4 x 23.4 cm, 1949, courtesy of The Elfriede Fischinger Trust, Long Beach, CA (Inv. No. 433a and 433b).

27 Oskar Fischinger, *Circles in Circle*, Oil on masonite stereo painting, each panel 30.48 x 30.48 cm, 1949.

28 Oskar Fischinger, "A Statement About Painting," 1951, https://www.oskarfischinger.org/Fisch1951Painting.htm (accessed October 10, 2018).

29 Randolph Blake and Nikos K. Logothetis, "Visual competition." Nature Reviews Neuroscience. 3 (1): 13–21 (2002), https://www.nature.com/articles/nrn701 (accessed October 14, 2018).

30 Gregory Garvey, *Homage to the Square: Stereoscopic Suprematist Composition II*, Inkjet print, Stereoscope, 2005.

tion."[31] But Garvey revisits the square through the lens, quite literally, of cognitive and perceptual psychology. *Homage to the Square* is a print work containing differently sized grey squares positioned side by side, which, when viewed with a stereoscope, are fused into a single image of nested squares. Due to the degree of binocular rivalry however, the resulting image is not three-dimensional. Instead, "(t)he squares appear to slowly slide over or behind the other as the brain's visual apparatus strives to maintain a single coherent view that exists 'only in the mind's eye.'"[32] Through the use of binocular rivalry, the modernist flattening is not reversed into a three-dimensional geometric space, but instead, Garvey pushes the perceptual boundaries of the square's sensations by adding this "internal," unstable, semi-spatial dimension that is only experienced within the viewer: "It is not a stereoscopic 3D illusion. Instead, a kind of 2.5D space is perceived."[33]

Forwards in time, and developed from within today's cultural-technological conditions, in Memo Akten's virtual reality artwork *Fight*[34] the use of a VR headset underlines the effect of binocular rivalry, as each eye is completely forced into its respective view. Akten's meditative, introspective exercise in visual perception probes the limits of binocular rivalry, taking the viewer through different chapters which start out in a stereoscopically fused, three-dimensional space. Partly through the viewer's own head movements, the space then folds into two increasingly opposed directions. As stereopsis is denied, a forever-shifting image presents itself, making those who encounter the work acutely aware of their own image processing mechanism and the "fight" between left and right eyes.

> Presented with rival signals, the conscious mind "sees" an unstable, irregular, animated patchwork of the two images; with swipes and transitions. The nature of these irregularities and instabilities depend on the viewer's physiology.[35]

The mostly abstract content of *Fight* underlines this collapsing of a total image/space as the two parts of a once stereoscopically fused image drift apart. This experience of extreme binocular rivalry can be dislocating and highly uncomfortable, as the viewer loses all reference points to a sense-making pictorial space, however abstract. Deliberately closing one eye gives temporary respite by reverting back to the un-broken space of monocular two-dimensionality.

However, when used with geometry that is displayed with the right amount of parallax to allow for stereoscopic fusion, binocular rivalry can be leveraged to generate particular visual effects unique to stereoscopic vision, such as the display of luster, which results from color disparities between the images presented to left and right eyes. One of the less extreme chapters in Akten's *Fight* is composed of three-dimensionally fused diamond-like particles which are "drawn" on the image space through the viewer's head movements. The colors of these diamond shapes are different for left and right eyes (their red and blue colors can be understood as a nod to the anaglyph process, which will be discussed further below). This color difference gives the objects a luminous sheen in the viewer's perception, which is distinctly different from any other color perception possible with 2D or non-expanded stereoscopic means.

In the 1970s, the Spanish artist Salvador Dalí had already created a series of stereo pairs of paintings which explore similar effects. Working from within the Surrealist movement with its focus on how the unconscious mind reveals and releases the power of imagination, it is no surprise that Dalí probed the binocular rivalry potential of stereoscopy to tease out perceptual possibilities that go beyond our everyday cognition, to create new and expanded optical illusions and experiences. By using different colors for certain elements in the left and right paintings of an otherwise stereoscopically fusible image pair, the corresponding parts appear to glow with a velvety luster, when the pair of paintings is observed through a stereoscope. This luster can be observed in a number of works including *Dali's Hand Drawing Back the Golden Fleece in the Form of a Cloud to Show Gala the Dawn, Completely Nude, Very, Very Far Away Behind the Sun*[36] or *Dali*

31 Gregory Garvey, "Gregory Garvey," In ACM SIGGRAPH 2005 Electronic Art and Animation Catalog (SIGGRAPH '05). New York, NY, USA: ACM, 2005, pp. 66–67, https://dl.acm.org/citation.cfm?doid=1086057.1086089 (accessed October 15, 2018).

32 Ibid.

33 Ibid.

34 *Fight*. Directed by Memo Akten, VR artwork, 2017.

35 Memo Akten, "FIGHT (2017)," Memo Akten Official Website, 2017, https://www.memo.tv/portfolio/fight/ (accessed October 15, 2018).

36 Salvador Dalí, *Dalí's Hand Drawing Back the Golden Fleece in the Form of a Cloud to Show Gala the Dawn, Completely Nude, Very, Very Far Away Behind the Sun* (two stereoscopic panels, oil on canvas, 60 x 60 cm), 1977.

Figure 3: Kazuhiro Goshima, *Shadowland*, 2013.

from the Back Painting Gala from the Back Eternalized by Six Virtual Corneas Provisionally Reflected in Six Real Mirrors.[37] Other paintings from Dalí's series such as *Athens Is Burning! The School of Athens and the Fire in the Borgo*[38] display both stereoscopic fusion and extreme binocular rivalry. In *Athens*, large parts of the left and right paintings (which are comparatively intimate, at about thirty by forty centimeters each) are completely different, making it impossible to see a coherent image, while some sections display elements of stereoscopic fusion, which partially anchor the viewer back into the image space.

Camera-Based Binocular Poetics

Further to binocular rivalry we discover the Pulfrich effect, named after the German physicist and instrument inventor Carl Pulfrich.[39] As a researcher at the Carl Zeiss company in Jena around 1880, Pulfrich achieved major advances in the improvement of optics and in developing stereoscopic techniques. In 1922, Pulfrich was the first to describe the phenomenon that came to bear his name. The Pulfrich effect is a psychophysical percept wherein three-dimensional depth is perceived in two-dimensional lateral motion, if the vision of one eye of the viewer is slowed down through a dark filter such as one-eyed sunglasses. This creates a relative difference in signal timings between the two eyes, leading to the perception of three-dimensional depth. Following this direction, the Japanese experimental filmmaker Kazuhiro Goshima created an intriguing series of stereoscopic works which play with the time difference between left and right eye in imaginative ways to create three-dimensional space from two-dimensional source material. Goshima's short film *Shadowland*[40] is shot with a fixed 2D camera and depicts a two-dimensional city at night, in which only the shadows, created from the time-difference parallax of moving car headlights, take on a three-dimensional form. Goshima (2014) emphasizes that,

> The essential factor of 3D vision is binocular parallax. I derive parallax from the slight time lag between the movies projected onto the right and left eyes. There are no digital special effects. I show the same movies to each eye but there is slight time lag (one–five frames).[41]

The outcome of this rather simple transformation is highly effective and surprising, as the ephemeral by-products of urban traffic—the wandering reflections and fleeting shadows—are poetically reimagined as sculptural characters three-dimensionally emerging from the cinema screen. *Shadowland* really comes into its own when viewed on a large-scale stereoscopic

37 Salvador Dalí, *Dali from the Back Painting Gala from the Back Eternalized by Six Virtual Corneas Provisionally Reflected in Six Real Mirrors* (stereoscopic paintings, left and right, unfinished), 1972–73.

38 Salvador Dalí, *Athens Is Burning! The School of Athens and the Fire in the Borgo* (stereoscopic paintings, left and right), 1979–80.

39 Carl Pulfrich, "Die Stereoskopie im Dienste der isochromen und heterochromen Photometrie," *Die Naturwissenschaften*, 10, 1922, pp. 553–564.

40 *Shadowland*. Directed by Kazuhiro Goshima, Stereoscopic film, 14:32 min., Japan, 2013. see also p. 174.

41 Kazuhiro Goshima, "Shadowland," in *CyberArts 2014: International Compendium Prix Ars Electronica*. Edited by Leopoldseder, Hannes, et al., (Berlin, 2014), p. 27.

Guest Editorial. Perception, 1994, vol. 23, pp. 981–89. https://journals.sagepub.com/doi/pdf/10.1068/p230981 (accessed October 18, 2018).

Figure 4: Blake Williams, *Red Capriccio*, 2014.

screen such as Ars Electronica Center's Deep Space 8K floor-to-ceiling projection environment. Then the shadows truly rise up from the screen and enter the room, which is all the more impressive since the city from which they emerge remains at a safe, two-dimensional distance from the audience. As the film unfolds and envelops us, we witness the beauty of time passing by, and we forget that it is time itself, through the different signal timings, which create the film's magic. *Shadowland* feels like a meditation on life and fleeting, in-between moments, on what is hardly noticed and mundane. Rather than a shadow play or shadow theater the work evokes the urban as a shadowy organic body in becoming, and as a site for hidden treasures, a poetry of light rhythms, impermanent, cursory figures appearing and disappearing like dancers against the city's concrete surfaces.

Vancouver-based artist Blake Williams also takes advantage of left-right time difference to create three-dimensional parallax in sections of his film *Red Capriccio*.[42] The film's main focus, however, lies elsewhere. Made entirely from found two-dimensional video footage, and created specifically for anaglyphic 3D glasses, the film plays with, and intensifies, the color-specific binocular rivalry built into the anaglyphic process. Through color correction and solarization of the separated red and cyan stereo channels, *Red Capriccio* creates intense eye-asynchronous flicker effects and duotone luster.

> The image, distilled through the Anaglyph filters—one bloodshot and the other frigid—grants each eye its moment; one fills in the blanks for the other, the two share together but then finally fight for exclusivity, blinding the other before being blinded right back.[43]

Again, here is the image of the fight, which Akten addressed in his film. Williams takes this fight for dominance between left and right, and playfully develops multiple open-ended strands of meaning from it, constructing *Red Capriccio* around polar opposites of machines and landscape, motion and stasis, crescendos and glissandos, and of course the multiple blinding reds and blues. Set in a desolate urban environment, the three movements of the film depict nighttime scenes of a parked Chevrolet Caprice Police Pursuit Vehicle, the Turcot three-level stack freeway interchange in Montréal, and an empty room illuminated only by moving disco lights. Through these juxtaposi-

42 *Red Capriccio*. Directed by Blake Williams, Anaglyph stereoscopic video, HDV, 6 min. HD, USA / Canada, 2014. Featured on Blake Williams's Website, https://blakewilliams.net/red-capriccio-2014/ (accessed October 15, 2018).

43 Blake Williams, "3D in the 21st Century. Becoming 3D." Mubi.com, 2015, https://mubi.com/notebook/posts/3d-in-the-21st-century-becoming-3d (accessed October 10, 2018).

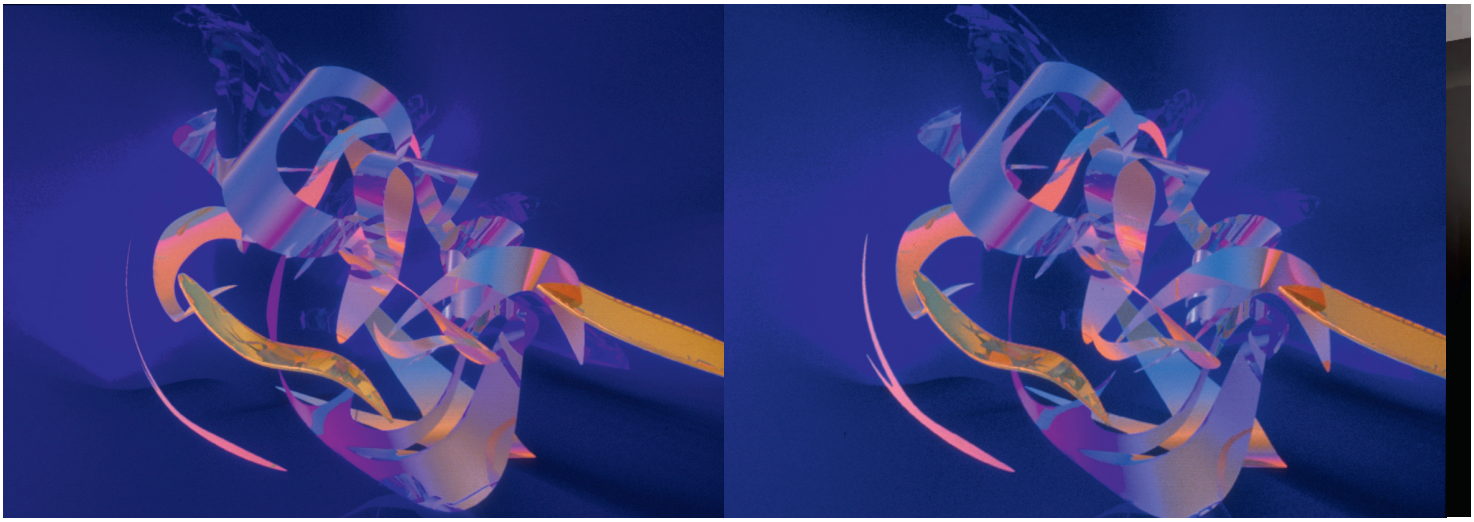

Figure 5: Vibeke Sorensen, *Maya*, 1993.

tions of the emptiness of his subject matter and the visual intensity of anaglyph flicker and luster, Williams manages to present a strangely manifold visual-narrative space. This red-blue color sphere is more like an afterimage or image behind the closed eye: an image of trauma or intoxication, a dreamlike remembrance of an event that might have never happened. Pulsating thoughts. Nightmarish, but so very real.

Williams's expanded exploration of anaglyph imagery also loosely relates back to Smith's *Film No. 6*[44] *[Untitled 3-D Abstraction]* from 1951, which creatively works with the red and green anaglyph process it relies on for stereoscopy. *Film No. 6* presents a recording of a live performance in which paper cut-outs are suspended in space and lit by red and green lights to create anaglyphic shadow images on the screen. These are combined further with red-green depth displaced projections of pre-recorded images to create multi-layered abstractions. "Smith's interest in Alchemy led him to design "magical" configurations that do not necessarily correspond to ordinary experiences,"[45] notes Moritz.

Paradoxical Digital Spaces

An early example of digital moving image work which features expanded approaches to stereoscopy is Vibeke Sorensen's computer-generated short film *Maya*.[46] This atmospheric abstract animation of organic shapes was produced at the San Diego Supercomputer Center's Advanced Scientific Visualization Laboratory and exploits mirroring and reflection within the three-dimensional image space to create spatial ambiguities and confusions. The film's title *Maya*, of course, refers to the Sanskrit word meaning "illusion" or "magic," or more precisely the conflict between illusion and reality. In Hinduism, the whole world is Maya: a veil that covers divine reality behind the materialist entrapment, which constitutes the illusion we perceive to be real. According to Sorensen,[47] the film is a reflection on representation and illusion, partly provoked by the quest for increased realism in computer graphics. Sorensen saw this emergent computer graphics realism as a surface illusion, that should not be confused with reality. Instead, computer graphics should be understood on its own terms, with its own specificities, which offer the potential for new experiences. In *Maya*, some of this new potential is explored through stereoscopic visual abstraction. Here, photorealism and "objective correlative" are removed, to focus the viewer's attention purely on the perception of space and how it unfolds over time within the three-dimensional computer environment. Some of this spatial exploration is done in novel, medium-specific ways, leading to contradictory, paradoxical spaces: for example, Sorensen maps 3D images inside of other 3D images, which leads to fractal-like spatial recursions, where objects become windows into other spaces.

44 *Film No. 6 [Untitled 3-D Abstraction]*. Directed by Harry Smith, 1951.

45 William Moritz, "Stereoscopic Abstract Film William Moritz's notes for 1999 lecture,"https://www.centerforvisualmusic.org/WMlecstereo.pdf (accessed October 12, 2018).

46 *Maya*. Directed by Vibeke Sorensen, Stereoscopic animation film, 7:15 min., USA, 1993.

47 Sorensen, Vibeke, "Art-Science / Art-Engineering Interactions: Four Decades of Experimentation," (Masterclass), Punto y Raya Festival 2018, CeTA Centrum Technologii Audiowizualnych, Wrocław, Poland, October 26, 2018

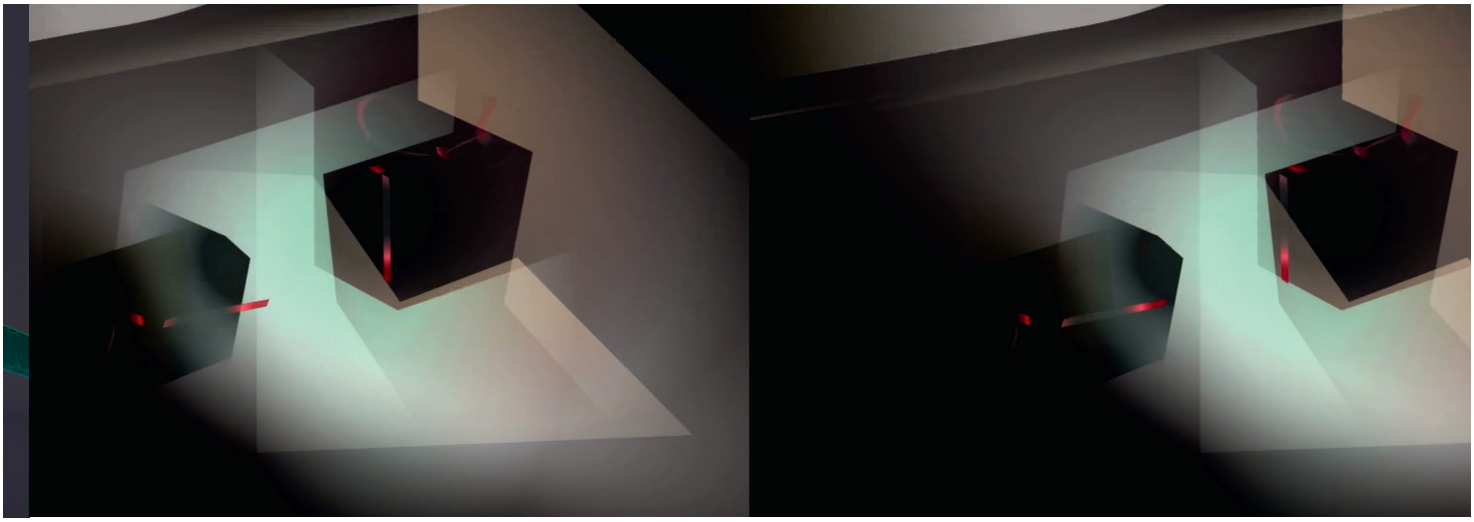

Figure 6: Sebastian Buerkner, *The Chimera of M.*, 2013.

> In one scene stereoscopic images are projected onto flat discs making up a small sculpture. Each disc is a circular window to another 3-D space. The result is a perceptual paradox: you see the edges of the disks in a sculpture made up of flat surfaces. But when you look at each separate, "flat" disc, you see windows to spaces that extend far beyond the space of the sculpture. The two spaces contradict each other, but the mind holds them together.[48]

The artist also made use of the computer's ability to adjust the interaxial separation between left and right eyes: "By using interaxial separation to scale up or down objects and scenes, I was able to better understand the structure and continuity of space and to have very fine control over the abstract visual elements that I used to compose *Maya*."[49] This was, for example, employed in a "3D cross-dissolve," where there are two sets of 3D cameras, and Sorensen controls the moving apart (increasing depth) and moving together (decreasing depth, flattening, and appearing farther away) to modulate spatial perceptions. As a result of this "3D cross-dissolve," the 3D scene on screen flattens and becomes the surface of an object of the next scene. This play with surface and depth, where three-dimensional spaces become surfaces of objects, and objects become windows into other dimensions, breaks and probes our preconceptions of space, and indeed, by extension, reality itself.

A more recent computer-generated work which re-configures and questions our perceptions of space is Sebastian Buerkner's 25-minute long stereoscopic digital animation film *The Chimera of M.*[50] Here, three-dimensional space appears malleable and disjointed, otherworldly yet strangely familiar. Ephemeral elements such as shadows, floating specks of light, and reflections are spatially foregrounded. Through the orchestration of multitudes of overlapping 2D-animated layers within three dimensions, Buerkner creates an unstable post-Cubist visual universe, which celebrates an abstracted, multi-perspectival version of space. This highly expressive use of stereoscopy, while pushing and distorting, or making malleable, the conception of reality, reinforces the spatial and visual ambiguity of the film's narrative.

In *The Chimera of M.*, the viewer is put in the position of an elusive protagonist who moves through obscure spaces as he reengages with his past relationships. If there are faces in this loose abstracted narrative, they have the quality of an animated, unstable Francis Bacon portrait, where details are brushed over, giving the impression that there may have never been a face in the first place. There is a lack of clear identification of a person or character, with Buerkner's use of stereoscopy supporting this dissolution of a stable visual coherence, of a reliable figure–of any reliable figuration. In this work this is beautifully posed in an atmospheric, soft, sometimes almost cartoonish and humorous manner, with the viewer being allowed to

48 Vibeke Sorensen, "Maya," Vibeke Sorensen Official Website, 1993, https://vibeke.info/maya/ (accessed October 15, 2018).
49 Vibeke Sorensen and Robert Russett, "Computer Stereographics: The Coalescence of Virtual Space and Artistic Expression," *Leonardo*, 32(1), 1999, p. 45.
50 *The Chimera of M.* Directed by Sebastian Buerkner, Stereoscopic animation film, 25:12 min., color, UK, 2013.

Figure 7: Max Hattler, *III=III*, 2016.

retreat into the unseen protagonist. There is also a sensation of, or hinting at, the sphere of a painterly scene we might find in Luc Tuyman's oeuvre. Such scene is in fact never a scene in the sense of being staged or deliberately constructed, but is a noticing of moments and givens in one's surroundings. And this is then reduced by the artist to showing us only bare visual clues.

Space in *The Chimera of M.* is reminiscent of Cubism, but equally connects to surreal futuristic film worlds. We want to be *in* the work precisely *because of* its deluding environment. And there is both a sculpturing dynamic as well as a flattening or schematizing motive in the way the film draws the viewer in. It wants you to be there, but at the same time occludes access. In that sense, the stereoscopic prospect is enticing as it underlines this process: dreamland in reality, imaginative, blending abstraction and the figurative in combinations virtually never seen before. This is a deliberately false construct, wherein the viewer's contorted relationship both with the uncertain spaces in the film, and the multi-dimensional film space itself, as well as with the protagonist's point of view, adds to the effect of absorption and disorientation. The sound supports the confused narrative. There are voices, splinters of conversations, motors, muffled techno beats and thunder, the door creaking as someone enters.

With *The Chimera of M.*, then, stereoscopy must be considered as expanded, as it becomes a means to underline viewer affect and narrative expressiveness in a contemporary spatiotemporal visual poetics. Visual abstraction and expression come together, as they merge in the exposition of the film's unfulfilled, inconclusive narrative. The spatial and visual ambiguity of the film's narration is reinforced by a vehement stereoscopic reconfiguration of space and spatial compounds as it were: and there is a sensation of a kind of mind game, or image of the deepening plasticity of the brain.

Lastly, random-dot stereograms should be mentioned here briefly, as a further approach towards paradoxical digital stereoscopic spaces. Invented by Christopher Tyler[51] and popularized by the *Magic Eye* book series,[52] random-dot autostereograms constitute single images of random dots which are computer-encoded with a depth map. When seen with the correct binocular convergence, the two-dimensional noise patterns open up into a fully three-dimensional scene hidden within. The revealed 3D space itself is not "expanded" as such; it relies on parallax and stereoscopic fusion to appear. However, the effect of something tangibly spatial appearing out of two-dimensional noise is so surprising and unique, that it warrants being included in this section, as it may open up avenues for further artistic experimentation. It was, in fact, one of the techniques I took up in my own artistic stereoscopic explorations.

51 Christopher Tyler and Clarke Maureen, "The Autostereogram," Stereoscopic Displays and Applications Conference, Proc. SPIE Vol. 1258, 1990, pp. 182–196.

52 N. E. Thing Enterprises, *Magic Eye: A New Way of Looking at the World* (Kansas City, 1993).

III=III and beyond

My animation piece *III=III* was developed for Animamix Biennale 2015–16 as an experiment, as a first approach towards expanded stereoscopic spaces.[53] The work was projected on a four-by-three-meter silver screen in the gallery space. It presented the viewer with a series of ten-second vignettes appearing in a looped sequence, which explore different stereoscopic effects ranging from subtle to extreme. The aim was to incorporate binocular rivalry while maintaining enough parallax-based geometry to ensure stereopsis. Several scenes explore different colors in left and right eye images to create luster. This effect is at times almost unnoticeable, as it does not draw too much attention to itself. A stronger binocular rivalry percept is achieved when a 3D object remains stereoscopically fused, while its textures are considerably different in the left and the right image. The viewer can process the image as three-dimensional, while simultaneously being confronted with the destabilizing sensation of binocular rivalry. Only in one scene, used for "shock value," the rivalry is so extreme that the image becomes completely unfusible, creating a conflicted visual space that is hard to watch and difficult to endure. Here, wireframe tubes, one per eye, rotate in *opposite* directions. At this point viewers in the Animamix exhibition often took their 3D glasses off to escape the jarring sensation. In other scenes, 3D depth maps are employed to create deformations and invisible, inverted spaces: in one scene, clusters of cubes move towards the viewer. When seen in motion and through 3D glasses, an opposite movement of invisible counter-cubes reveals itself. In two scenes, I adapted the random-dot stereogram *Magic Eye* technique with animated stereo pairs of random dot images. Here, the viewer only sees random noise on the screen, as they approach the work in the gallery space. Yet a fully three-dimensional, animated space "magically" appears when 3D glasses are donned. These sections were the most commented on by the Animamix audience, as they elicit the greatest amount of surprise, derived from the extreme difference between watching the screen with 3D glasses and without. Since the creation of *III=III*, I have continued to explore expanded stereoscopy in and through my moving image work. In 2018, some of the *III=III* scenes were adapted to a Unity-based VR environment. While the use of a VR headset made the binocular experience stronger, it simultaneously weakened some of the compositional aspects I am used to working with, through the open-endedness inherent in the VR space. My current moving image work picks up and continues some of these issues by further experimenting and exploring, with both camera-based and computer-originated stereoscopic approaches. At the same time, experimental stereoscopy has found its way into my audiovisual performance practice, in the form of another iteration of the Hattlerizer setup, namely *Hattlerizer 4.D*.[54]

Conclusion

Stereoscopy holds the potential for expanded uses that go beyond the emulation of human vision and the faithful recreation of perspectival space. This can take the form of spaces where depth relations are disjointed and appear to be paradoxical. Or spatial manifestations where new dimensionality and visual intensity is excavated, carved out from flat source material. This is a sculptural process with implications: what is considered flat–and is also often seen as secondary and minor to perspectival space–hosts space or cosmos. In that sense the "flat" holds the potential of re-ordering hierarchies and power relations in new and unpredictable ways. Beyond this speculative note around an animation of the yet-to-come, the use of binocular rivalry stipulates and bears unique perceptions ranging from the subtle observation of luster to the uncomfortable, destabilizing experience of a complete breakdown of stereopsis. The promise an expanded stereoscopy holds, especially when it develops from artistic practitioners or film makers, comes as a promise of the imaginative, as it channels our desires for unexplored and unthinkable realms against or beyond "realism." There is a drive towards rupturing familiar narratives that the expanded stereoscopic is drawn to. This is fascinating, especially when it maintains its power of being something marginal and liminal, actual and virtual at once; escaping precise categorizations and forensic readings. Having been reluctant about stereoscopy and its relevance to my work in the past,

53 To be precise, there is one earlier stereoscopic experiment, an animated loop for Pulfrich effect 3D glasses entitled *Forms II (Karate)* (directed by Max Hattler, 2011). Here, motion capture data is abstracted inside a polyhedron mirror, creating complex spatial confusions. It was produced at CalArts with a group of Experimental Animation students and guided by technical and inspirational advice from Michael Scroggins.

54 *Hattlerizer*. Audio-visual performance by Max Hattler, length variable, 2010–. See also "Live and Direct," Max Hattler (website), https://www.maxhattler.com/live/ (accessed October 15, 2018).

this research has opened up many new lines of inquiry beyond my comfort zone, as it were. And I am excited by the still relatively untapped potential for artistic expression. In conclusion, alternate uses of stereoscopy constitute modes of an expanded cinema which allow for novel ways of seeing that are at once deeply personal and subjective–individual to each viewer–and unique to technologically aided binocular vision. These approaches, with flatness and new depth, spatio-visual abstractions and confusions, and a re-empowered viewer in essence, compel ways of seeing which are exceptionally *impossible* in the real world. As such, they can be seen as a true, "magical" as well as real, expansion of the senses. How this expanded cinema registers the technological and the ways we narrate the human and in/animate as it evolves further remains to be seen. One strategy might be to continue to try and rupture things, and carefully observe if and how the broken remnants are exploded into space to create new spatial configurations.

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