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The innovations of distortion

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Abstract

The following article looks at the concept of distortion in technologies of mediation. Distortion is considered a by-product of all media, but its assignation of value reflects cultural assumptions as opposed to objective standards. The two primary conditions looked in this article are anamorphosis and photogrammetry, which are discussed in both historical terms and within contemporary practices. The author includes a few examples of his own work with photogrammetry. In conclusion, the article argues that the qualities of distortion are part of how artists begin to misuse technologies towards aesthetic effects not intended by the original purposes of the media and that this can include any technology of mediation, including the developments of artificial perspective in the Renaissance.

Introduction: 'Noise'

Written by Paul Simon and sung by Art Garfunkel, 'Bridge over Troubled Water' is an amazing song. The conflicting moods of melancholic reverie – vulnerable in its fragility yet also confident in its grandeur – has influenced pop music from its release till today. But, as great as the song and performance may be, they have little to do with why it is here at the start of this article.

Instead, I am interested in a single sound. The sound made by what appears to be a drum-timpani-cymbal crack at the end of the 1969 studio recording. The assignation of the instruments is in truth minor, for the sound one hears is only partly due to these. The important fact is simply that the 'sound' is too loud for the recording levels of the magnetic tape; it crosses a threshold, becomes clipped by the technology of mediation, and distorts.

A musical performance is typically recorded to achieve the highest fidelity and the fullest dynamic range to become as close to 'reality' as the virtual experience of playback can recreate. Recording desires transparency. But all media operate within a limited range, and when these thresholds are crossed, the resulting sound becomes conditioned by the physical capacity of the technology.

I am fairly certain that Simon and Garfunkel did not intend for this distortion to happen, but they had to have heard it, had discussions with the engineers and producers and decided to leave it in. This decision radically changes the song, for once the listener notices this sound, they are jolted from listening *through* to listening *at*. It makes one think that something is wrong with their stereo, that they have set the volume too loud, or that this was a glitch in the recording. I am sure other reactions exist as well, but regardless of the response triggered, the listener is no longer in the illusion of performance, but in the world of stereos, speakers, microphones, record players, needles, magnetic tape, volume knobs, EQ settings, etc., the reality of the room, car, computer, phone, that form the background of our daily lives.

Let us consider another example, one where the desire for distortion is undeniable: 'Sister Ray' as recorded in 1967 by The Velvet Underground. Here, the distortion is on from the needle drop till the recording stops seventeen minutes later, two guitars and one organ purposefully overdriven as sonic attitude. What makes the song a great *song* may be the thick funk of the lumbering groove, the splatters of guitar shards, the fuzzy whine of the organ holding both low and high end or the listener's attempt to determine exactly what it is that will 'stain the carpet', but again, these are not the features that interest me most for this discussion. Famously the recording engineer walked out after the band started playing, leaving the recording levels at their initial settings, so that as the performance volume increases, the gain level of the recording is not adjusted, and thus, tape distortion occurs. Where in 'Bridge over Troubled Water', it is one crack of distortion, here we are treated to a plethora of effects. The most interesting often come through the organ played by John Cale. The instrument is already heavily distorted through amplification, but as it crosses volume levels at different frequencies the sound begins to fray, to scumble into textures and mixtures unpredictable, to meld into a mediated object. You can listen to this recording for the song, for the improvisation, for the groove, for the lyrics; but you can also listen to it as the document of matter and energy interacting and interfering. If this last option is chosen, the listener will most likely have to alter their previous assumptions regarding what is and what is not considered music.[1]

1. There are countless bands influenced by The Velvet Underground, but if we consider the interrelated combinations of distortion, noise and mediation, we find a list of which The Velvet Underground is one among many. List includes but is not limited to: Edgar Varese, Karlheinz Stockhausen, Glen Branca, Rhys Chatham, Sonic Youth, Swans, Einstürzende Neubauten, Suicide, Keiji Haino, Merzbow and of course Lou Reed's *Metal Machine Music*.

Audible distortion is produced when a sound wave's frequency is altered. This can be created by overdriving the power running through a vacuum tube amplifier, it can be created by electronically squaring the signal of a sound wave to multiply harmonics, and it can be created by saturating the recording medium, which is commonly known as 'tape distortion'. To be clear, all musical instruments alter the audible signals of a pure tone; this is the instrument's timbre, its character. These tonal disturbances are not commonly referred to as distortions, yet this is exactly what they are when considered as alterations to a pure tonal signal. 'Distortion' as an attribute is typically reserved for departures from the 'natural' occurrence of a phenomenon, especially when it is due to an artificial mediation.

Tape distortion in recording occurs when the voltage is more than the electromagnetic range that the magnetic tape can carry. As described by recording engineers,

> when the input voltage exceeds the system limit or the saturation threshold of the tape, the iron oxide molecules of the tape reach their maximum magnetic potential. In other words, they cannot be polarized any further and neither hold any more amplitude. As a result, the signal gets compressed and distorted in a nonlinear fashion. This means that when the part of the signal passes the saturation point, that part of the signal does not represent the frequencies or the amplitude of the original signal. This is the actual signal, which is sent to the recorder and instead, it is it's distorted and compressed version.
>
> (https://soundbridge.io/tape-distortion-saturation/)

With tape saturation, the representational medium becomes audible; it replaces part of the sound it is attempting to store with a 'distorted' version. On playback, at these moments, the listener is hearing the medium itself as an artefact of recording. If fidelity to the live acoustic tone is the primary concern, then tape distortion is a loss of information. But, if considered as the product of an energetic exchange, then the medium of capture adds something to the sound, it opens alternate issues that include the entire complex of sound production, storage and transmission (Kittler [1999] 2010: 26). To state this another way, the meditation itself becomes an instrument, not simply a transparent medium that records for reproduction, and in this, the limitations are no longer a technological problem but a quality to be explored.

Technologies of Mediation

New technologies are often proclaimed as new paradigms. That technology changes the conditions upon which cultures exchange information is accepted, but the differences that it introduces are not always in the bigger, faster, further variety. Quite often the change is lateral, unpredictable and

conditioned by thresholds. What is important about 'distortion' is that the interference of the mediation becomes an aesthetic provocation; one that challenges culturally constructed conventions used to establish what qualities should or should not be valued.

The cultural critic Boris Groys argues that innovation is the result of an exchange where what was previously considered extra-cultural becomes valued while at the same time the traditionally privileged is devalued (Groys [1992] 2014: 139–41). In standard practice, the role of the artist is to produce art that fulfils and continues the values of a discipline, profession, culture, and the role of the critic is to defend and maintain these categories by explicating their coherence and by demeaning potential attacks from the extra-disciplinary. Propositions that operate outside cultural norms are considered profane, unintelligible, noise. From time to time however, pressures mount either internally or externally, to challenge conventions and redistribute how the world is made sensible. Innovation occurs when the boundaries are crossed and values exchanged; the profane sacralized and the sacred profaned (Groys [1992] 2014: 64–65).

Technologies of mediation are treated initially as extra-cultural, as purely technical, as efficiency without affect. The position of the following article is that all media interfere with that which they attempt to mediate. Mediation technologies alter cultural relations not only by connecting more people, with higher resolution representations, but through their qualities as artifice, for their effects to assumptions calcified around conventions.

What follows is not an article on rock and roll, as fun as that would be, instead it will focus on the representational conventions of perspective. Within art and architectural discourse, perspective has been dissected and discussed; valued and devalued so many times that there seems little that can be added within the confines of a short article. I will however suggest that the notion of 'distortion' holds particularly interesting possibilities not only for specific historical aspects, but also for how certain assumptions within perspective are still at play within contemporary technologies of mediation such as photogrammetry.

Perspectival distortions

One of the most frequently used terms within the discourse on perspective is distortion. But what perspective distorts is not exactly clear. Does it distort vision? measurement? light? form? Let us begin by laying out two positions.

Position one: Perspective constitutes a paradigm shift in western culture where art and science are bound through mathematics to systematize a method for reproducing the visual appearance of natural reality on a picture plane. This is achieved by the geometric *regulation of distortions* of length and angle through the sectioning of a projection.

Position two: Perspective creates a homogenization of visual space for the bureaucratic management, positivistic exploitation and despotic surveillance of the environment and human relations by *distorting natural vision* through the artifice of mathematical computations.

These two descriptions are purposefully exaggerated to emphasize the point. For some cultural critics, perspective was a fundamental component in the development of Enlightenment thought, while for others, it unleashed a multitude of problems; conceptually, socially, politically and ecologically. The conflict between these two positions on perspective however is a false problem given that they are talking about completely different things: perspective treated as a representational convention is fundamentally different than perspective treated as perceptual simulation (Damisch 1994: 34). One side *values* perspective for the regulation of distortion, as a technology of mediation, as knowledge. The other *devalues* perspective because it is a distortion of human perception, a biased and false substitution.

There are several issues entangled here. Part of the problem is ethical – what is true vs. what is false; another facet is epistemological – geometry vs. perception; and finally, there are aesthetic questions regarding realism, abstraction, absorption, naturalism, attention and mediation. All three of these modes of engaging the world have important contributions, the problems occur however when a specific aesthetic effect is condemned from an ethical stance, or a certain apparatus of knowledge is assumed to account for the truth of an image. These collusions and confusions follow discussions of perspective from the Renaissance till today; in many ways, they echo distinctions between what was known as *perspectiva naturalis* and *perspectiva artificialis*.

Looking through

> For the modern vanishing-point construction distorts all widths, depths and heights in constant proportion, and thus defines unequivocally the apparent size of any object, the size corresponding to its actual magnitude and its position with respect to the eye. That is precisely the enormous advantage of the modern method.
>
> (Panofsky 1997: 40)

Erwin Panofsky's *Perspective as Symbolic Form* originally published in 1927, is still a touchstone for conversations regarding the history of perspective. In this passage, we find the term distortion used in a specific way, as the distortion of formal dimensions regulated through a system of mathematical proportions. This is the system of *perspectiva artificialis* developed by painters, architects and mathematicians in the Renaissance, and its 'enormous advantage' was that it could regulate transformations of any spatial dimension as diminished in depth by treating all space as a homogeneous continuum. Lengths may distort, but their distortion is conceptually, technically and graphically controlled. One

of Panofsky's primary points is to show how *perspectiva artificialis* is a conceptual abstraction with stark differences from lived perception, and that this established a 'symbolic' regime, effecting ethical, epistemological and aesthetic norms for centuries within western culture (Panofsky 1997: 40). Although Hubert Damisch disagreed with Panofsky's use of Ernst Cassier's notion of 'symbolic form' for perspective and cast doubt that it can constitute a sign like other sign systems such as language, one of the key contributions of Panofsky's article was to demonstrate the manners in which perspective was established and maintained through sets of cultural conventions (Damisch 1994: 10–15).

Panofsky views Leon Battista Alberti's *De Pictura* (*On Painting*) ([1435] 1991) not as the beginning of a paradigm shift, but as a component in establishing the conventions that would allow the art of painting to become valued within the humanities.

> In this way the Renaissance succeeded in mathematically fully rationalizing an image of space which had already earlier been aesthetically unified. This, as we have seen, involved extensive abstraction from the psychophysiological structure of space, and repudiation of the antique authorities. But, on the other hand it was now possible to construct an unambiguous and consistent spatial structure of (within the limits of the 'line of sight') infinite extension, where bodies and the intervals of empty space between them were merged in a regular fashion into a *corpus generaliter sumptum*.
>
> (Panofsky 1997: 63–65)

The body generalized by Renaissance artificial perspective was more than just the literal measure of bodies in space on a plane of representation, it was also the legitimation of a body of knowledge that could serve as the basis for a humanistic discourse on the 'art of painting'.

Multiple authors have noted the importance of the difference between *perspectiva naturalis* and *perspectiva artificialis* (Damisch 1994: 26–27; Ackerman 1991: 60; Perez-Gomez 1997: 16–19). At one level, this is the medieval optics of light and vision vs. the Renaissance picture plane construction of painters, but the names also signify an important conceptual distinction. One is considered unmediated, 'natural', the other as artificial. Medieval optics was based on the work of Euclid and Ptolemy – the Latin translation of 'optics' after all is 'perspectiva' (Field 1997: 6). The debate between extromission and intromission (the eye sends out beams vs. receives light) matters little if an optical ray is geometrically understood as travelling in a straight line, and classical Greek 'optics' was primarily what we would now call solid geometry, that is, pyramids, cones, cubes and the planar cuts that demonstrate proportional principles. When Alberti places the novel *perspectiva artificialis* of Renaissance painting next to the *perspectiva naturalis* of traditional optics, his connection is not biological or phenomenological, it is the geometric methodology of cutting solids with flat planes (Ackerman 1991: 60–61). The slice of the picture plane is posited as equivalent to a slice of a visual

pyramid. It should be remembered that Alberti was steeped in the late medieval/early Renaissance traditions of rhetorical recombinations from classical precedent (Grafton 2000: 40–42). The arguments of *De Pictura* can be understood as attempts to legitimize these new techniques within the concepts of classical optics. What Alberti proposed here is a technology of mediation where the sectional intersection of linear rays produces a constellation of points, which when linked translated into the outlines of figures (Carpo 2008: 52–53). This is why the 'extrinsic rays' that translate the bounding contours of an object are stressed as opposed to the 'median rays', which refer to the surface qualities of colour (Alberti [1435] 1991: 39–40). Alberti never discusses distortion, for him the edges are important because they can be regulated, measured, drawn. These techniques were necessary for the canvas to become a window transparent to the world beyond (Alberti [1435] 1991: 48).

When Alberti discusses light – the colour information supposedly carried by the 'median rays' – he treats it closer to the practical conventions of painting workshops at the time, not as something that could be regulated through his new technological system of artificial perspective (Ackerman 1991: 60–61, 75). Many of his suggestions for colour are rules of thumb passed down through generations, with statements such as,

> painters should first of all study carefully the light and shades, and observe that the colour is more pronounced and brilliant on the surface on which the rays of light of strike, and that this same colour turns more dim where the force of the light gradually grows less.
>
> (Alberti [1435] 1991: 82)

In order to paint this obvious effect of light on a body, Alberti tells the reader to 'change the colour with a little white applied as sparingly as possible in the appropriate place within the outlines of the surface, and likewise add some black in the place opposite to it' (Alberti [1435] 1991: 83). Even though light itself is what vision detects, within Alberti's mediation, it is the outlines of form that are regulated by the picture plane; light follows a different secondary process of rendering shade, shadow and colour. This division between vision and light will continue to infect representational media for centuries to come, even after both are fully understood through the geometry of projection.

Shadows and the section cut

We have yet to use the term projection to describe perspective, primarily because it was not how Alberti conceived his system. Projection would enter the discussion in the early sixteenth century with attempts to understand both vision and light through geometry (Kaufmann 1975: 267). This does not mean however that these two phenomena were valued as equal. The canvas, picture plane or screen was a section through a projection of vision perpendicular to it; its material presence

should disappear, its distortions suppressed. The projection of light however was used to define the shadows of three-dimensional bodies as if they resided within the virtual space depicted. These were treated as two different ideas, in a way two different ontologies. The viewer was to be immersed in a projection of spatial recession, yet remain outside the projections of light.

This division between vision and light becomes evident when one considers the question of distortion. The perceptible distortions of form should be made to disappear into the illusion of perspective diminution and foreshortening. The distortions of shadows however should be evident as they cast across the various surfaces of the environment. As contradictory as this first sounds, one reason for this is due to assumptions that perspectival distortions are 'false' illusions that simulate vision, while shadows are 'true' intersections of bodies and light in space. The analogy is that the viewer is looking *through* the canvas as a transparent window; perspectival distortions should match visual distortions and hence disappear into the illusion. But the viewer is also looking *at* light and its effects of shadow and shade. These effects aid the painting in creating a sense of reality, thus if shadows elongate and distort in the world due to angle of view or direction of light, these must be accurately, faithfully represented. I would like to stress that these became two different systems of projection; one perpendicular to the picture plane, the other oblique; one meant to disappear, one meant to be clearly seen; one that removes apparent distortions, the other emphasizing their effects; one was for vision, the other was for light. There are echoes here of *perspectiva artificialis* vs. *perspectiva naturalis*, but there is also another issue that brings us into the discipline of architecture and its conventions of representation.

There is not the space here to rehearse the debates on *scenographia* (perspective) vs. *skiagraphia* (section) as the appropriate third term in the Vitruvian triad that includes *ichnographia* (plan) and *orthographia* (elevation). This has been researched and argued by several scholars, and I would direct the reader towards the writings of Alberto Perez-Gomez (Perez-Gomez 1997: 111–12) and Filippo Camerota (Camerota 2004: 197–98) for more detailed discussions. Briefly, the problem for Renaissance architects was that *scenographia* was not an orthographic projection, it was perspectival, it thus distorted true length and angle. Furthermore, the scholars at the time considered perspective a modern invention, not something evident in the time of Vitruvius. Thus, it was proposed that the profile cuts of *skiagraphia* be considered a more accurate third term (Perez-Gomez 1997: 111–12). *Skiagraphia* itself is also ambiguous. The term translates as 'shadow drawing', which can be interpreted as both the shadows cast by light used for stage scenery *and* as the cut sections of stereotomy for templates in stonemasonry. Some meanings lead towards visual perception and the illusion of bodies modelled by light; they are theatrical. Other implications are as slices of material reality with an abstract plane to register a contour profile for precise measurement. In the background of this argument is distortion. The section cut was orthographic; it preserved measurement, it was verifiable

and true. Perspective, on the other hand, distorted measurement for visual effects. Beginning with Alberti, one of these was for architects and the other was for painters (Alberti 1988: 34).

By the middle of the seventeenth century, Girard Desargues would bind all projections into a coherent system laying the foundations of modern projective geometry. For Desargues, a point projection (perspective) and a parallel projection (orthography) are not different in kind, only degree, parallel projection is the limit condition for a projection point at infinity. Although known within the theoretical circles of mathematicians at the time, one of the primary ways the work of Desargues was preserved was through a group of publications produced by the master engraver and professor of perspective, Abraham Bosse (Bosse 1642–48). What Bosse published was how Desargues' theories would apply to stonemasonry (stereotomy), sundialing (light), and perspective (vision). What is important here is not simply the practical applications of projection, but that projection itself was understood as an abstract artifice that could process all spatial relations through a mediated apparatus. Thus, geometry, light, and vision could all be regulated through exactly the same technology. Desargues worked out the theoretical connections between *skiagraphia* as perspectival illusion, stereotomic section and cast shadow, and showed that their differences lied in cultural assumptions, not in the system itself.

We have seen distortion as a term within perspective discourse used positively to describe the geometric control of proportional variations and used negatively to describe the departures from embodied visual perception. These are both largely disciplinary and philosophical arguments. As a commonly used term for perspectival representations, however, 'distortion' typically describes the elongations of form produced when the viewer is either too near, or the projection too oblique to the picture plane. Near the directed centre of vision, everything appears fine regarding perspective; it is at the edges that distortion becomes perceptible. At these extremes, the image of a form looks deformed, thus a new term was used to describe the condition: anamorphosis. As indicated by the work of Desargues, the important realization is that 'normal' perspective and anamorphosis are not different in kind, the only difference is where and when a threshold is crossed that triggers an observer to apply the term 'distortion'. Architect Stan Allen marks the importance of this shift, which implies that,

> Perspective in these cases is not understood as a means to visually transcribe reality, but rather as a more or less coherent system that can be manipulated to produce various results. Perspective is not presented here as naturalized vision, but as artifice and the construction of illusion.
>
> (Allen 2000: 13)

Double projections

Hans Holbein's *The Ambassadors* (1533) is an incredible painting for many reasons, but its discursive importance for perspective has typically revolved around the smear that appears across the bottom of the canvas (Figure 1). This stretched shape resolves into a human skull when viewed from the side of the canvas, the view glancing across the surface. This skewed skull is usually cited as a bizarre example of technical mastery, as a trick, an extreme form of perspective, the maximum distortion of projection; it is also likely the most famous example of anamorphosis in the history of painting.

Following our discussion above concerning the different projections for vision and light, the painting contains two systems of projection, one perpendicular to the picture plane, the other oblique. *The Ambassadors* has in essence two points where the viewer can locate their eye to make a portion of the painting look 'normal'. What Holbein has done, is to register both projections as images legible to vision on the surface of the canvas. These are superimposed on each other, whichever point the viewer chooses, the other projection will look distorted, it is impossible to hold them both simultaneously as intelligible projections. The effect is one of blockage: the viewer can no longer simply look *through* the canvas to the scene depicted beyond, because something has been placed *on* the material surface of the canvas, an object to be looked *at*. This painting can no longer be considered a window towards a representation of reality, but instead must be treated as a real material plane with real material pigment on top of it. The transparency of perspective is challenged by an abstract smear. Holbein's painting predates the work of Desargues, but it is already positing an aesthetic where the distortions of light, vision, and material cut are equated.

In a discussion of the seventeenth-century perspective treatise of Jean-Francois Niceron, art historian Lyle Massey argues that,."Anamorphosis reverses the projection of perspective so that the picture no longer recedes away from but rather extends toward the viewer" (Massey 2007: 56). The object is conceivably "between the eye and the picture plane." (Massey 2007: 56). In line with the argument above regarding the blockage of transparency as presented by the skull in Holbein's painting, Massey continues,

> In fact, the anamorphic picture is the antithesis of the Albertian window. If the window provides an analogy for the centered Cartesian subject who surveys the world as picture, anamorphosis turns this illusion inside out, forcing the viewer to see perspectival space as a fiction of geometry and to see the pictorial surface as an object that stares back.
>
> (Massey 2007: 68)

Furthermore, I would add, that if the object could be posited as in front of the picture plane and between the observer and the image, this is akin to saying that the image is a shadow on the plane of the canvas, a record of the real as cast by light in the world. *The Ambassadors* is the double projection made literal.

Figure 1: Hans Holbein, The Ambassadors, *1533, 207 cm × 209.5 cm, National Gallery London*

Now, three related aspects from this conversation – the blockage of perspectival illusion, the acknowledgment of the flatness of the canvas and the materiality of paint – can be interpreted within the dominant arguments for modernism beginning with the realism of Gustave Corbet and Eduard Manet where the artwork acknowledges the facts medium as artifice, as a distorting abstraction. This line of thought was used as an explication in different ways for the movements of impressionism, post-impressionism, collage, cubism, suprematism, futurism, abstract expressionism and the medium specificity of hard-edge abstraction.[2] Each could be understood as a revaluation of distortions, and there are important implications for twentieth-century visual culture extended from this trajectory. But as these distortions of concrete abstraction are valued, what is typically devalued is mimetic naturalism and the conventions of perspective. *The Ambassadors* should give us pause however, for it raises issues that suggest we may not be done with the distortions of perspective just yet.

2. Although this narrative explaining modern art in terms of medium and against the illusion of perspective may be found in multiple arguments, the primary one is that of Clement Greenberg's medium specificity, see Greenberg 1993.

The depth of light

> Whenever one wants to see the illusion of a sphere in a room, one must take the sphere and hang it in the middle of the room with a thread tied in an equinoctial circle. Then, if one places a burning candle very near the south pole one will see, on the wall opposite the candle, the sphere and its 'construction' in a plane. The same thing will come about if the eye be placed where the candle was.
>
> (Kaufmann 1975: 267)

This description of a stereographic projection comes from Biagio Pelacani's *De Visu* or *Questions de Perspective* written at the end of the fourteenth century, its method descended from Ptolemy and was used in astronomical mappings. Although it is interesting that roughly fifty years before Alberti's *De Pictura* we have a direction connection between vision and shadow projection, of greater interest is that if the eye and the candle are replaced by cameras, we have the technology of mediation known as photogrammetry.

Photogrammetry measures a point in space through the projective triangulation of two images of that point. This technique has been used in surveying for millennia, more recently, (apparent in the name), through two different photographs of a spatial environment. The computation works through projective geometry – an element in space is linearly projected to create two images, which are then used to triangulate the spatial location of the original element. These can be points on the picture plane in *perspectiva artificialis*, they can be grains of chemically reactive emulsion in photography, or they can be the scanned photons in digital images.

John May reminds us that digital images are not photographs, they are a collection of photons within a range of the electromagnetic spectrum that resembles visual light and stored as information

(May 2019: 45). Digital photogrammetry operates through sets of digital images, depth computed through captured energy and output as a model. The user of these technologies interacts with a three-dimensional array of illuminated points, each one representing the location and colour of a light reflecting body in space and assigned an XYZ location along with Red Green Blue (RGB) or Hue Saturation Brightness (HSB) data.

The conflict between vision and light appears to be resolved with photogrammetry. Since light is geometry *and* energy, space becomes measured *and* visualized. But, as with all technologies of mediation, the transparency of the medium is never as clear as imagined, and yet again we find the collisions between light and vision create distortions.

One distortion concerns the difference between the view where an environment is captured from vs. the view from where one looks at the resulting model. With a photogrammetry model, the 'normal' view is the one where these two 'views' align, like placing your eye at the light source. All other views however are, in a way, anamorphic. This aspect is not that odd, there are many examples in history of a simulated perspective demonstrative from a single view that then appears distorted everywhere else, (in fact, this could be pulled back all the way to Brunelleschi on the steps of the Cathedral in Florence looking at the baptistry of San Giovanni.) (Damisch 1994: 67). However, the basic premise of photogrammetry is not a single eye or single point, it is a double view, the double image necessary to compute depth. When this principle is repeated, it reduces apparent distortion, a resolved spatial model requiring the largest set of captured energetic information (photographs) possible. Furthermore, these images are best when captured perpendicularly to the environmental surfaces, as close to orthographic as possible – a mode of visual address similar to the traditions of painting – but this also means that the surfaces at the periphery of the line of focus are captured obliquely. Since all points in the model are the result of two images of that point, the fringe of the model is the result of double oblique projections. Photogrammetry software computes these points as accurately as the ones captured perpendicularly – the same algorithm is operating after all – but as manifested in the point cloud model, the central areas of focus look normal and the fringe looks distorted, as if the camera has sprayed coloured light across the environment.

Another oddity is that with digital photogrammetry, we have a projective system that cannot differentiate between edge and surface – these models are built from millions of points, there are no 'lines'. In Alberti's terms, there are no 'extrinsic rays' only 'median rays' (Alberti [1435] 1991: 39–40). There is only the projection of light. The anamorphic quality here is not as an elongation of lines measuring the lengths of edges, proportions, form. It is literally the shadow of energetic information that is clipped and distorted by the technology of mediation as a threshold of computation is crossed.

As described above, all points determined in the photogrammetric model are located spatially through the triangulation of at least two images from two different locations. This also means that

the colour of every point is determined from two different images of that point, which by necessity will have different hues, shadows and luminosities given that they are imaging the environment from two different locations. The colour of each point in the model is thus not an exact index of the electromagnetic radiation given off by that chunk of material in the world related to a single viewer, the colour is an artifice created by the algorithmic computations of the software mixing the two source scans. This fact creates a strange aesthetic effect in photogrammetry models where abstraction and realism combine in unexpected manners. Often, they look incredibly painterly.

The three images included here (Figures 2–4) come from a series of experiments with photogrammetry software done by the author of physical models made by the artist James Casebere. There are two primary aspects under investigation here. First is the colour spectrum as captured by the digital images. These models are computed from interleaved digital photographs that have had their colour saturations increased. This allows the spatial computation to be fragmented by filtering thresholds of the energetic spectrum, or in other words, spatial points can be pulled apart and manipulated based on their colour. These models are ultimately montages of photons – albeit through millions of points in space as opposed to several fragments of cut photographs. The other interest lies in how the model represents surfaces oblique to the camera, such as the surface of the floor. Since the captured photo sets are focused on the sculptural model – which is where the greatest level of resolution is achieved – the background of the floor is captured at the fringe of every photo. These points are still computed within a range and fall off when the software can no longer accurately determine their location through the double oblique. The outcome is a frayed and scumbled edge where the reflected energetic information shreds into a blackness of 'un-computability.' These edges manifest in a manner akin to directional clusters of coloured points, elongated towards the centre of focus, precise anamorphic distortions of light as reflected energy. The image of a model made from images flickers between abstraction and realism.

What strikes me as interesting in this is that several of the distortions created in these models are deeply related to discussions from the history of perspective, only it is now the realm of energy, of light, that is the driver of effects, not the edges of form manifested as drawn outlines on a flat plane. Photogrammetry, for all its realism as a spatial model, is interesting precisely because the distortions this technology produces open alternate aesthetic and conceptual possibilities and provoke a revaluation of disciplinary assumptions regarding representational conventions. The hope is that by pushing at these thresholds, art and architecture will find manners by which they can turn the artifice towards expressions it was not intended for, and through this, speculate on how the world we inhabit can be other than we assume it to be.

The photogrammetric model is often prized for its accuracy, for its lack of 'distortion.' Therefore, archeological documentation, preservationist studies, machine vision technologies, governmental surveillance, military operations, and energy extraction corporations have come to value its

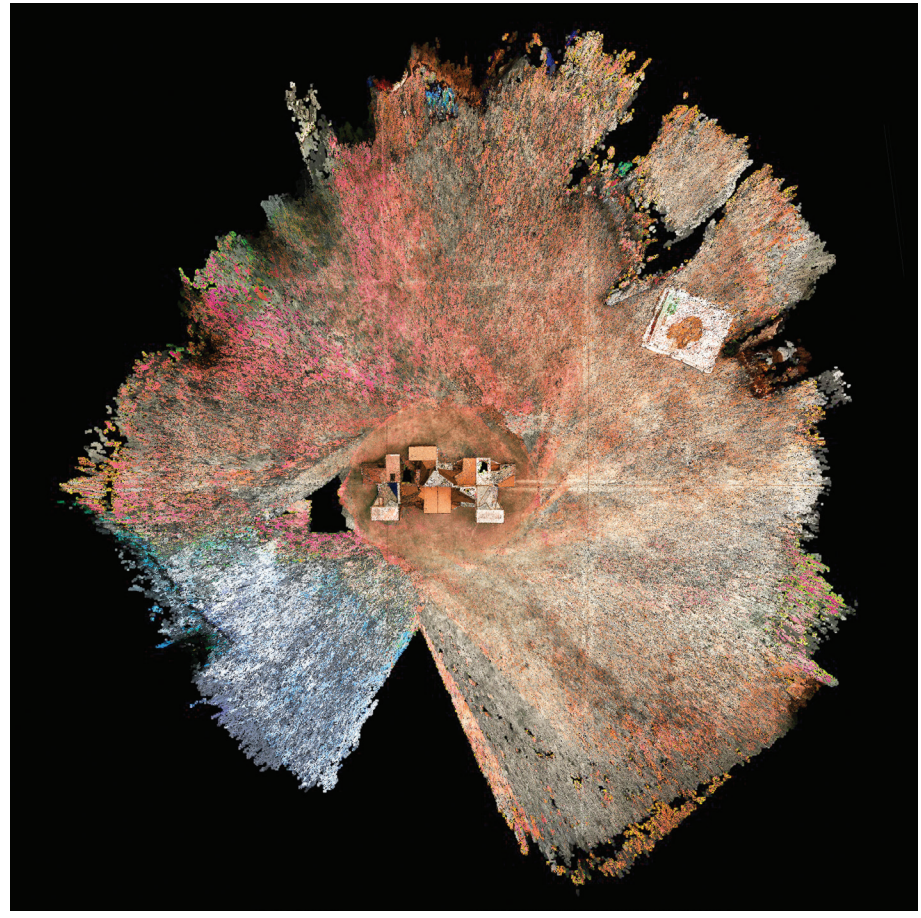

Figure 2: Michael Young with James Casebere, Reality Modeled after Images*, 2020.*

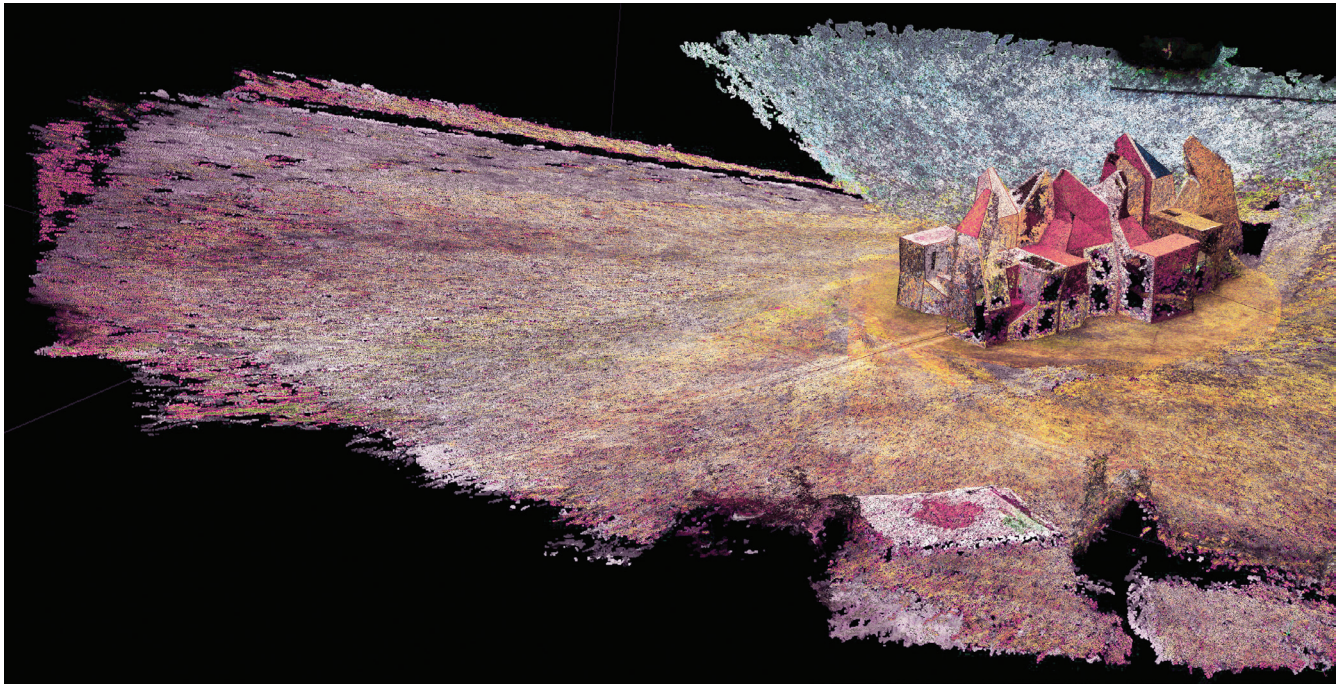

Figure 3: Michael Young with James Casebere, Reality Modeled after Images, *2020.*

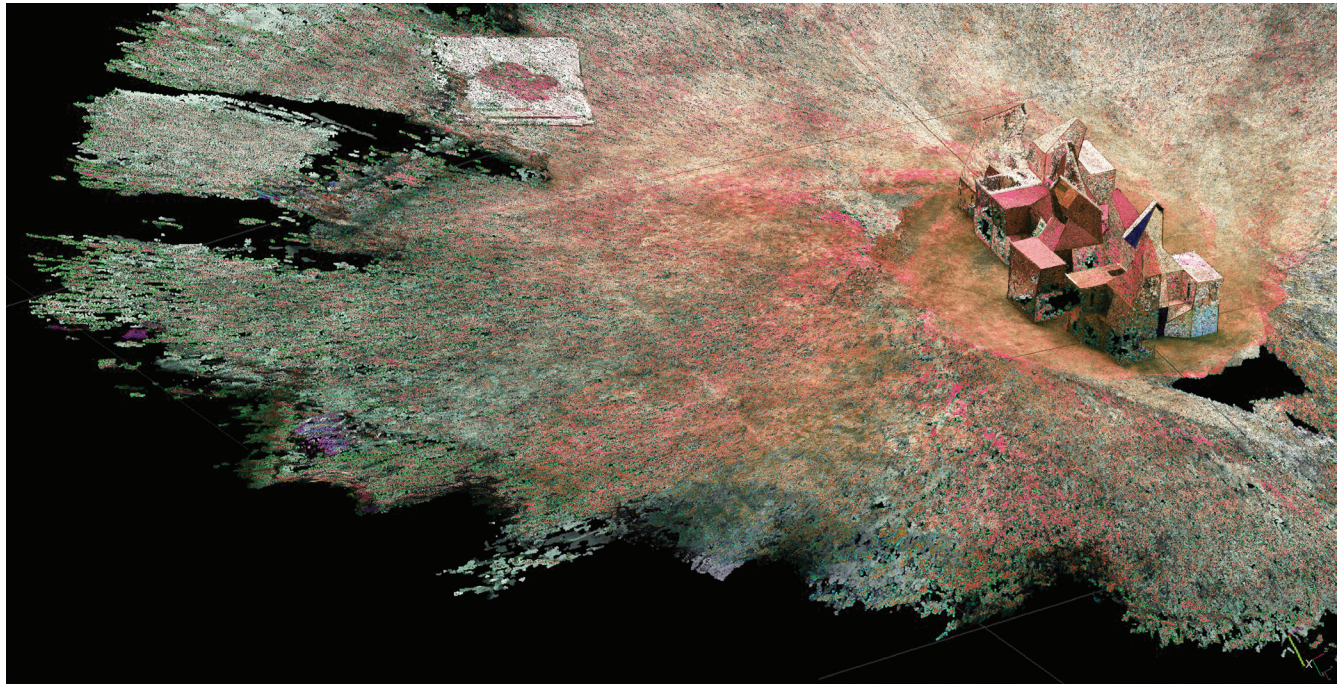

Figure 4: Michael Young with James Casebere, Reality Modeled after Images, *2020.*

mediations for their respective desires. Embedded in the discussions of this essay, ostensibly on aesthetics, is a political argument. Reality modeled after images is a distortion. How these distortions are exploited, monetized, and used for the monitoring of human activities and control of the environment are ethical questions. To understand these requires one to be able to see them. And this, as with perspective before it, is initially an aesthetic experiment at the limits of a technology, in other words, explorations in how distortions mediate the world.

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