Observations on the Moving Image as a Physical Phenomenon and Future
Possibilities for the Animation Medium

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Declaration of Originality

This dissertation is submitted by the undersigned to the Institute of Art Design & Technology, Dun Laoghaire in partial fulfilment of the examination for the BA (Honours) (programme name). It is entirely the author's own work except where noted and has not been submitted for an award from this or any other educational institution.

Ross Maloney   Signature here

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Abstract

This thesis examines the aspects of physical phenomena inherent in the moving image, aiming to inspire a contemporary treatment of the animation medium. Juxtaposing the visual developments in live-action cinema, as fine art; a new ground for analytical discourse, display technology and artistic practice is underscored. Artists' work of past and present are selected, communicating a progression of practice that manifests the medium's physical properties. This thesis endeavours to inspire those of its persuasion, solidifying this physical manifestation as a viable practice, and one of deeply rooted foundations.

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Introduction

Throughout this thesis, we will investigate the physical phenomena present within the moving image. This is in the sole interest of enlivening our appreciation and understanding of animation and its sensory effects, of which may propel the innovation of its form for years to come. I endeavor to post this phenomenological analysis within the broader animation discourse, as to see - within their juxtaposition - the analytical contrasts that lie. Artistic developments within both fine art and live-action cinema will be discussed allegorically relative to the progression of animation, and its future trajectory. With focus upon the moving image's technical constraints – that of the camera – the unfounded convention of animation's appropriation of photographic reality will be discussed in a cautionary manner. In the latter two chapters, examined are the artistic considerations that our phenomenological purview may inspire. These two chapters attend to the optical and material aspects of the medium respectively. I hope to communicate the baseline of animation – straying from the categories of two-dimensional and three-dimensional – as to illustrate the key phenomena present within all forms of moving imagery.

Chapter One:

Observations on the Moving Image as a Physical Phenomenon

My only interest in defining animation (or rather, defining by undefining), is to cast off the arbitrary limitations that colour how we teach and work in the medium. For the moment, forget about animation's cultural, historical connections and important work. Animation is a visual phenomenon; an optical illusion that exists within the bounds of optical reality. Then, a worthwhile question may be: How does animation distinguish itself of reality? Or: What qualities of an animated image are not present in natural motion?

An open film projector demonstrates this key optical conversion. The film stock is both pulled at speed and mechanically posed frame by frame. The key transformation conducted by the projector is that of the visual consistency of the frames as an *object* (leader and all) to consistency within *frame displacement* projected on a surface. The mechanical, intermittent feeding of film stock in front of the lens displaces each frame with the next; the shutter covering its transition. This facilitates the sequential displacement of each frame as opposed to projecting a speeding filmstrip. Similar mechanisms, as the viewing slit of a zoetrope make this conversion also. Projecting imagery in this staggered fashion is in sole interest of preserving image clarity; the illusion of frame displacement - though less clear - is visible upon the physical filmstrip as it is pulled through the machine.[1] The significance of this fact means the demystification of the animated image, placing it not within a realm unto itself, but as an optical phenomenon occurring within natural motion. Moving images are not limited to their projection upon a screen, their phenomena are present and inseparable from the physical world.

Another instance of 'frames' in optical reality may be seen as LED car headlights, passing at high speed. Each flicker produces an impression of light plotting its trail, persisting as a dotted line. (Fig.1.). A common misconception is that *flicker* is what facilitates moving imagery, though it is just a remnant of older technology. Modern displays suffice without flickering; progressive scanning is most common - revealing each subsequent frame by scanning top to bottom - essentially maintaining a median light-level in its transition. Returning to our previous question, what are animation's distinguishing characteristics? The technical reality is, animation - as it is widely understood - need be nothing but *frame displacement*. When an image remains in place for longer than its transition to the next (combined

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[1] Technology Connections, (2022), *Movies made sound with a light bulb*, Youtube.

with its resulting visual nuances, as we will investigate later), distinguishes animation of visual reality. Since the entire medium is founded solely upon this minor technical basis, why is that we impress such a particular definition upon it? Seemingly most people understand animation only for how it has been previously used; being narrative treatment and casual structures of communication. Despite this, animation remains an artistic field of boundless phenomenological expression and experimentation.

Long exposure photograph, illustrating the optical effects of both flicking and constant lights in motion.

Paul Wells writes: 'Animation's capacity to embrace all of the other arts within its production process … hides its virtuosity and identity as a form.'[2] The sentiment of this remains true, I might add that because of this versatility - encompassing optical reality in its entirety - the medium escapes any meaningful definition, identity or form. This state of limbo does not make for satisfying analytical discourse, though for the future artistic progression of the medium it may. Animation is not only capable of embracing all the other arts, but also embraces all of visuality; rendering any definition shortcoming. Fundamentally, animation is a just a word, a term of

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[2] Paul Wells, (2015), *Animation Manifesto; or, What's Animation Ever Done for Us?*, Metro Magazine, p99.

communication, and a ballpark figure. Labeling the medium places it within a box much too small for itself.

Wells speaks of animation's complicated identity, 'the underpinning issue here is that animation isn't 'serious'. It has never been the case, of course, that animation hasn't taken the world seriously.'[3] There is some truth to this statement, animation rarely presents itself as a singular experience, something in and of itself, routinely drawing from external sources. *Fantasia* (1940) for instance, self-describes as a 'new form of entertainment', while relying on well-revered classical music in hopes of - probably - aligning with its artistic validity. It may be harsh to call pandering on part of animation, though since its inception, it sought to bedazzle on common terms, appropriating rational figures and situations such as to cater to the common person. Think *Gertie the Dinosaur*, even *Humorous Phases of Funny Faces*.

Wells suggests that animation's perception of being 'inherently funny'[4] might factor into its difficulty in the art space - accounting the 'American animated cartoon'[5] as its cause. I don't believe that this claim is valid, such that artwork and entire art movements feature humour extensively. Much more likely a cause be the assimilation of animation to the form of live-action film and television narratives, perpetuating this notion of non-seriousness or parody; assimilating established art, diluting for a select audience - as often children. From our phenomenological standpoint, this imitation of form is distracting, it belies the manifestation of physical and structural elements inherent in the medium. Tom Gunning - in his *The Cinema of Attractions* - references a 'disappointment at the way (the medium of cinema had) developed, its enslavement to traditional art forms, particularly theatre and literature.'[6] I believe that animation is enduring a similar treatment to that described by Gunning, though enslaved to live-action cinema.

For now, we will pit animation and live-action cinema against each other as to investigate the phenomenological aspects of the former. (For clarity, in mentioning live-action filmmaking; the connotations are single-perspective imagery

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[3] Paul Wells, (2015), *Animation Manifesto; or, What's Animation Ever Done for Us?*, Metro Magazine, p98.
[4] ibid. p98.
[5] ibid. p98.
[6] Tom Gunning, (1986), *Cinema of Attractions: Early Cinema, Its Spectator, and the Avant-Garde.*, Wide-Angle, p56.

as created by a camera, then edited in a conventional manner.). A practical scale that - I feel - most often applies in defining animation; does it *comment* on an experience or is it an experience *in its own right*? This scale - commentary to experience - surprisingly traces our understanding of the medium.

The physical restrictions of the high-speed camera have bred a form of narrative and visual language peculiar to itself. Think shots, scenes, allegory, symbolism, the cut; all are borne of the technical restrictions affiliated with the construction of photographable scenarios. Rudolf Arnheim speaks of these limitations in *Film as Art:* 'The raw material that the film can use for its representations consists entirely of material objects and physical happenings. But mental processes may be expressed by means of these.'[7] The virtuosity of live-action's movement is similarly bound to photography. Arnheim references this also: 'Motion as it is actually experienced by the audience relies on... the movements of the objects, alive or dead, that are photographed by the camera.' Moreover, the temporal resolution of the high-speed camera facilitates (and often necessitates) a *realistic* quality of movement. I believe that these restrictions lend the medium to a form and depiction that is inherently commentative of real-life itself. Significantly, as these conditions of camera are not present within the animation process, they may be considered as traits of live-action itself. Consequently, the inverse of these traits may be attributed to animation, unshackled by commentative propensity, tending towards an experience in and of itself.

Photographical filmmaking is limited to a single-perspective viewpoint, meaning that all visible light within a field of view converges at a single point; being the camera's lens. This is the same for our own vision; though in a stereoscopic manner. The structural similarities of an image generated by camera and that of our own vision are obvious; the camera's viewpoint being most often treated as an 'observer' or 'third-person perspective' attests to this.[8] This pictorial limitation alone has greatly affected the language of film since its inception. Gunning speaks of these growing pains as endured by early cinema: 'the potential of the new art did not lie in 'imitating the movements of nature' or in 'the mistaken path' of its resemblance to

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[7] Rudolf Arnheim, (1957), *Film as Art*, University of California Press, P134.

[8] Jakob Isak Nielsen, (2007), *Camera Movement in Narrative Cinema - Towards a Taxonomy of Functions,* University of Aarhus, p14.

theatre. Its unique power was a 'matter of making images seen'.[9] Here, Gunning notes a transition of filmic approach. He references the 'ability to show something' as an opposition to the voyeuristic aspects of early narrative cinema. Distinguished is a form of cinema that spoils 'realistic illusion(s)', 'establishing contact with the audience.'[10] Sergei Eisenstein proposed this mode of analysis also, one concerned with 'sensual or psychological impact.'[11] Before returning to animation – and with the previous statements in mind - I would like to further our allegory to developments within fine art:

The Love Letter, Vermeer, (1670).

'Using semantic analysis we can often… identify a deeper narrative message or theme in Vermeer's paintings. To do this we must play the detective and piece together the composition of a series of objects that act as visual clues, indicating to us something that has potentially happened outside the immediate image, that may in some way affect the main person in it.'[12]

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[9] Tom Gunning, (1986), *Cinema of Attractions: Early Cinema, Its Spectator, and the Avant-Garde.*, Wide-Angle, p56.
[10] ibid. p57.
[11] Sergei Eisenstein, (1923), Montage of Attractions, Cambridge University Press.
[12] Mark Collington, (2016), *Animation in Context*, Bloomsbury Publishing, p27.
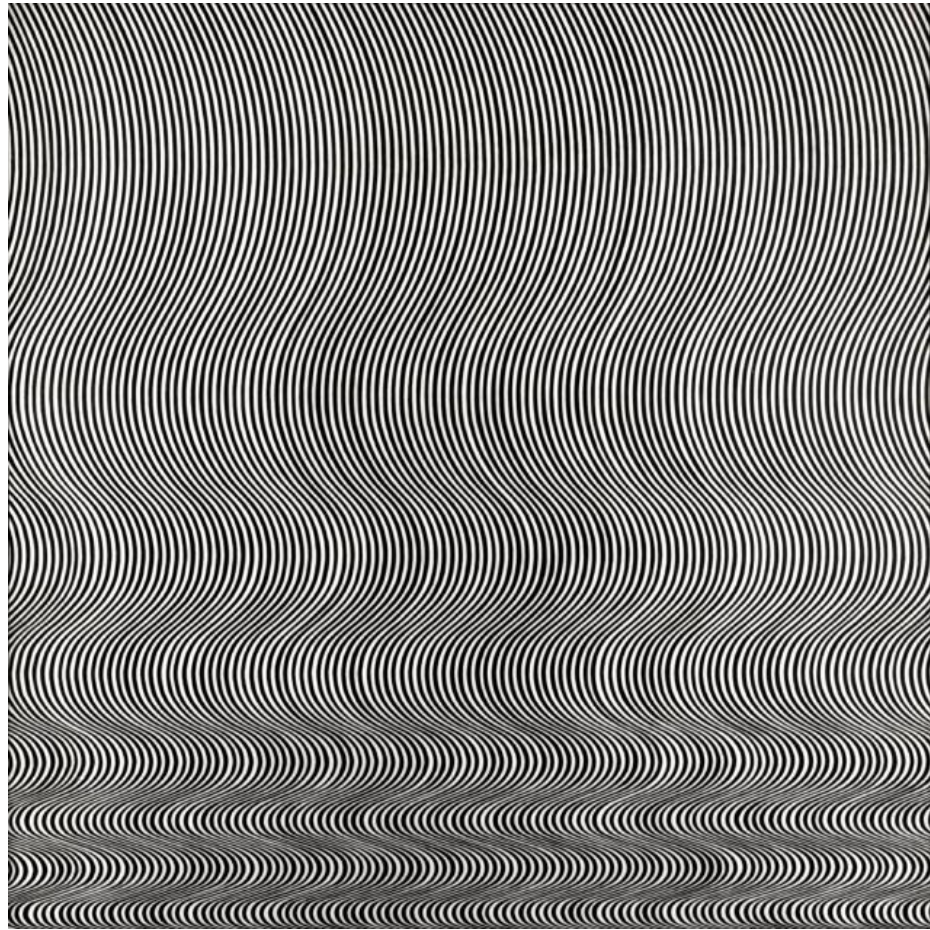
Fig. 3

Fall, Bridget Riley, (1963).

Interviewer: 'Do you see your work as an actual experience as opposed to a comment on other experiences?'

Riley: 'Yes.'[13]

    The contrasting appearance of these two artworks - and their analysis thereafter - mirror that same shift that Gunning and Eisenstein identified in filmmaking. In analyzing the work of Vermeer, Mark Collington pieces the painting apart as to derive meaning; constructing an illusory understanding of the scene both internal and external of the image-boundary. This analytic approach is both implicit and facilitated by Vermeer's realism, as the painting's photographic appearance. Whereas the optically oriented work of Bridget Riley presents a sensual experience

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[13] Kinolibrary, *(2018), 1960s Bridget Riley Talks About Jackson Pollock, Art, Artist, Interview*, YouTube.

within the act of viewing itself. Notably, Riley's work is independent of any camera-like perspective; instead, encouraging viewing from various spatial perspectives. Clearly, Vermeer and Riley are operating upon two different visual pretenses. If the work of Vermeer was to define the semitoic mode of image-reading, Riley's work seems to draw attention to the nature of experience itself. For painting as animation, the validity of the phenomenological experience within both mediums is often unacknowledged.

Fig. 4

Bridget Riley's solo exhibition at Hayward Gallery, (1971).

The 'attractions' as previously mentioned by Gunning, signify a progression of cinematic language of voyeurism towards sensory effect. The medium grew to accommodate a treatment of its material that references the viewer directly. Crucially, the extent of this sensory efficacy was limited to that of photography itself. Photographical filmmaking may form an experience within its own right, though – I would wager - to a degree less than animation. The optical plasticity of a photograph is extremely limited when compared that of a drawn image. (It should be mentioned, though drawn imagery is most often represented by photography, this is but a means to an end; such photographs merely communicate the drawing itself.) Furthermore, photography's deficit of virtuosity warrants the extensive

supplementation of animated elements within live-action films as seen presently. Though for our purposes, this combination of animation and live-action need be nothing but symptomatic of the former's phenomenal potential.
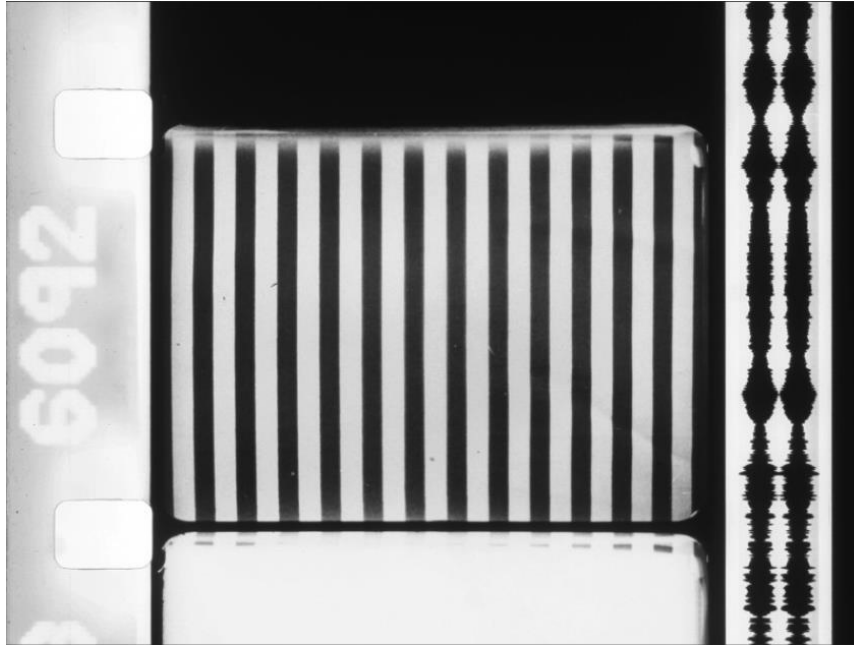
Straight and Narrow, Beverly and Tony Conrad (1970).

Beverly and Tony Conrad's *Straight and Narrow* exhibits flickering as to produce hallucinatory colours, though printed on black and white film. This film harnesses the technique of flickering as to generate psychological phenomena. Though a film of relative novelty, it utilises the animation medium well; it generates a (non-commentative) potent phenomenological experience unique to animation itself. Echoed by Gunning, there is a clear distinction between filmic work of voyeurism from those – as *Straight and Narrow* - founded upon 'its ability to show something'.[14] One would have considerable difficulty in drawing meaningful comparisons between the Conrad's film and that of live-action cinema. Unfortunately, this cannot be said for all of animation, routinely mimicking both its visual and narrative form.

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[14] Tom Gunning, (1986), *Cinema of Attractions: Early Cinema, Its Spectator, and the Avant-Garde.*, Wide-Angle, p57.

In indulging the scale of commentary to experience, the act of defining animation becomes a matter of attraction; expanding the limitations of photographical filmmaking may constitute animation - and too, visual stimulation that is unbound by the limitations of the high-speed camera. What animation may be - above all - is a treatment of moving image that details the viewer's experience within its visuality.

The routine form of narrative animation, as previously mentioned, mimics the form of live-action cinema. Mark Collington's *Animation in Context* focuses on the medium's narrative aspects. Chapter one, entitled *Defining Narrative and Creating Visual Meaning*, endeavours to investigate the visual qualities within an image of which we derive meaning; namely abstract symbols, objects, environments and composition.[15] Collington's focus is upon narrative imagery, structurally photographic images that may be pieced apart and decoded. His approach in analysis flags some key shortcomings of narrative animation's imagery; emphasised is the importance of metaphor and symbolism as to instill work with meaning. The key omission here is a consideration of the influence of *photography* within the medium's form and – as detailed previously - the defining limitations of photographical filmmaking. The camera bears a heavy load upon narrative language, necessitating that symbols and metaphor deepen its non-plastic method of image-making. As detailed before, Collington analyses Vermeer's painting *The Love Letter* as an opportunity for structuralist image-reading; Vermeer often cited as using a camera obscura may illustrate my point further.[16] For animation, the opportunity for semiotic analysis may be symptomatic of a lack of inspiration, and an over-reliance on established film language and image-making (too, a preoccupation with realist narrative).

Animation's routine imagery - figuration and naturalism - have cultivated a filmic form similar to photographical filmmaking, and thus endures its semiotic appraisal. In such doing, all of what differentiates drawn imagery from photorealism is neglected. Circling back to drawn animation, any element may be readily treated with an evocative *depiction*. All things within the frame may be visually distinct, and carry an interpretive sentiment. Will Eisner remarks in *Comics and Sequential Art*: 'In comic art, the addition of style and the subtle application of weight, emphasis and

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[15] Mark Collington, (2016), *Animation in Context*, Bloomsbury Publishing
[16] Charles Seymour Jr., (1964), *Dark Chamber and Light-Filled Room: Vermeer and the Camera Obscura*, The Art Bulletin.

delineation combine to evoke beauty and message.'[17] Aside from the concrete *look* of the animation's imagery, movement operates upon an entirely different pretense. Crucially, movement is unbound to a single perspective as in photography, thus *movement itself* generates meaning. When motion is independent of physical realism, its sole interest is no longer upholding our suspension of belief; but creating tactile sensations for the viewer. This sentiment is largely unconsidered in conventional animation teaching, favouring meticulously structured perspectives and physically consistent forms. This traditional approach is perpetuated throughout Disney's *The Illusion of Life*[18], in which the term life is in reference to images that are sufficiently *life-like* - or photographic. The aforementioned pandering within animation is evident here, the medium is but a means to stylise and evoke a superficial - often undemanding - cognisance of the world. Within this line of thinking I believe that any semblance of animation's artistry is dampened by convention - taken that these photographic structures do not inform the work itself. It should be considered that a moving image, operating upon a phenomenological basis - thus eliciting a real, sensory response - be more *life-like* than the mere imitation of photographic reality. Animation's plastic image may channel experiences beyond the bounds of photography, photo-like imagery and realist narrative, despite common teaching.

Semiotic analysis ignores many components of animation filmmaking that render the whole endeavour worthwhile. A film's constant erasure of imagery, its temporality, blooming light and presence of sound qualify itself as an experience if nothing else. The pretense of the moving-image illusion implies depth and a capacity for change, one lost in analysing work as it were a still image in a book. We engage with the moving image in a similar way to our own phenomenal experience of the world, it beckons for us to bring forth our personal experiences in *impulsive* interpretation. David R. Cerbone writes in *Understanding Phenomenology*: Your current experience intimates that there is more to be seen. This lends your current experience more in the way of 'depth' and 'density' than the experience of a flat image has.'[19] This phenomenological stance is much more encompassing of the medium overall and is one seldom written with regard to animation. Furthermore, as with 2D, stylised or abstract imagery, an extra (and intrinsic) personal effort is

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[17] Will Eisner, (1985), *Comics and Sequential Art*, Poorhouse Press.
[18] Thomas, Frank, Johnston, Ollie, (1981), *The Illusion of Life: Disney Animation,* Abbeville Press
[19] David R. Cerbone, (2006), *Understanding Phenomenology*, Routledge, p15.

required in their interpretation. Enlightened by the phenomenological aspects of the medium, new leagues of artistic work present themselves. Sound, light, motion, timing, viewing context; all tactile aspects of the medium inform a *felt* meaning.

Returning to the traditional toil of the drawn animation process: depicting and maintaining physical consistency through time. (Speaking of frame-by-frame animation.). The term on-model is commonly used within conventional animation practice, defining an element that maintains consistency with a predefined model-sheet. By and large, the craft of traditional animation boils down to keeping these elements consistent through time and perspective (on-model), while in many cases sustaining an evocative acting performance. Books like Richard Williams' *The Animators Survival Kit*[20] educate to this end. One may argue that the animation process in its natural state - having not learned the aforementioned methodology - tends towards symbolic inconsistency through time. One need look no further than preliminary student animations. (It should be noted that different processes - namely a digital workflow - counter this point, on part of static symbols being the status quo.) Seemingly, a visual entropy is naturally ingrained within animation, and its common teaching is its dissimulation. Collington references this sentiment: 'It is similarly surprisingly difficult to learn how to break down the seemingly obvious process of animating the key frames of a walk cycle for the first time… There are many processes in animation that we take for granted and therefore often overlook; or do not develop our understanding of them to the extent that we should to create more convincing work.'[21] This may illustrate a divergence in my understanding of the animation medium; naturalism and semantic consistency does not equate to convincing work. *Convincing* though, may mean different for the traditional animator as the modern artist. In the interest of artistic expression, there need be no barrier of entry or one proverbial methodology within the animation practice.

'One of the dangers of scientific naturalism, according to the phenomenological tradition, is that such a preoccupation makes one lose sight of (and sometimes actively deny) the idea that things are manifest at all.

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[20] Williams, Richard, (2007), *The Animators Survival Kit*, Faber & Faber inc.
[21] Mark Collington, (2016), *Animation in Context*, Bloomsbury Publishing, p25

Potentially lost as well is any appreciation of the kinds of essential structures that are definitive of the kind of beings we are.'[22]

Cerbone remarks that the grounds of phenomenology stand in opposition to the casual structures of naturalism; these casual structures tend to conceal the manifestation of present phenomena. From this I would propose these semiotic structures perpetuated by Richard Williams and those of similar persuasion, similarly belie the manifestation of the phenomenological aspects of the medium. This is a matter of display as *window* than display as *for the senses*; such traditional design language beckons us to suspend our disbelief as to recognise its simulated physical system. This pretense dampens animation's phenomenological aspects, splitting our attention between illusory comprehension and sensory response. In short, traditional animation has channeled the medium for its communicative powers opposed to exercising its inherent structure- being light and sound.

'I am a physical object sitting in a physical world. Some of the forces of this physical world impinge on my surface. Light rays strike my retinas; molecules bombard my eardrums and fingertips.'[23]

Despite my previous arguments, I do not wish to say that symbolism and communication are unsuitable within a hypothetical 'true' form of animation; rather that they are often treated with banality. Of animation, there are two classes of symbolism that warrant distinction: symbols that are necessitated by photographic structures (as to suspend our belief) and those that *inform* the phenomena of the moving image. The films of Robert Darroll depict symbols and elements the latter class. As before, the key distinction is that these elements are treated optically, Darroll's imagery has been designed to be *looked at*, not as to suspend our belief. This approach facilitates a singularly dynamic manifestation of light, motion and sound. Our attention is no longer split, between illusory meaning, suspension of belief and sensory effect; the latter being emphasised. The symbols - as the ducks in figure 6 - do not warrant a semiotic analysis as per their unrealism. Their frame of reference is not ours, but the phenomenon of the moving image.

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[22] David R. Cerbone, (2006), *Understanding Phenomenology*, Routledge, p17.

[23] W. V.Quine, (1957), *The Scope of Language and Science,* The British Journal for the Philosophy of Science.
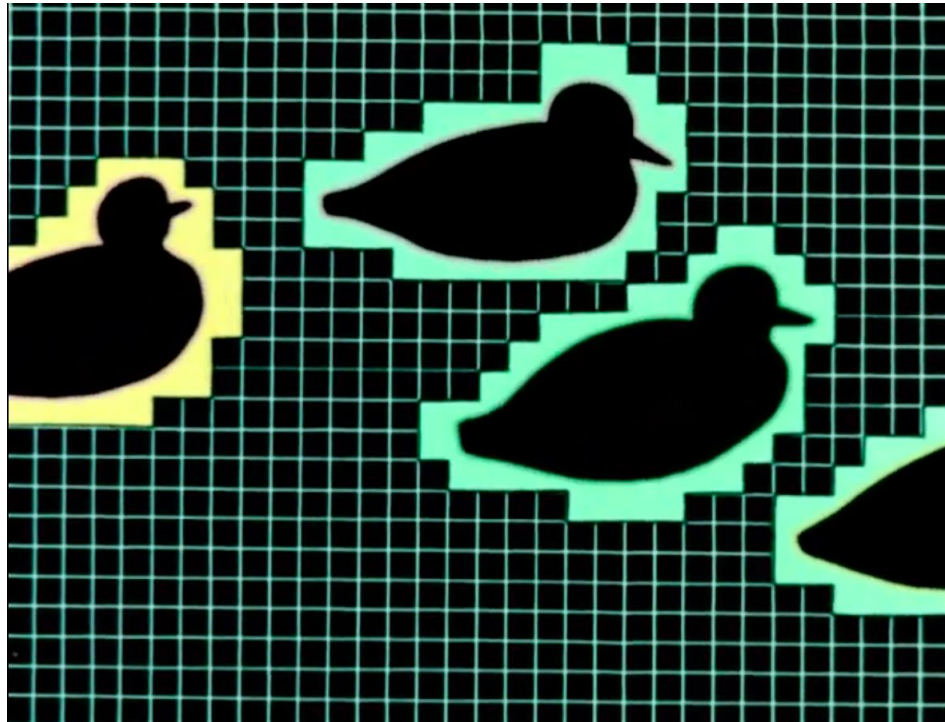
Fig. 6

Feng Huang, Robert Darroll, (1988).

Though the intricacies of sound design are outside the scope of this thesis; briefly, it should be noted that Darroll's use of music complements and punctuates the visuals in such a way that emphasises itself as a primary experience (being an original piece of music). In contrast, the work Oskar Fischinger (*An Optical Poem* [1938] for example), features previously established musical compositions. The discrepancy between these two is palpable, electronic sounds in the former case defy origin; or rather, the sounds of identifiable instruments often feel disconnected from imagery of all but said instruments. Furthermore, depending upon the previous establishment of a soundtrack, the supplementary animation may harbour a commentative aspect upon the prior existence of its sound. These distinctions maintain similar implications as diegetic and non-diegetic sound – and are worth your consideration. The navigation of this complementarity is a personal and artistic affair; the importance of sound design for animation cannot be overstated in channeling the medium's phenomenological aspect.

'Out of my own inexperience I have struggled to define my vision. I wanted to show you my ideas for a new language of art. I've demonstrated the earliest beginnings of a musical language of visual action, symbol and colour; but are these elements united in true complementarity? I do not know. I do know the union of colour and tone is a very special gift of computer technology and I expect that younger talent - undaunted by the challenge of making art with music - will find a potent voice in complementarity.'[24]

John Whitney - in his search for complementarity - proposed *symbol* as a pillar within the development of the new form of digital animation. For the sake of argument, an *inverse* of my thoughts in the previous example: Of animation in a sensory vein; the symbolic element is often dampened. When complex visual action is presented optically and rapidly as Whitney has done, then symbolism must come secondary to this. It proves difficult to meaningfully interpret symbols while the imagery is changing and promptly erased. A dedicated focus upon light, motion and sound distract from their concrete symbols. Again, I would not reach to say either sense or symbol should be discounted in creating moving imagery, although without tactful inclusion, their respective presences can be relegated as novelty. The implementation of symbolism and communication - within phenomenologically oriented animation - must be treated with tact; illusive interpretation and sensory experience are often weighed against each other.

    Whitney's work is important, its articulation of natural – and mathematical-phenomena manifests their optical patterns, bridging non-visual to visual. Relevant to our analysis, - aside from the sensory aspects of his work - the detail of his imagery retains concrete connotations of unseen phenomena, as present within the natural world. Whitney on these phenomena: '… all of the numbers at certain points will arrive at some sort of a harmonic relationship among themselves… and as a result produce a more-simple pattern… this harmonic phenomenon has many similarities and kinship to the phenomena at the root of the organization of music.'[25] Whitney remarks upon the rarity of work of his kin, being of phenomenological

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[24] John Whitney, (1992), *A Personal Search for the Complementarity of Music and Visual Art*, Youtube.
[25] Documentary Educational Resourses, (2015, filmed 1972), *Screeening Room with John Whitney Sr – PREVIEW,* Youtube.

complementarity betwixt sound and image: 'I have been very much a loner, I have wanted to see similar work and I wish there were much more than there is.'[26]
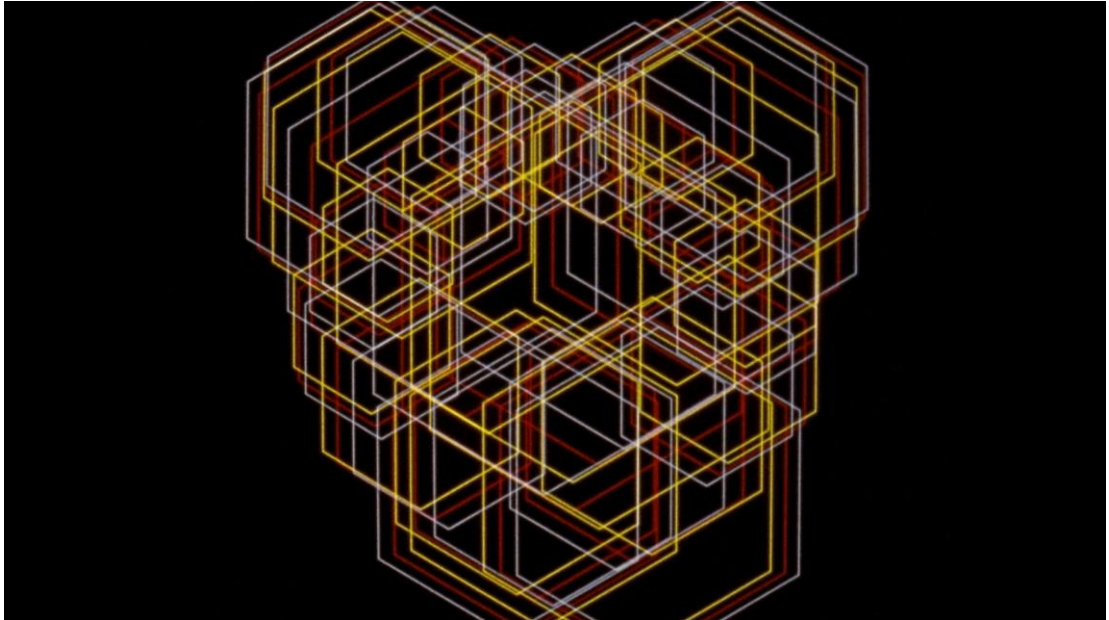
Matrix III, John Whitney, (1972).

…it will no doubt be noticed that books are designed and constructed with the aim of reading in mind. To that end, books and designed and constructed as to accommodate various aspects or dimensions of your body. If books were too large, the size of an automobile for example, or too small, say the size of a sugar cube, then you would have considerable trouble putting them to proper use…. Similar observations apply to other aspects of the book: the size and shape of the print, the spacing of the words, the dimensions of the pages and so on. Your bodily existence is not just imitated in your experience of the book, but it is more directly manifest.[27]

Cerbone's allegory concerning the design of a book - or rather reading material on the whole - as both a manifestation and accommodation of our senses - inspires

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[26] David Em, (2017), *AN AFTERNOON WITH JOHN WHITNEY*, Youtube.

[27] David R. Cerbone, (2006), *Understanding Phenomenology*, Routledge, p17.

meaningful connotations for the process of moving image design. We, as animators, should indulge our senses foremost; animation need be nothing but this indulgence. Regarding the medium's complementarity, forming imagery as a manifestation our own phenomenological existence may trump even the most imposing realist narrative. In the following chapter, I hope to outline some of the technical criteria that define a sensory persuasion of moving-image design.

Chapter Two:

Motion and The Image Boundary

 The foremost technical consideration in designing moving imagery is that of the tonal treatment movement itself. For our purposes, we may omit hue from our consideration per its dispensability; nothing may be seen independent of tone. (From black to white.). The phenomena of movement are sustained by incremental changes of tone, frame after frame.

Firstly, we will investigate how motion appears and progresses within real-life. (Natural Motion)

Figures 8 through 10 reference our visual perception at stages of lateral speed. Figure 8 details a pebbledash wall in stillness. Figures 9 and 10 show the same wall at moderate and high speed respectively. These illustrations visualize an effect often described as *motion blur*, though our vision is not blurred in motion. At speed, our eyes sample a larger stretch of detail than in stillness, such that the tonal consistencies relating these details are most apparent. In other words, individual details (as contrast) disappear, and their tones are approximated relative to a direction of movement.
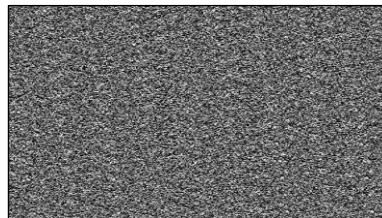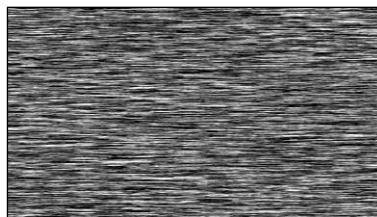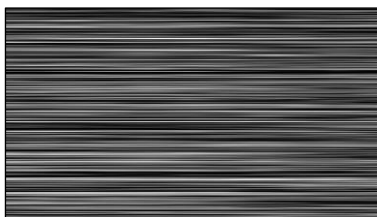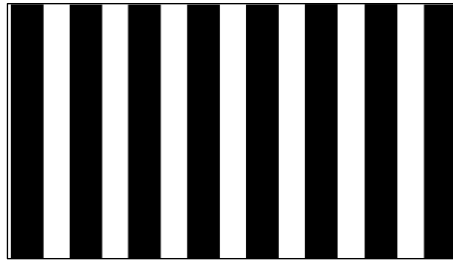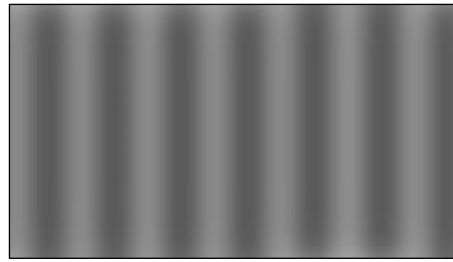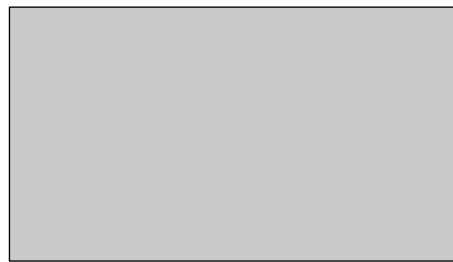

Fig. 8

Fig. 9

Fig. 10

Vertical lines crossed laterally are among the least consistent designs of motion to our eyes. Conversely, lateral lines crossed laterally are of the most consistent, perceived as motionless.

The intense detail of a pebbledash wall lends the eyes a great array of detail to interpret and derive tonal consistencies; both in motion and in stillness. In a less ideal view, such as the pillars in figures 11 through 13, another visual extreme is observed. (Again, each consecutive figure denotes the pillars in a state of increasing speed.). As seen in the progression in these illustrations, as the movement speed is increased, the pillars vanish. At high speed, the eye approximates a transparent tone; this transparency becomes increasingly invisible with speed. This phenomenon of *dynamic tonal contrast* defines naturalistic movement. If one is unconvinced, they may look from the window of a moving vehicle; sampling disappearing fenceposts and lateral ribbons of tone upon the pavement.

Considering these two cases, it is shown: all we see is tonal consistency, and (crucially) tonal inconsistency is invisible. 'The perceptual process is flexible: it depends on the context of the stimulus being perceived… It should be mentioned that not all stimuli result in a perception: some of the stimuli are not perceived at all (e.g., a light signal of very low contrast)'[28]

Returning to the moving image and the concept of *frame-displacement*; being the single optical distinction of animation from natural motion. The quality of movement sustained by natural motion is notably *smooth*, a sensation that must be reimplemented following the optical transformation to frame-displacement. Considering movement *as* tonal change, this smoothness is attributed to the incremental gradation of tone across frames; no harsh tonal changes occur frame to frame, thus less tonal contrast appears within the line of movement. An animation designer must be conscious of the appearance of natural motion; as in real-life, inconsistent elements may only be visible below a certain speed threshold. Simply put, if movement is to be consistently tracked and sensed as smooth, the comprising element must be blurred (tones approximated) relative to its line of motion. The absence of this tonal gradation presents further visual phenomena.

Inter-Frame Consistencies

Inter-frame consistencies are a visual nuance of frame-displacement. Within any two-frame instance, there exists a perceptual duality: one frame presents tonal consistencies tracking to the following frame, while both frames sustain tonal consistency in their contrasting impression. In the absence of tonal gradation between frames (as in natural motion), this new phenomenon is perceived. It is technically understood as *strobing* or *judder* and is considered an undesired effect in both animation and live action footage; though for our purposes, it is an important and exciting animatable space. (Strobing references the 'flashing' that occurs as a consequence of not fully gradating tonal contrast.).

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[28] T.Q.Khan, P.Bodrogi, Q. T. Vinh, H Winkler, (2015), *Led Lighting: Technology and Perception*, John Wiley & Sons Incorporated, p8.

Though widely misunderstood, this phenomenon occurs when our eyes prioritise the *tonal intersections* of consecutive frames as opposed to tracking movement sequentially. This effect is evident when hard-edge vertical stripes (mirroring the fig.11) are panned at constant speed in frame-displacement:
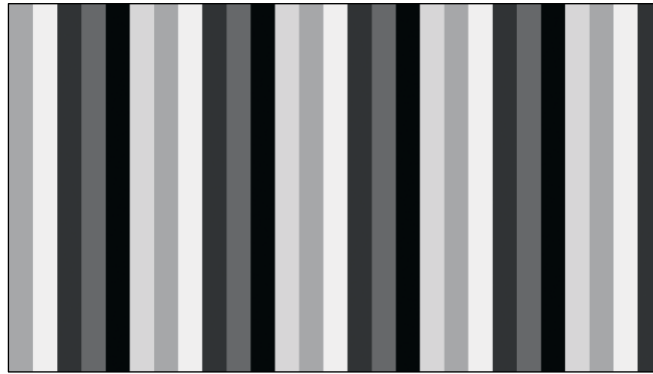
Inter-frame consistencies; these flickering divisions are apparent within viewing panning, contrasting, vertical stripes.

At standard frame rates (12-30 frames per second) - if to remain properly tracked frame to consecutive frame - high contrast elements must shift position by small increments. When these contrasting stripes are spaced at increasingly wide increments, other inter-frame consistencies thwart the leftward momentum. Significantly, this impresses illusory, flickering tonal divisions that are distinct from one another - not necessarily within concrete frames but within our perception. These visual sensations cannot be attributed to any one frame, but the combination of many. As mentioned, the intersections of frames form an animatable space; every two-frame instance sustains an intersection, and these intersections may be modulated throughout a sequence.

This phenomenon is sustained by several variables:
- Frame Displacement
- Plane size and viewing distance; tonal spacing.
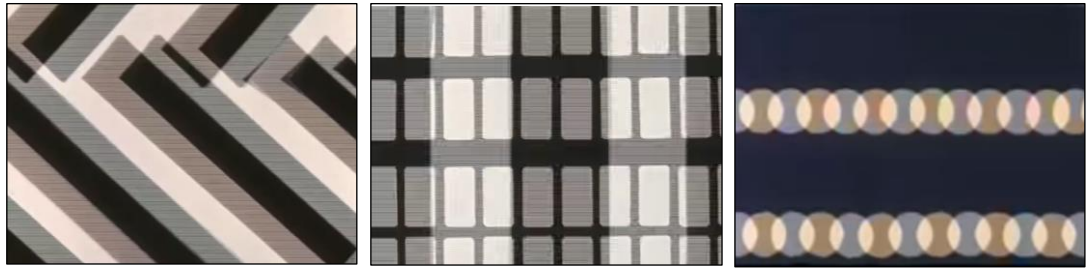- Frame rate.
- Tonal contrast

Train Landscape, Jules Engel, (1974).

Inter-frame consistencies are the driving force of Jules Engel's *Train Landscape*.
This film depicts variations of repeated patterns in leftward momentum.
Intermittently, the momentum is halted, and the eye tracks inter-frame consistencies;
virtue of the widely spaced, contrasting designs. Rightward momentum counters this
too, referencing the reversal of momentum that may occur in fast moving, repeated
patterns; such as a spinning wheel. Had Engle gradated his tones or employed
multiple exposures - as to emulate the aforementioned natural motion sensation -
these intersections would be toned down, thus rendering a realistic depiction of
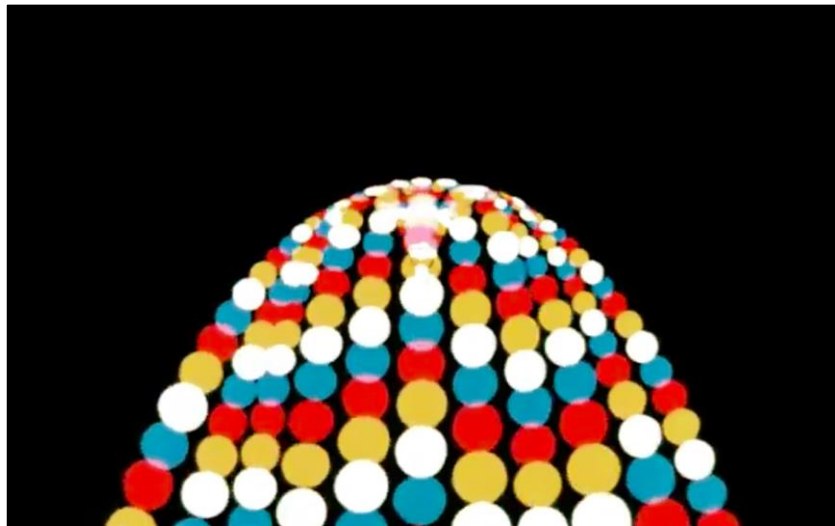speed.

Feng Huang, Robert Darroll, (1988).

 The phenomenon of tonal intersection is enforced as an element of design in Robert
Darroll's *Feng Huang*, as pictured above. With the implementation of colour - thus

more divisions - even more unique intersections are generated, exhibiting flickering colours that cannot be easily identified as any one hue. Notably, despite the divisions of each circle remaining still as pictured; movement is tracked through their path, in flickering hue and tone alone. This highlights an important consideration for the artist: movement may be generated independent of shifting tonal divisions, and tracked within static divisions of changing tone and hue.

In conclusion of the previous two sub-sections: The sensations of movement are a by-product of how we - as animators - control light. The incremental gradation of tone across subsequent frames sustains an effect akin to that of natural vision, that of smoothness and unambiguous motion. Whereas the inter-frame consistency method defines the contrary; harsh tonal changes between frames, birthing strobing intersections and ambiguous motion.

Tracking

In haptic visuality, the eyes themselves function like organs of touch. Haptic visuality, a term contrasted to optical visuality, draws from other forms of sense experience, primarily touch and kinesthetics. Because haptic visuality draws on other senses, the viewer's body is more obviously involved in the process of seeing than is the case with optical visuality. [29]

Dan Torre speaks of our animate vision: 'We do not simply look at a room, take a mental 'photograph' of it and work from that stored image. Our vision is much more akin to our cognitive processes; it is continually in process. Animate vision involves the movement of, not just our eyes, but also our head – in fact, our whole body is in constant motion as we visually perceive our environment … Therefore the 'leaping' from one view to another in film editing is cognitively plausible.'[30] Tracking does not only cognitively justify film editing, it bears the intrinsic design of the moving image; tracking defines our ability to shift our periphery and focus. Movement independent of stillness is inconceivable, motion by definition is a tonal progression towards or away from a still boundary, often our periphery. (In speaking of motion-

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[29] Laura U. Marks, (2002), *Touch: Sensuous Theory and Multisensory Media*, University of Minnesota Press, p2.

[30] Dan Torre, (2017), *Animation – Process, Cognition and Actuality*, Bloomsbury Publishing, p107.

tracking for animation, one must speak of motion relative to stillness; this stillness may comprise surrounding elements, or the image boundary itself.).

Returning to what we do not do - take a single mental photograph. Firstly, let's deconstruct the term photograph; for our purposes here, image boundary and single-perspective. Most importantly, I would like to communicate a key phenomenal discrepancy in our tracking of real-life motion and that of the moving image. In our active tracking of real-life motion, tracked elements are rendered still within our periphery; other movement then arises relative to this stillness. Though a camera captures many images within a second, its visuality derives from a single perspective as ours. The camera participates in tracking just the same as us, thus in watching its footage our tracking is *secondary*. Footage is tracked first by the camera, then by ourselves. This empirical gap has profound connotations for moving imagery, despite being widely unconsidered.

Animation is not restricted to single-perspective representation, though routinely emulates it. In an animated, panning landscape, objects in the foreground will move faster than those in the distance. This defines the innovation of Disney's multi-plane camera, named parallax, it emulates the illusion of depth and perspective.[31] (Parallax exhibits a discrepancy in motion - usually foreground and background - as to interpret depth and scale.). Though of this, the simulated camera-move is objective; crucially, its image boundary is *fixed*. Similarly, if a camera were to record a passing landscape from the window of a speeding car, the parallax effect would be the same; fast midground and slow background, *fixed boundary*. Though in reality, in viewing this landscape for ourselves, our tracking (shifting the image-boundary) of passing elements dictates the nature of our image in its entirety, the landscape is reactive to our eyes. If one were to track a passing tree, the entirety of one's image would perceptually revolve around that tree. As described before, tracked elements render themselves still within our periphery and the motion of non-tracked elements conforms to that stillness.

The cruces of this are the fundamental differences that define the phenomenological experience in our tracking of moving imagery versus ours of real-life motion. In a manner more directly manifest, 'blurred' elements - being those that swiftly cross the camera's field of view at larger shutter angles - will retain their blur

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[31] Disney Family, (2011 - Filmed 1957), *Walt Disney Introduces the Multiplane Camera*, Youtube.

regardless of our personal tracking - this is contrary to our natural vision. (Though this may be mitigated by utilising high frame-rates.). Moreover - within the bounds of our consideration – a *static* image boundary is customary within the medium; this is fundamentally dissimilar to our ever-shifting periphery.

The Image Boundary

Providing that the image boundary is in view, motion is often tracked relative to its boundary as not our periphery. (All depending on viewing distance.). The potency of tracking sensations hinge on the visibility of this boundary. Upon a small screen, similarly small movements occupy a negligible amount of our field of view obviating opportunities for tracking. Contrarily, in the case of a large screen with its boundaries extending past our periphery, the sensation of movement differs; motion can be tracked and plotted relative to each other, and our non-fixed periphery. The image boundary itself may generate alternate tracking sensations to those centre-frame. In the case below, a diagonal line is panned left and cropped by the image boundary. Though the objective motion of the line is leftward, the boundary sends our eyes downward as it crops the diagonal line vertically. (It should be said that regardless of my examples exhibiting simple line illustrations, these sentiments persist within all classes of moving imagery.).
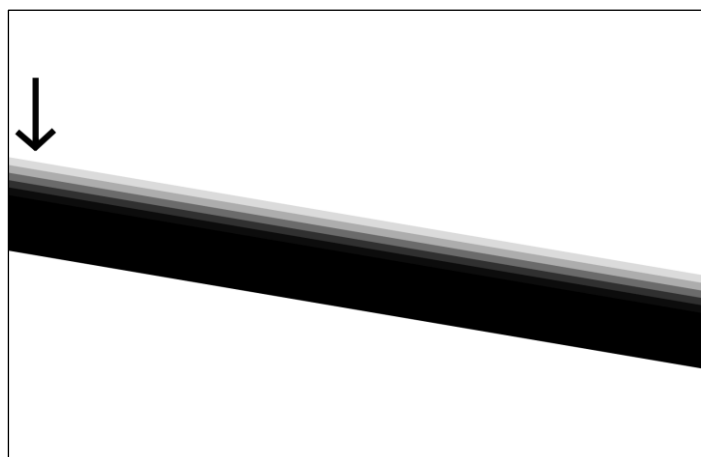
A diagonal line panning left is contextualised by the image boundary, the result is a downward motion.

The alteration of tracking sensations imposed by the image boundary are not limited to said boundary. All elements - still and motive - intrude upon each other to varying degrees. This is important, as it infers that concrete design, in layering, re-contextualises existing motion.

The phenomenon of moire intersection patterns - detailed in figures 20 through 22 - mirrors the previous example. This simple interference pattern generates entirely new movements in contextualisation. (If one is still unconvinced of the contextual effects of the image boundary, they may visualise fig.22 as a reoccurring instance of said boundary. In a sense, the image boundary is an immutable interference upon the moving image.).
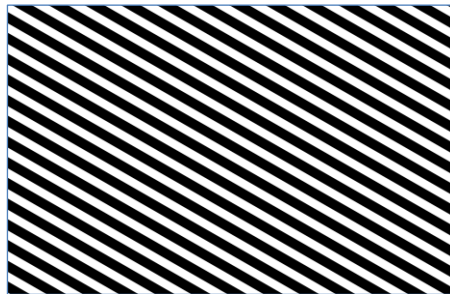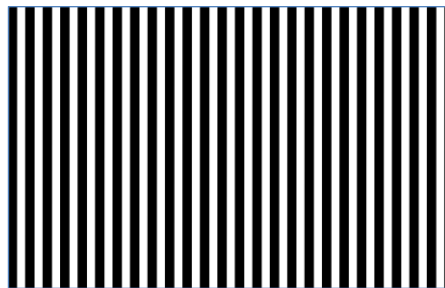

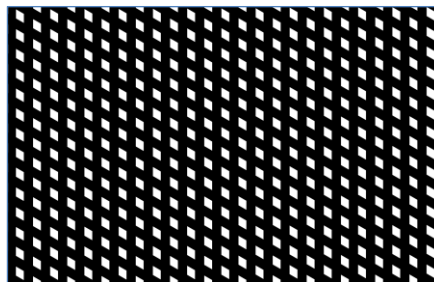*Fig. 20: Diagonal Lines Panning Left.*

Fig. 21: Still Vertical Lines.

Fig. 22: Layering of Fig.18 and Fig.19.

In layering figures 20 and 21, their white intersections track in downward movement.
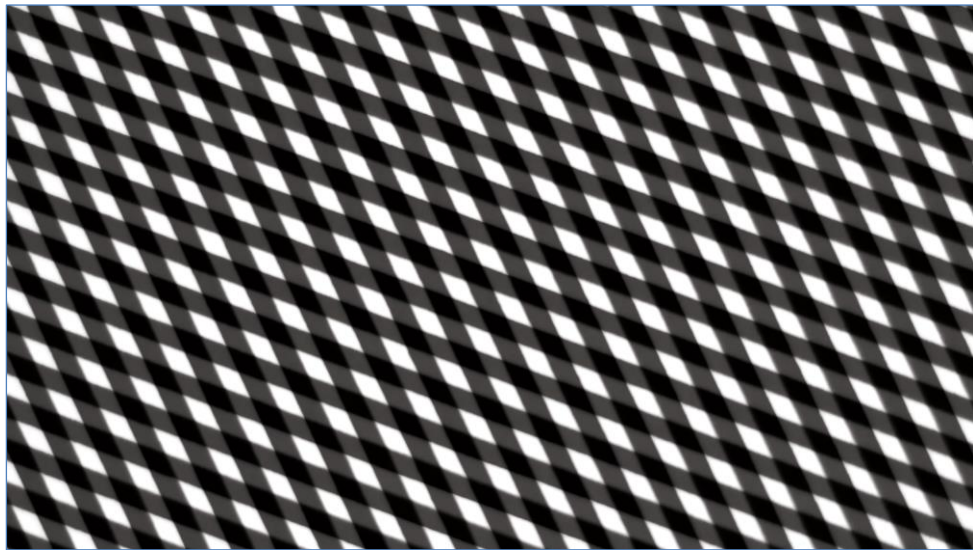
Fig. 23

WATERPARK, Ross Malo, (2023).

In my own filmmaking practice, I discovered that momentum may be tracked in multiple and contrary directions within a repeating loop. Tracking and inter-frame consistencies (or strobing) are often seen as opposites; if an element sufficiently tracks, then its progressive motion is prioritised over contrasting frames. Though, if an image were to track to every odd-numbered frame, and another image to the even-numbered; both images would track on an inter-frame basis. This concept may be understood as providing the viewer with *partial imagery* within single frames; of which are perceived - in motion - as whole images in frame displacement. All depending on the visual nuance of the partial imagery, they may be perceived at once; as one cohesive image. The ambiguity of strobing generates an image that is - in a sense - reactive to our gaze. As this type of image exists within our psyche (not within any single frame) its appearance is dictated by the viewer themselves. With the advent of higher frame rates, even more layers of trackable motion can be sustained – and with perceptibly less strobing.

Chapter Three:

Displays

Displays are the immutable matrices of which the phenomena of the moving image are interfaced. The nuance and capacity of a display should be a key consideration for the moving-image artist, though few stray the generalist, high-definition displays of our time. Baffling is the constant omission of display technology from so-called screen studies; only venturing as far as the discussion of aspect-ratio. This highlights an unfortunate attitude within animation analysis; its discourse is limited to that of the concrete information contained within the image boundary. As briefed in the previous chapters, animation's plastic image is more phenomenologically capable than as to justifiably impose this limitation within its discussion. When visual design and display are considered in unity, the resulting effects far exceed these bounds. In speaking of displays, I will omit those of direct control of the image by the viewer. Meaning VR, AR and similar displays will not be discussed because that would comprise a thesis in and of itself; we are only concerned with fixed, unmoving screens. Stereoscopic displays and active shutter glasses will also be omitted for the same reasons. Though of this, the considerations in this chapter (and those of the previous chapters) apply to those omitted.

In a manner more directly manifest, displays breed imagery peculiar to themselves. Contemporary screen-design is preoccupied with presenting photographic realism.[32] Higher pixel-counts are valued for their clarity and sharpness, though gradually they shy away from the tactile appearance of the individual pixel. While modern, high-pixel-count panels benefit photographic imagery, this is not the case for designed imagery. There exists a wealth of modern design - created for smaller pixel-counts - that do not benefit from resolutions greater than its native. Pixel-art intended for a CRT display illustrates this fact; the unique qualities dictated by CRT technology were paramount in its design. In comparing such design (fig.24), as displayed on both CRT and modern panels, their presentation markedly differs.

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[32] Temkar N. Ruckmongathan, (2014), *Addressing Techniques of Liquid Crystal Displays,* John Wiley & Sons Incorporated

Fig. 24

Final Fantasy VI (1994). Sharp Pixels (left) Sony PVM-20L2MD (right).

In seeing this discrepancy, one wonders how modern screen conventions have dictated our imagery in recent years. Echoing Cerbone's allegory from Chapter One: 'Your bodily existence is not just imitated in your experience of the book, but it is more directly manifest.'[33] If we are to apply this same logic to displays as books; we may further our consideration of designed imagery as not just a manifestation of our own visuality - but by proxy - a manifestation of the display itself.

Viewing Distance

Drawing upon the tradition of impressionistic painting, viewing distance is that which binds separate elements into approximative fields. Figure 25 details Seraut's *A Sunday Afternoon*, altered in greyscale. Though its paint is applied fragmentarily, its consistency binds tone. When the painting is seen from a distance, its approximative ranges of tone prevail, and their fragmentation is less obvious. Nearly all displays are built upon this concept, many thousands of pixels comprise an image. Modern displays viewed at a 'too-close' distance, presents an unconsidered moving image, dictated by an arithmetic display. Akin to an impressionist painting, the image resolves at a longer

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[33] David R. Cerbone, (2006), *Understanding Phenomenology*, Routledge, p17.

viewing distance. For the modern animator, this may not need be; each pixel may be directly interfaced with via computer animation. Though pixels are not the sole means of displaying animation, the sentiment remains; the notion of animation designed both close and far could be interesting.
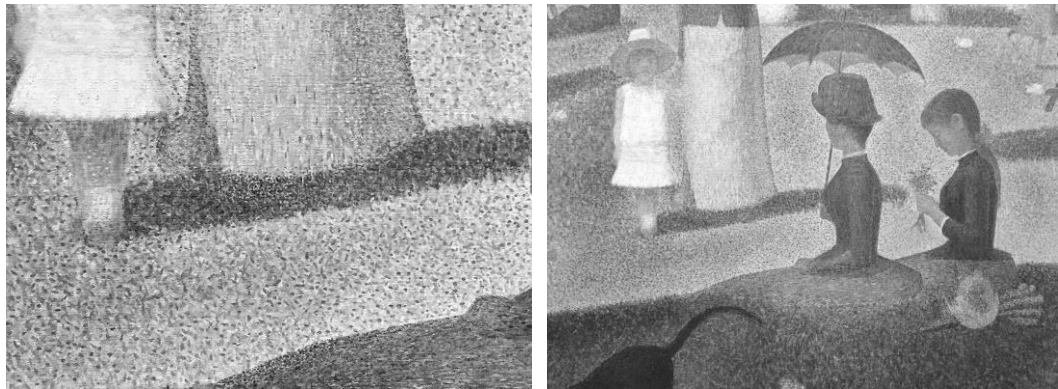

Fig. 25

Fig. 26

Internet Dream, Nam June Paik, 1994.

The sculptural work of Nam June Paik works to this effect; most of which may be viewed at varying distances. In the case of *Internet Dream* (fig.26) multiple screens facilitate a viewing experience of varying distances. The impression of multiple screens combine into a greater image at a distance; the details of each individual screen become less apparent. Similarly, concerning motion - visual momentums are carried across the bounds of the individual screen and continued across multiple. Its motion and image vary up-close and far-away, a present phenomenon even in conventional screening setups; though rarely utilised.

Light and Eclipse

A key consideration in modern animation design is the exertion and distribution of light from the display. As it stands, displays tend to emit light as to show their image with clarity, necessitating that light itself be a key consideration for the wholistic artist. External from the concrete divisions of the screen, somewhere between the viewer and viewing plane, exists an animatable space of blooming light.

Surface light: The presence of surface light is most apparent when concrete elements of design align or merge, especially in high contrast imagery. This effect is most pronounced in hard-edge design, and is only worth discussing within its limitations. The approach of controlling light with concrete design introduces an extra dimension to 2d work. Occulsion - one may call it - acts as an extra optic layer that is intrinsically tied to its concrete design; resembling mid-tones. Similar to concepts of hatching or pointillism in still design, when two or more tonal elements come together - dark, for instance - the eye will approximate their respective area as a darker tone. These tones may be animated and shaped by their occluding concrete elements.
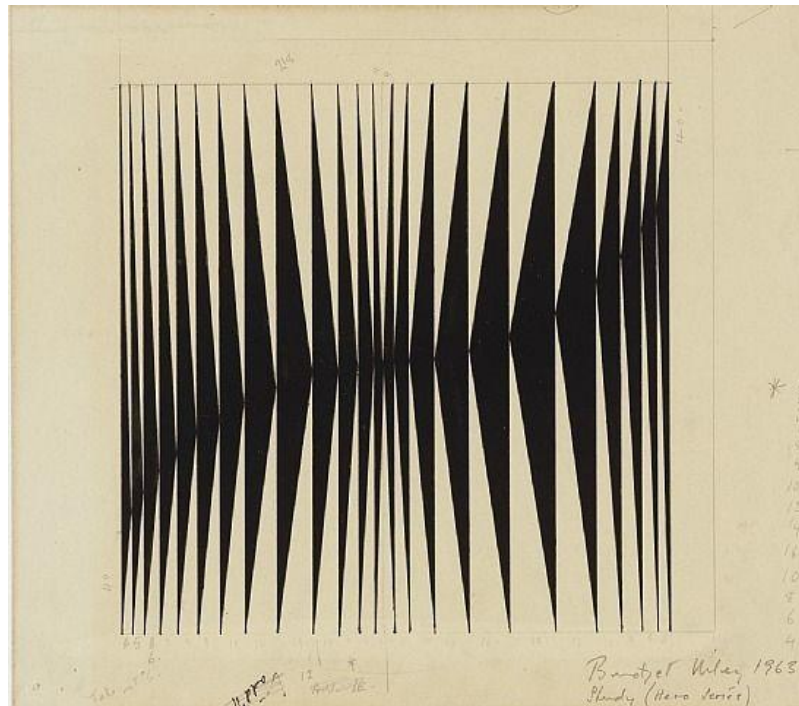
Fig. 27

This illustration by Bridget Riley demonstrates the concept of occlusion. Controlling the greater hard-edge elements as to form an illusory line of tone, bisecting the design.

Environmental Lighting: This aspect of lighting denotes a preoccupation with the physical, phenomenological effects upon a space; of which the display enacts. In other words, the spatial presence of light generated by the display itself. The presence of light emitted from a display is dependent on the lighting of its viewing context, necessitating that – in an ideal world – the environment and atmosphere in which a work is shown be considered by the artist. This consideration may simply be the insistence of showing work within a dark room, emphasising light itself. An extreme example of this can be seen within the work of Anthony McCall - introducing a sculptural element to light:
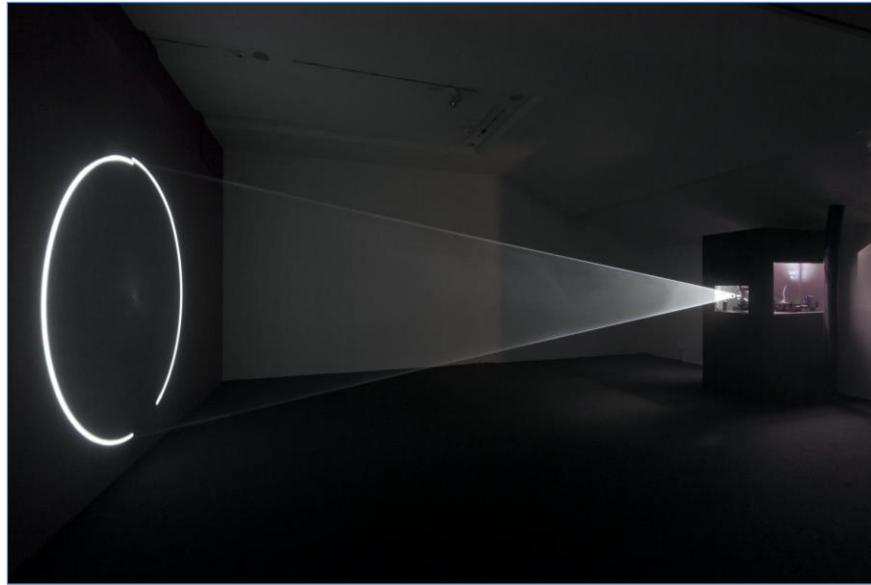
Anthony McCall's simple and elegant installation Line Describing a Cone (1973) is a thirtyminute film showing a circle taking form projected onto the wall of a dark room. The beam of light coming from the projector becomes clearly visible with the artificial fog that also features while rendering the volume of the horizontal cone of the light/line when it is fully formed/closed as a circle. In this cinematic installation, light is the basic element that allows the spectators to interact with it – "become a physical part and participant in the work of art"[34]

Darkness of the Boundary: As discussed within chapter two, the image-boundary is the termination of an image and thus - for our consideration here - its light. This technical reality need not be ignored (as it routinely is) but harnessed an aspect of the artistic work. Given that the environmental lighting is dark as to hide the image-boundary (and emphasise the display's lit elements), formed is a semblance of image independent of said boundary. Paul Wells denotes the symbolic aspect of this approach: the term synecdoche[35] being the representation of parts, opposed to an entire depiction. When the boundary is hidden, it may be then revealed in a performative manner by virtue of the concrete animation, or rather be omitted entirely, partial to the image's fragmentation.

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[34] Verina Gfader, (2008), *Nervous Light Planes*, Animation: An Interdisciplinary Journal
[35] Paul Wells, (1998), *Understanding Animation,* Psychology Press

As previously mentioned, a key aspect of the modern display is the contrasting impression of two subsequent frames. This effect is intrinsic to raster displays, the technological foundation of modern imaging systems; each frame's comprising pixels are imperceptibly scanned upon the last. Digital projectors are bound to this method of frame displacement too. Alternative displays – namely the *vector display* - do not retain these properties; an image is traced by means of calligraphic projection. A vector image is traced by electrons and beams of light at high speeds, exploiting our persistence of vision to interpret the light's path as consistency. Though rarely used in current times - most prevalent in the 1970s - this technology retains some exciting connotations for the future development of moving image displays. This type of display is independent of frame sequences, it is forwardly and perceptually live; its drawing of imagery is an active phenomenon in and of itself. In terms of image-tracking, vector graphics - unlike raster graphics - do not conform to the pipeline of once tracked by camera, then tracked by our eyes (as described in Chapter Two). The performative aspect of the display allows us to track its imagery as we would real life, thus its image is reactive to our tracking. Clearly, there are particular idiosyncrasies of the vector display in its current state, being the simplicity of its imagery:

Fig. 29

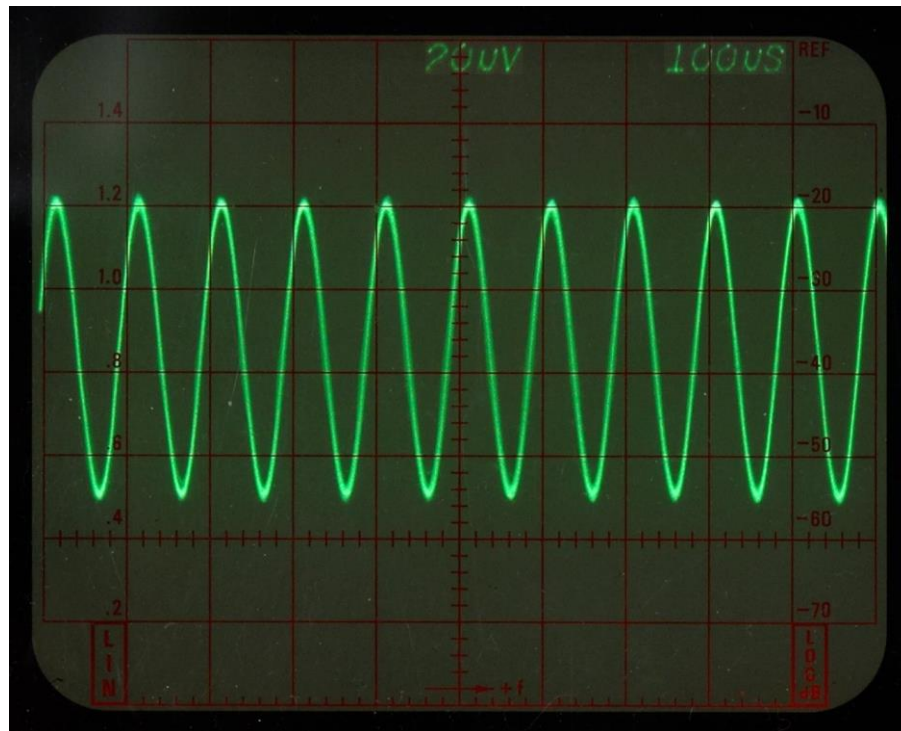The *Vectrex*, its controller and *Asteroids* on display.

Fig. 30

Oscilloscope.

It should be noted that a CRT raster display is a highly controlled modification of vector display technology.[36] Furthermore, modern arithmetic displays emulate this raster variant. There have been no recent developments in vector display technology, likely due to the almost-universal shift towards digital, raster imaging. Aside from current conventions, there exist great possibilities for animation experienced upon vector monitors and their kin. Again, its independence of frame-displacement places it as a visual phenomenon closer to natural motion than secondary-tracked animation. The current state of this technology may not be ideal, suffering from very particular and load-bearing visual limitations; though its facet of live-drawn motion is unusual and unique.

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[36] Sean Cubitt, Daniel Palmer, Nathaniel Tkacz, (2015), *Digital Light*, Open Humanities Press

Fig.31

Magnet TV, Nam June Paik, (1965).

Nam June Paik's *Magnet Tv* illustrates the previous considerations of raster and vector imaging*;* a CRT's electron beam is appropriated in drawing a vector-like image – virtue of the industrial magnet's interference.

The laser-light work of Max Hattler stems from this visual line:

Fig. 32

X, Max Hattler, (2012). (Flash animation before projection).

Fig. 33

X, Max Hattler, (2012). (Projection upon *water screen*).

'As I was developing the work, I was thinking 21st century Oskar Fischinger, but also *Tron*, *Asteroids*, and yes, lasers.' 'This came mainly out of wanting to create a piece that is highly energetic, and works well with the water screen.'[37] - Hattler on *X*.

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[37] Creative Bloq Staff, (2012), *Max Hattler's laser light graphics*, Creativebloq.com

Conclusion

As we have discerned in our analysis of the moving image, the aspects of its phenomena are abundant, potent, endlessly versatile and current. For the practicing artist, utilising the medium's material and sensory properties will form artistic work that will persist throughout time; though many conditions will change, our senses should not. For an ideal scenario, I would like to see developed: a progressive analysis of animation that encompasses all of its structural and phenomenological aspects. Likewise, a mode of artistic practice in awareness of its own phenomena. As we saw before - from Wells and Collington - the current climate of animation analysis is both limited and exclusionary of the many aspects which define animation of other artforms. Though, this climate is both facilitated and justified by the contemporary lack of originality within the medium, and its crutch: the live-action cinematic form.

I hope to have highlighted an alternative mode of practice within the latter two chapters, comprised of personal observations with common knowledge incorporated. Key is the artist's use of light, dictating qualities of movement and all thereafter. The medium after-all, need be nothing but light and its absence. Ideally, a greater variety of display technology would be developed as to inspire new appearances of animation. As for supplementary aspects of phenomena, *sound* layers another infinity upon the medium. As John Whitney remarked, it would be compelling to see an influx of artists interested in the union of light and sound.[38] Preferably, practicing artists would become knowledgeable within the medium of sound design also, a sentiment held by Whitney as myself.[39]

In conclusion, I hope to have communicated a contemporary practice of the moving image medium, one that has roots in fine art, as filmmaking; one of viable, phenomenological ground.

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[38] David Em, (2017), *AN AFTERNOON WITH JOHN WHITNEY*, Youtube.
[39] Documentary Educational Resourses, (2015, filmed 1972), *Screeening Room with John Whitney Sr – PREVIEW,* Youtube.

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