



JPEG: the quadruple object

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I declare that the contents of this thesis are my own work.

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Abstract

The thesis, together with its practice-research works, presents an object-oriented perspective on the JPEG standard. Using the object-oriented philosophy of Graham Harman as a theoretical and also practical starting point, the thesis looks to provide an account of the JPEG digital object and its enfolding within the governmental scopic regime. The thesis looks to move beyond accounts of digital objects and protocols within software studies that position the object in terms of issues of relationality, processuality and potentiality. From an object-oriented point of view, the digital object must be seen as exceeding its relations, as actual, present and holding nothing in reserve. The thesis presents an account of JPEG starting from that position as well as an object-oriented account of JPEG's position within the distributed, governmental scopic regime via an analysis of Facebook's Timeline, tagging and Haystack systems.

As part of a practice-research project, the author looked to use that perspective within photographic and broader imaging practices as a spur to new work and also as a "laboratory" to explore Harman's framework. The thesis presents the findings of those "experiments" in the form of a report alongside practice-research eBooks. These works were not designed to be illustrations of the theory, nor works to be "analysed". Rather, following the lead of Ian Bogost and Mark Amerika, they were designed to be "philosophical works" in the sense of works that "did" philosophy.

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This object would not have the form it does without my supervisors. Thanks to Tim Markham for ruthlessly ensuring the sensual dimensions did not overwhelm any real qualities my work might have. Particular thanks to Jussi Parikka who has been more than an academic supervisor. Generous with his time, challenging with his feedback and personally supportive when the object withdrew from all access - whatever value there is in this object is credit to him.

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Also included:

- One 4GB SD memory card
- One 35mm stereo slide

Introduction

When confronted with photography, Roland Barthes suddenly becomes poetic. In *Camera Lucida*, he struggles for the right language:

One day, quite some time ago, I happened on a photograph of Napoleon's youngest brother, Jerome, taken in 1852. And I realized then, with an amazement I have not been able to lessen since: 'I am looking at eyes that looked at the Emperor.' Sometime I would mention this amazement, but since no one seemed to share it, nor even to understand it (life consists of these little touches of solitude), I forgot about it... I was overcome by an 'ontological' desire: I wanted to learn at all costs what Photography was 'in itself,' by what essential feature it was to be distinguished from the community of images. Such a desire really meant that beyond the evidence provided by technology and usage, and despite its tremendous contemporary expansion, I wasn't sure that Photography existed, that it had a 'genius' of its own (1990, p. 3).

As Geoffrey Batchen discusses (2009, p. 9), *Camera Lucida* was a self-consciously tentative, even modest project, written - in a way reminiscent of Walter Benjamin's *Arcades Project* (2002) - on index cards, with the subtitle *Note sur la photographie*.

As a photographer, I too sometimes find the language of analysis inadequate. It cannot quite cover the totality, the reality of photographic practice particularly in the digital space. Sometime the question of what photography *is*, and particularly *is now*, demands a different register.

I remember making a print. It was always called that: prints were "made". I put the negative in the enlarger, projected it onto the easel for a specified number of seconds, my hands made shadows to "dodge" parts of the image, hold light back from hitting the paper. My hands then made a narrow aperture, "burning" more light into particular sections of the print. I slid the piece of paper into the dish and gently agitated the clear liquid over its surface. An image gradually appeared. If all went well, the blacks deepened while the whites remained clear and the greys neatly spaced out between. If not, I would take the paper out of the dish and breathe on an area of the

emerging image. The heat of my breath would speed up the chemical reactions darkening the area. This was the last step in a series of rituals and crafts: measuring the light; choosing the aperture and shutter combination that, following Ansel Adams' "zone system", gave me the tonal range I saw; the chemical manipulation of silver halides and the emergence of the negative from the tank; holding the 36 exposure length of gelatin and silver up to the light. I remember photography as a complex mesh of human and unhuman objects:¹ the photographer; the camera; film and its silver mined, bought, sold and traded; lightmeters and enlargers; gelatin and chemicals bearing the traces of life, paper and forests; media industries, clients, contracts and postmen delivering slides.

With the advent of digital imaging,² everything changed and nothing changed. Photography is still a mesh of objects. The smell of the chemicals,

1. I use the term "mesh" in preference to the more common "assemblage". Timothy Morton uses the term in his discussion of the ecological thought. He says, "*mesh* doesn't suggest a clear starting point" (2010a, p. 29) and "[t]he mesh is made of insubstantial stuff, and its structure is very strange" (*ibid* p. 35). The term is particularly useful when looking to develop an object-oriented account. As Morton continues, "the mesh isn't bigger than the sum of its parts" (*ibid* p. 35). Such a term therefore keeps the focus on objects not some meta context or field and does not preclude an account of nested objects.

It is important to note, that Morton's "mesh" is not an holistic term. When he talks of everything connected within a mesh, each of the objects has its own specificity and reality. This is a flat ontology, not a holistic whole. Drawing on the image of Indra's net and its jewels reflecting in jewels, He says, "[t]otal interconnectedness isn't holistic.... Indra's net implies that large and small things, near and far things are all 'near'" (*ibid* p. 40).

Manuel De Landa also uses the term "mesh" notably in *A New Philosophy of Society* where he compares assemblages and totalities (2006, pp. 8-25), even going as far as to speak of a flat ontology (*ibid* p. 28). Graham Harman says that De Landa's ontology is "a good ontology" (2010, p. 170). But, while applauding what he see as De Landa's "realism", Harman fears that for De Landa, "realities are never fully actualized even in the physical realm, let alone in our minds" (2010f, p. 171). Assemblages are an emergence (*ibid*, p. 184). I will come on to address Harman's insistence on actualism (in comparison to Levi Bryant's object-oriented ontology, in my discussion of potentiality).

2. I use the term "imaging" throughout this work to draw attention to a wider field of picturing of which "photography" is now a part. Such imaging includes montages and remixes in Photoshop; mechanic images captured by CCTV; visualisations and infographics; and, as I shall discuss, mash-ups. For discussion of the changing nature of the "visibility economy", see Kember (2008) in terms of issues of "becoming"; Murray (2008) on "everyday aesthetics"; Jackson (2009) on young people and visual new media cultures; Palmer (2010) on archives and neo-liberalism and Schwarz (2011) on "the negotiated panopticon". More generally on the growth of "ubiquitous media", see Featherstone (2009); Schick & Malmberg (2010) and Deuze (2011). For a broader discussion of "personal media", see Lüders (2008).

the orange safelight and the paper have gone but there is, for me as photographer, still ritual, craft. I still read the light and chose *my* exposure. I still see in terms of Adams' zones, now as histograms. I'm still part of a mesh of human and unhuman objects. I still chose the decisive or indecisive moment. Light still becomes information, a RAW "negative" that Adams used to refer to as a musical score, waiting to be performed in the darkroom. I load a disc into my iPad rather than a film strip into my enlarger but my fingers still dance, dodge and burn areas on the haptic interface rather than over the paper.³

But there is still something inaccessible going on. Somewhere "in" my camera and computer something happens to turn the light I see into an image that circulates online, that can be seen and embedded, searched, tagged and linked, that makes my photograph inevitably social. Information still becomes image becomes representation and then becomes social as it joins the panoply of images, imagings or even imaginings (what we might call imag(in)ings) circulating online. My images may no longer hold the privileged position that my NUJ card-stamped photos once had. They may now be one among many, but imaging, like photography before it,⁴ still poses Barthes' question: what is it "in itself"?

There is still a mesh of actant-objects in play within photography. The cast list still includes Olympus and Fuji (if no longer Kodak) but now includes Apple and Google. Metals and plastics, toxins and discourses of professionalism are still in play but there is also a new player: software.⁵

3. Jenni Mäenpää and Janne Seppänen call this digital photo editing space an "imaginary darkroom" (2010, p. 454). I will come on to argue that while it is certainly a space of imaging and imagining, it is also real and material.

4. It is important to note that there is no simple linear teleology in play here. The contemporary digital imaging scopic regime must be seen in complex relations with that of the sort of "Decisive Moment" photography that Henri Cartier-Bresson practised (1999) or any other "way of seeing". There are continuities and discontinuities.

5. I am of course exercising a bit of poetic licence here. Although as an analogue photographer, I used purely mechanical Leica and Bronica cameras, I also used an electronic light meter as well as analog Nikon cameras with electronic (and therefore software) shutters and meters. What is different about the digital/software imaging mesh is the centrality and pervasive position of that software. If the Nikon software failed I could always use the Leica. If the light meter ran out of power, I could always guess the exposure. If my iPhone runs out of power or crashes... so does my imaging.

This project is about that new player, in particular one aspect of software: the software standards that enable that technosocial mesh. At the moment of taking and sharing something happens to turn light into data and more significantly social data. To rewrite Kodak's slogan, when I press the button, software does the rest. JPEG photography is a complex ecology of human and unhuman objects connecting the photographer, the camera, the silicon and battery, the factories and poisoned workers, the card and the router, Web 2.0 businesses, servers and the power that runs them, the carbon burnt to keep those searchable archives running, the "friend" and searcher, the IP lawyer and countless other actants. This project is about those objects⁶ and the complex, inaccessible relations and connections that make up digital imag(in)ing.

I am a JPEG photographer. I photograph with, through and against JPEG. I photograph, encode light as data, compress it as JPEG JFIF files and upload them and allow them to circulate as social photographs. JPEG, as one of the objects in my imaging apparatus⁷ and practice makes sure people can search for them, see them, download them, share them, embed and mash them with other data. My photographs are standards-compliant because they were created with standards. That standards component in my photographic

6. Along with Harman (and Bruno Latour), I use the term "object" rather than "thing". Harman discusses how Heidegger (1975) distinguishes between the Thing which "things" i.e. does something, "stands independently in itself", and the "object" which is what we represent to ourselves (2010a, p. 24). For Heidegger, "[o]bject" is a negative term, used to describe entities only in their presence-at-hand. But thing' is a positive term referring to entities in their proper reality" (Harman, 2007, p. 129). Harman stresses that these are not to be seen as separate objects but rather dimensions of an object (something I pick up when discussing "sensual" and "real" objects). Harman's point which he develops in *The Quadruple Object* (2011g), when he brings Heidegger and Husserl together in his own fourfold, is that the thing/object has both dimensions. His use of the term object is meant to cover both. For other accounts of Things, see Brown (2001; 2004).

7. I use the term "apparatus" rather than "camera" so as to include my "mash-up" and screengrab works but also to bring in the sense of "dispositif" used by Foucault (1980) and Giorgio Agamben. Agamben says, "[f]urther expanding the already large class of Foucauldian apparatuses, I shall call an apparatus literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions. or discourses of living beings" (2009, p. 14). For a discussion of text-as-apparatus, see Weight (2006).

apparatus and practice is “weird”.⁸ It is real. It does things, but we can’t see it or touch it. Its traces and connections are everywhere: in dot JPEG image files, in social media archives and search engine and hard drive caches, in data-mining strategies and surveillance practices, in business models. But like Keyser Söze, the mysterious figure in Bryan Singer’s film *The Usual Suspects* (1995), JPEG just slips out of sight. It withdraws.⁹

This work sets out to address JPEG as a standard enfolded in software and hardware meshes at play in contemporary imaging, as an imag(in)ing protocol which like transmission protocols enable network effects.¹⁰ More than that however, it seeks to explore how JPEG plays its part in the regime of governmentality with which the social, distributed imaging in spaces such as Facebook, are implicated. I come on to explore how JPEG is enfolded in Facebook’s tagging and Open Graph technologies, its datamining strategies and working as a governmental “relationship engine”. I set out to understand that weird object, its nature, its workings and its relationship to dimensions of contemporary governmentality, the practices of governmental rationality, ordering, “conduct of conduct” and the relationship of self to self that characterise contemporary regimes of power.¹¹ These were my research questions.

My way into these questions is to approach JPEG as an “object” in the sense in which object-oriented philosophers such as Timothy Morton, Levi

8. I use the term “weird” in the same sense in which Jussi Parikka discusses the “weird objects of network culture” (2011a, p. 268 see also Hertz & Parikka (2010)). the term is also used by Douglas Hofstadter in his discussion of Artificial Intelligence. He says, “we will have a very hard time deciding when and if we are dealing with an AI program, or just a ‘weird’ program” (1999, p. 680).

9. A character in the film, Roger “Verbal” Kint, says “the greatest trick the Devil ever pulled was convincing the world he didn’t exist”.

10. Technically JPEG is a compression standard, rather than a protocol which usually refers to common rules enabling network transmission. JPEG could perhaps be seen as as social or imag(in)ing protocol, a common standard enabling the networking of images and abiding by (or in OOP terms, connecting with) the transmission protocols of the Internet. Throughout this work I use the term “protocol” in that wider sense of a technical standard of compression written into software and hardware meshes but also a networking standard enabling (social) imag(in)ing and as we shall see scopic governmentality.

11. These issues, derived from the work of Michel Foucault, are discussed in more detail in the *JPEG: the governmental object* chapter.

Bryant and in particular Graham Harman use the term. As I discuss, I use this framework as not just an ontological starting point but also a methodology. While I do not position this as a philosophical work, I do argue that object-oriented ontology offers a powerful way of addressing weird objects such as JPEG.

This is a practice-research project, I use practice to answer my questions about JPEG. This document is a report on that practice, an account and an analysis of using, refusing and even abusing JPEG and what doing so has taught me about the nature and working of JPEG as an object and the ways it connects with the panoply of other photography objects at work in contemporary social imaging. As I discuss, I developed a practice designed to explore JPEG through imaging. I designed and used a number of scopic apparatuses or imaging devices as a way of exploring the implications of treating JPEG as what Graham Harman calls a “quadruple object”. This practice forms the basis for this report.

The practice-research on which I report is a development of my photographic/imaging practice, an object-oriented imaging project around the site of the London 2012 Olympics near my home. As I discuss, the specific object-oriented practice-research “experiments” I developed built on my existing project looking at, for and through the objects in the liminal spaces around the Fence surrounding the site. It is important to note that while 2012 was the site and object of my original photographic project it is not the subject of this project. I am exploring JPEG not 2012 or even the imaging of 2012.

This report is structured as follows. I approach JPEG as an object and so my way of approaching the relevant literature is to trace how the digital object and the scopic apparatus have been seen through the literature. In *The JPEG object in the literature* chapter, I argue that existing accounts of digital objects have been dominated by issues of relationality, processuality and potentiality - perspectives that fail to deal adequately with the nature, character and workings of “weird” objects such as protocol.

In my second chapter, *The JPEG object in theory*, I present an object-oriented account of JPEG.¹² Following Harman's framework of the "quadruple object" I map JPEG as a real and a sensual object. This allows me to map JPEG's relation to matters of time, space, eidos and essence. This in turn allows me to locate JPEG within an object-oriented set of relations where objects connect within the molten core of other objects, rather than as secondary to some broader field of relations, processes or potential. I also discuss a range of critiques that can be aimed at such object-oriented accounts.

The JPEG object in practice discusses my imaging experiments with JPEG. I explain and explore my practice research whereby I developed object-oriented scopic apparatuses and practices in order to understand the nature of JPEG, in particular Harman's account of the "fission" and "fusion" that characterise the sorts of object relations that I argue are at the heart of the JPEG scopic/governmental regime. I look to move beyond a purely theoretical account of JPEG imaging to explore that framework in practice.¹³

I then present a *Report* of my findings where I explore the ways in which an object-oriented account of JPEG appeared in my practice.

In *JPEG: the governmental object*, I use this account of the quadruple object and its relations to explore the distributed imaging regime and its governmental implications as encountered in the digital detritus of Google, Facebook and Flickr's infinite archive: the spaces of imagining 2012. Through a discussion of Facebook's photo storage system Haystack and the patented technologies that underpin its Open Graph, I look to again provide an object-oriented account of the social imaging mesh through theory and my practice.

12. There is some disagreement around the best term for perspectives that start from and work with objects. Harman prefers the term "object-oriented philosophy" while Levi Bryant, Timothy Morton and Ian Bogost prefer "object-oriented ontology". Following my use of Harman's quadruple structure I choose to use his terminology, hereafter abbreviated to OOP.

13. As I discuss in this chapter and the next, I am not looking to develop a philosophical work or account of JPEG. Rather I position OOP as not just an ontology but also a method. Rather than engaging in debates about whether OOP is valid as philosophy, I look to ask whether it has anything to offer to software studies and to practice.

In addition, the text is interspersed with considerations of object-oriented photographers, or more correctly object-oriented considerations of photographers, as the photographers considered would probably not consider themselves working within what I call object-oriented photography. These interventions in the text are part of the e-Books that I have created as part of this project. These objects are also included here as a way of grounding the theory in a wider object-field as well as exploring what happens when disparate written objects are made to collide and connect within this PhD-object.¹⁴

Like *Camera Lucida* there is something very personal about this work. It arises from and works through my practice as a photographer. Its object is clear: JPEG, yet that object, like Barthes' photo of his mother has a complex form, character and power. The central question is simple: "what is JPEG?" like Barthes' "what is Photography?". Yet both questions open up a complex mesh of connections, relations and actants in play. Barthes' mission took him outside his comfort zone of language. Mine has taken me outside the comfort zone of both "pure" practice and "pure research". Finally, like *Camera Lucida* this work is modest and tentative: *Note sur le protocole*.

14. In my conclusion I talk of how the form of this project and report are themselves object-oriented and how I created the work in that way in order to explore the critical potential of object-oriented approaches to academic writing and publishing.

The Digital Imaging Pipeline

This project seeks to understand, and also takes place in, the “digital imaging pipeline”,¹⁵ that space of objects and object connections within hardware and software scopic apparatuses and imag(in)ing meshes where light-becomes-data-becomes-image. Although the term “pipeline” would tend to connote process and movement and linear relations, I will come on to draw it in terms of objects. To provide a grounding for these discussions it is necessary to lay out the technical form of that pipeline in order to establish the range of objects we are dealing with.¹⁶

One way to understand the “digital imaging pipeline” is via its chemical equivalent. I use the term “chemical” rather than “analogue” because I want to avoid debates about a digital-analogue divide. The issue here is not whether one deals in discrete one and zero steps and the other a smooth curve, but rather the way in which encoding works. The issue within which JPEG is important is the difference between action of light on silver halides within a chemical process, and light on silicon within a digital process.

In “chemical photography” photographic film carries an emulsion binding silver halide crystals to a gelatin base. Silver halide consists of silver combined with a halogen element, such as chlorine, bromine or iodine. These crystals react to the light that hits them, forming a latent image which is amplified during development to form a visible, black image where light has struck the emulsion. When the film is “fixed” the remaining unexposed crystals are removed, leaving a negative image on film. Vastly simplified, the chemical imaging pipeline can be characterised as: light hits silver creating latent image; development amplifies latent image creating final image.

Of course photography adds other stages and technologies to the process. Most photographers want to turn the negative into a positive. By shining light

15. This term “pipeline” is not simply a metaphor. Rather it is the recognised technical term for addressing the ways in which digital imaging works and, as I understand it, the way the various objects connect. See for example Ramanath, Snyder, Yoo & Drew (2005) and Gonzalez & Woods, (1992).

16. For the recognised FAQs around JPEG, see Lane (1999a; 1999b).

through the negative onto a paper coated with a similar silver halide emulsion, the exposed areas (black in the negative) stop light hitting the paper, while unexposed areas (clear in the negative) let light hit the crystals.¹⁷ What was light in the scene and black in the negative become light in the print and vice versa. There are other technologies (or objects as I would refer to them) in play. Lenses (or in my case pinholes); camera apparatuses including the shutter and aperture assembly; enlargers; film and paper as well as corporate objects such as Kodak as well as their failed business strategy.¹⁸ Some of these of course are also in play in digital photography. What is different is the encoding - the journey of light through latent image or data to visible image.

Many things *are* similar, metaphorically and literally. Concentrating just on the encoding, light hits a sensor (silicon rather than silver halide). This generates data (electronic information rather than a latent image in silver) that becomes an image (through software processing rather than through chemical development). But there are important differences that impact on how JPEG, as my main focus, works within imaging and to create images.

To work with objects: the first object in the digital imaging pipeline is the sensor. In digital photography these are two main types: CCD (charge-coupled device) and CMOS (complimentary metal-oxide semiconductor) sensors.¹⁹ Sensors are effectively an array of silicon, solar or photovoltaic cells. When light hits one of these cells, some of its energy is absorbed by the silicon, knocking electrons loose which are forced to flow in a particular direction creating a current: photons become electrons, light become electricity.

17. For the sake of clarity I focus on basic black and white photography rather than colour imaging or reversal (slide) photography.

18. As I shall argue, just because an object or an object connection “fails” does not mean it is not an object. The collapse of Kodak in 2012 can be understood in object-oriented terms as its business strategy object failing to connect with other objects in the imaging mesh. Latour famously explores such “failed” object relations in *Aramis* (1996).

19. There are other types of sensor such as the Olympus Live MOS sensor and the Sigma Foveon DP sensor discussed by Bogost (2012a, pp. 69-71) see pp. 65-66.

CCD and CMOS sensors have either a red, green or blue filter over each cell, essentially making the cell only sensitive to red, green or blue light. These are arranged in a Bayer mosaic pattern consisting of two green, one red and one blue filter - designed to match the bias of human perception of colours.

The sensor reads the amount of charge from each cell (what comes to be known as pixels). These electrical charges need to be collected and organised before they can be processed by other software objects. A CCD sensor handles this differently than a CMOS sensor. In a CCD sensor, a control circuit causes each capacitor to transfer its contents to its neighbour with the final output read at one corner of the array. In a CMOS sensor, each pixel/cell is accompanied by several transistors that amplify and move the charge using more traditional wires. Thus each pixel can be read individually.²⁰

At this point the light-as-electricity is still “analogue”. In order for the software (including JPEG) to be able to work with it, it needs to become digital. Here we come to our second object:²¹ the analog-to-digital converter (ADC). An ADC is an integrated circuit that samples the analogue feed from the sensor into a number of discrete levels of brightness. Most cameras use 8bit ADCs which allow 256 distinct values for the brightness of each pixel.²² This digital information simply records the luminescence at each location on the sensor. This is greyscale data. The ADC adds extra information to its output: information about a pixel’s location (and hence whether it was “under” a red, green or blue filter) as well as metadata about the sensor’s colour space; and the camera’s white balance setting. This digital

20. CCD sensors are generally seen as more expensive and power hungry but also having higher sensitivity and being capable of delivering higher quality. CMOS sensors tend to be found in mobile phone cameras

21. Of course OOPs would be clear that we have already been dealing with a whole series of nested objects in terms of the sensor, but for clarity's sake I outline the key actants.

22. A bit in computer terms has a value of on or off, one or zero. A two-bit ADC would divide the information from the sensor into levels 00, 01, 10 and 11. An 8-bit sensor can divide it into 256 levels from 00000000 to 11111111.

information becomes the RAW data file that is written to the camera's storage medium.²³

Because each pixel/cell only senses one wavelength of light (red, green or blue), the information making up the "latent image" needs to be interpolated so that the image can represent the amount of red across the whole image not just on those bits where the filter measured the red light. To do this a "demosaicing algorithm" averages the values from the closest surrounding pixels to assign a "true colour" to each pixel. This data can be encoded as a visible colour image file. It is here where JPEG comes in.²⁴

The demosaicing algorithm outputs three 8-bit colour channels of data as opposed to the one 12-bit RAW channel. These three channels are then encoded in particular formats: usually either a 24-bit TIFF or a 24-bit JPEG/JFIF or JPEG/EXIF file.

To concentrate just on the JPEG processing of that RAW feed of data, the digital imaging pipeline continues in four steps: Sampling, Discrete Cosine Transform (Cabeen & Gent, 1998), Quantization and Huffman Coding (Miano, 1999, p. 44; Haas, 2008). At the end, the light-as-data is a JFIF image, commonly known as a "jpeg photograph".

The pixel data is first converted from RGB to YCbCr colorspace. The JPEG standard is principally about compression. Its role in the imaging pipeline is to reduce the amount of data in the file - hence its importance in the early days of the Internet when bandwidth was at a premium. Part of the work of compression is the move from RGB to YCbCr. Storing image data in both RGB and YCbCr colorspaces demands three channels of information - in RGB: red, green and blue; in YCbCr: luminance and two chrominance, blue and red (Miano, 1999, p. 6). Both allow a full range of colours but in RGB,

23. This RAW data/file is not "pure". Each camera has its own way of writing the RAW data, its own format. RAW converters (the part of software that interprets and renders that data as image within other software) have to know the various formats Olympus, Nikon, Canon etc use in order to "make sense" of that data, see Fraser (2004). The evocatively named "digital negative" DNG standard was developed to solve incompatibility problems and also provide a standard that retained all the RAW data in a standard format that could form the basis of archives.

24. For accounts of the history and development of JPEG, see Palmer (2011) and Wallace (1992).

each channel is sampled at the same frequency while in YCbCr, this can be varied. The Y component contributes most information to the visible image and JPEG therefore assigns more weight to that component and reduces the amount of information in the Cb and Cr channels, thus reducing the amount of information and so the file size. As John Miano explains:

“By adjusting the sampling frequencies you could include each pixel’s Y component value in the compressed data and 1 value for every 4 pixels from the other components. Instead of storing 12 values for every 4 pixels, you would be storing 6 - a 50% reduction” (1999, p. 41).

The next step in JPEG encoding is “Discrete Cosine Transform” (DCT). First the YCbCr image data is divided into 8x8 blocks called data units.²⁵ DCT does not actually compress or throw information away, it merely readies the data/information for that to happen in the next step by sorting the information which can safely be discarded. Rather than record the individual values of each Y, Cb and Cr component over an 8x8 block, we can average the values for each block and record how each pixel differs from that average value. DCT takes the set of values in each data unit and transforms it into a set of coefficients to cosine functions with increasing frequencies (Miano, 1999, pp. 77-90). In effect DCT arranges the digital information ready for compression by finding the frequency of each value - in lay terms the most frequent tone or colour values.

JPEG compression depends on the fact that human perception is not perfect. A lot of information can be thrown away and, effectively we fill in the gaps in a similar way to the way the demosaicing algorithm does. The next step takes the sorted data from the DCT and discards those coefficients that contribute less information to the image.²⁶ This is the quantization step. Quantization is a “fancy name for division. To quantize the DCT coefficients we simply divide them by another value and round to the nearest

25. JPEG works with 8-bit data.

26. This is why JPEG compression is referred to as “lossy compression” because data is lost.

integer” (Miano, 1999, p. 88).²⁷ This rounding process effectively discards some of the coefficients and so information. The JPEG standard does not specify the value to be used in quantization. It leaves that up to the application using JPEG. Rather it provides 8x8 quantization tables that map onto the 8x8 data units. We normally come across these tables when we choose the “quality” setting for JPEG compression in end-user software such as Photoshop or select Fine, HQ or SHQ quality settings in a camera.

Having discarded data from the RAW data file, JPEG’s final step is to create a visible (JFIF) file. This is achieved through Huffman coding. Like DCT, Huffman coding takes the set of values in each data unit and transforms it into another set of values. Unlike the DCT, Huffman coding is lossless - no further information is discarded. Rather this process saves further space by assigning shorter codes to the most frequently used values. Like Morse code, Huffman Coding assigns shorter codes to the most frequently occurring values (vowels have shorter Morse code symbols than x or z) according to a Huffman table. As Calvin Haas explains:

Creating these tables generally involves counting how frequently each symbol (DCT code word) appears in an image, and allocating the bit strings accordingly. But, most JPEG encoders simply use the Huffman tables presented in the JPEG standard (2008, n.p.).

Having mapped the data to new (shorter) values according to a Huffman table, the resultant file must include that table (or reference the standard table) to enable other software to decode the data as a visible image.

Having started as light photons, being turned into electrical charge and from there into data, the resultant information has been sorted and compressed by JPEG into a file ready to be written (potentially alongside a RAW file) to the camera’s memory. JPEG wraps the compressed data within a

27. Jesse D. Kornblum identifies how quantization tables can be used for image source identification within digital forensics (2008). While issues of JPEG and digital forensics as well as “steganography” (the potential to hide data within JPEG-encoded images) are dimensions of JPEG’s relation to broader regimes of power and governmentality, they are not the focus of this work which aims to look at the more prosaic position of JPEG as standard within imaging, its standard connection with other digital and governmental objects. For accounts of steganography, see Johnson & Jajodia (1998); Provos & Honeyman (2001); Fridrich (2004) and Fridrich, Pevný & Kodovský (2007).

format that includes the Huffman and quantization tables necessary to decode the compressed data, the data itself and a series of markers that break the stream of encoded data into its component structures. These markers are 2 bytes length with the second byte denoting the type of marker.

One such marker is the APP marker which hold application-specific data. These are used by software or applications to add additional information beyond what is demanded by JPEG. An encoder that uses JPEG can specify particular information within an APP marker. This is important when it comes to the two most widely used JPEG-encoded file formats.

JPEG does not define a file format. As Miano says, “it says nothing about how colors are represented, but deals only with how component values are stored” (1999, p. 40). Other file formats such as TIFF can compress using JPEG. JPEG can therefore write more than one sort of data/image file. The two most common follow the JFIF (JPEG File Interchange Format) (Hamilton, 1992) and the EXIF (Exchangeable Image File Format) (CIPA, 2011) standards. The two standards are very similar with EXIF allowing the addition of specific metadata tags but not allowing colour profiles. Most cameras encode to an EXIF file while imaging applications use JFIF. Technically JFIF and EXIF use different APP markers (APP0 and APP1). In practice most photo applications use JFIF and include the metadata from the APP1 marker.²⁸ Other markers provide space in the file for comments, details of the width and height and number of components in the image as well as the Huffman and quantization tables.

As I shall discuss in *The JPEG object in theory* and *The JPEG object in practice* chapters, this “family of compression algorithms” (Lane, 1999a, n.p.) can be addressed as an object in Harman’s terms not only in terms of its existence in paper standards documents but also in terms of its “weird” quadruple existence within the digital imaging pipeline. Clearly however, it is possible to address this whole pipeline (or indeed the chemical imaging pipeline) through OOP.

28. Strictly speaking this goes against the standard with both JFIF and EXIF demanding that their marker is first in the data-stream. As with much software, this demand is fudged.

OOP enables, even forces, us to see a panoply of objects in play in any situation or mesh. Human and unhuman, material and virtual, even real and imaginary actants (in Latour's terms) connect and reconnect in ways that we experience as processes or pipelines. In terms of chemical photography, the photographer, lens, shutter blades, gelatin, silver and sodium thiosulfate (fixer) all have their own presence and material actuality. They all do things as individual objects as they connect and reconnect with each other. But they also form components of other objects: the camera, Bourdieu's photographic society (1990), Snappy Snaps, Kodak. It is objects all the way down.

Similarly in the digital imaging pipeline hardware and software objects, mathematical algorithms and tables, silicon and electrical charges, Adobe, the photographer and photons are all in play. They all have their specificity and their connections. Some are material, others immaterial. Some we can distinguish. Others, like an algorithm, have a weird presence and actuality. Some are often characterised as systems or contexts, but they too are objects just at a different scale. We may experience the pipeline as a process but what we are really faced with is a network of objects connecting and reconnecting with and within other objects.

What OOP (at least in the Harman version I explore) offers is firstly a refusal to leave that focus on objects - to refuse to talk of systems, assemblages, meshes or contexts as anything other than objects. Secondly Harman's OOP refuses to characterise those objects as defined by their relations. Rather they have an existence and, in Jane Bennett's terms a "vitality", that exceeds their relations (2010a). Thirdly, those objects are not processes. They are not in flux. Rather, change is matter of new objects formed in new object connections. Finally, from an OOP perspective, the objects in play in the digital imaging pipeline do not hold anything back. They do not harbour potential. They are fully present in their connections not harbouring potential, or somehow waiting to "become".

It is these refusals and positive claims that I explore in my practice-research. But in the next chapter I show how this perspective on objects runs counter to much discussion about digital/software objects and protocols.

Interlude: Eugene Atget

It has justly been said of him that he photographed them like scenes of crimes. A crime scene, too, is deserted; it is photographed for the purpose of establishing evidence. With Atget, photographic records begin to be evidence in the historical trial [*Prozess*]. This constitutes their hidden political significance. They demand a specific kind of reception. Free-floating contemplation is no longer appropriate to them. They unsettle the viewer; he feels challenged to find a particular way to approach them (Benjamin, 2008, p. 27).²⁹

Atget walked the streets of Paris from 1897 until his death in 1927 with his view camera and a particular sensibility. He was a working hack. He took pictures to sell as “documents for artists” in the nearby town of Montparnasse. At the same time as Russian constructivists and Italian Futurists were feting speed as technique, source material and inspiration, Atget plodded around Paris like the fabled flâneur and his turtle,³⁰ unfurling his equipment, waiting as the light encoded Paris as information and then waiting while light encoded it again as an Albumen print.

The long exposures meant the pictures were often devoid of people but that is not what makes his sensibility object-oriented. Rather it is the ghostly traces of humans occasionally caught in the doorways, on street corners or reflected in windows alongside the rags ‘n refuse³¹ of Paris that make Atget object-oriented.

His object-oriented sensibility (his “eye” as photographers might call it) is democratic, in the sense in which Levi Bryant uses the term.³² His litany includes gargoyles and statues, steps and railings, beds and bottles, hats and

29. For discussion of Benjamin and Atget, see Dennis (2009).

30. For discussion of the flâneur and online media, see Featherstone (1998) and Atkinson & Willis (2007).

31. The term comes from Walter Benjamin’s account of the fragments collected in *The Arcades Project* (2002, pp. N1a,8). This is discussed further in my conclusion.

32. For Bryant “[t]he democracy of objects is not a *political* thesis to the effect that all objects ought to be treated equally or that all objects ought to participate in human affairs. The democracy of objects is the ontological thesis that all objects, as Bogost has so nicely put it, equally exist while they do not exist equally” (2011a, p. 19).

mannequins, toys and fruit, traders and trees. Like an *istockphoto* freelancer³³ compulsively imag(in)ing in the belief that someone, somewhere needs a picture of X, Atget documented. But here there is no “decisive moment” or even privileged access. His scopic flânerie was extensive but not comprehensive. He selected particular objects to make into objects but there was no hierarchy of Parisian reality. No Eiffel Tower at the top and a particular staircase at the bottom nor vice versus. His was not a humanist imaging nor an anti-humanist one. He simply didn’t care or maybe even see the distinctions.

For Atget, as for anyone walking the city, Paris withdrew. Yet he encountered it. There was a sensual dimension to Paris that Atget and his camera connected with and it was the withdrawn reality that made the sensual so powerful. His images are a trace of those encounters. Our encounter with them echoes that withdrawal/access tension as we enjoy the coffee table book or search online, as the images resonate or evoke and yet something, somewhere withdraws.

In *The Genius of Photography* TV series, photographer Joel Meyerowitz makes strange Atget’s *Coin du Quai Voltaire* of 1916 by turning it upside down (Kirby, 1996a). When he has defamiliarised the image of the Paris street with its Colonne Morris, streetlamp, trees and cobblestones, he sees Atget’s object: “[a] white zipper. Zip! Running right up the middle of the building” (op cit.). For Meyerowitz, this is a “punctum” (Barthes, 1990). This pricks him as he argues it must have Atget. But the cemented-up chimney flue can also be seen as a street object, alongside, not above or underneath the Morris column or the window, just another object connecting with the wall and the tree and the light and the photographer and his stall of images for sale and... Trees and a cathedral share the frame in *Notre-Dame, 1922* as well as the ontological space. Like the cluttered *Collector’s Room* (1910) or the barrels and gramophones in the *Grocer and wine merchant* (1912) everything and nothing is punctum.

33. *istockphoto* is a “crowdsourcing” website/photo library allowing aspiring professional photographers to sell images (Brabham, 2008).

When Atget wrote “Va Disparaitre” on the back of *41 Rue Broca* in 1912, it was a note to himself and us that the building would soon disappear. Literally it would suffer the fate of *La maison no 5 de la rue Thouin* on the 10th August 1910. It would soon have its day of demolition with its new rubble objects nestling next to a blurred ghostly figure and a boy who seems to have stepped out of a Diane Arbus picture. But Atget is not nostalgic. Nor is he simply a recorder of passing time. His object-oriented sensibility knows that 41 Rue Broca disappears in another sense. As an object it disappears from access at the moment of taking and viewing in 1912 as much as it does a century later. Just as Atget knew it was sensually present for him and for us then and now, it was also out of reach. It had already, inevitably and irrevocably disappeared. It had withdrawn.

Atget’s Paris, often the name for the books published about him, as an object then and now for the Paris tourist board, Eurostar, Woody Allen, my iPhone and the wheel of Mark Cavendish’s bike is never fully there. It is not just a brand, an ideology, a metaphor or a sign, but it is also never fully accessible as a real object. Those objects encounter its sensual dimensions as did Atget, his camera and the light that fell on the *Door knocker* (1909) or the *House of pleasure* (1921) and rendered his albumen prints. Atget’s object-oriented sensibility emerges from his willingness to sink into that mesh of objects and sensual/real connections, to refuse the correlationist agenda offering him a subject as opposed to object position or some privileged access to Paris’ objects.³⁴

34. The term “correlationist” is Quentin Meillassoux’s (2009) and is discussed in *The JPEG Object in Theory* chapter.

The JPEG object in the literature

The relational object

For software and critical code studies,³⁵ locating the digital or code object within a field of relations has been a powerful axiom. As part of a broader hegemonic struggle within media and cultural studies, exploring protocols, interfaces, languages and algorithms as powerful because of the way they relate to other actors in the network,³⁶ has allowed software studies to establish a critical praxis while also arguing for software's pervasiveness and enfolding within the complex meshes of contemporary technocapitalism and technoculture.

As an example, David M Berry's discussion of the "computational knowledge society" (2011b, p. 3), as well as remaining focused on the specifics of code, draws a relational map of software's entanglements. When he says, "[s]oftware is a tangle, a knot, which ties together the physical and the ephemeral, the material and the ethereal, into a multi-linear ensemble that can be controlled and directed" (*ibid* p. 3), those relations allow him to unpack military hardware, trading and shopping systems and the institutional and structural powers that they support.³⁷ He says, "[c]omputation reveals a particularly rich set of active relations, between human and non-human actors, both collective and individual" (*ibid* p. 124). Software and critical code studies' willingness to remain concretely focused yet relationally oriented has opened up such macro-micro analyses.

As I will come on to argue, OOP is not opposed to an idea of relations. Nor is it against an account of the network. Indeed, as Harman's feting of

35. The term is Mark Marino's (2006). Later he says, "Critical Code Studies names the practice of explicating the extra-functional significance of source code. Rather than one specific approach or theories, CCS names a growing set of methodologies that help unpack the symbols that make up software" (2011, n.p.). See also Mackenzie & Vurdubakis (2011)

36. I use the term "network" in a Latourian rather than a technical sense. For studies of interfaces, see Bratton (2008) and Chun (2008).

37. For an alternative account of the materiality of finance systems, see Miyazaki (2005) and on algorithms and trading, see Lenglet (2011). For a discussion of the relation between "data derivatives" and risk within the context of border security systems, see Amooore (2011).

Latour in the first part of *Prince of Networks* (2009c) makes clear, actants in networks is a powerful model: objects connect. Where OOP differs is in demanding that objects are not defined by their relations and that relations are matters of objects not of exterior context. Objects' character and power exceeds their relations and the networks or meshes within which they are enfolded. As my own work will show, exploring JPEG as having an existence, character and power beyond its relations allows us to see how governmental issues of data-mining are best addressed as a matter of the JPEG-object connecting with a search algorithm-object within another, specific object. Objects relate within objects not within contexts or fields. This is the heart of "object-orientation", a refusal to leave an account of specific objects even when building a critique of networks. It is this refusal (or perhaps more positively, focus) that enabled me to engage in my particular imaging and build my particular critique.

For some seminal work in software studies, including the first discussions of protocol, this is not the case. Objects are best addressed in terms of relationality.

Lev Manovich's *The Language of New Media* in 2001 is credited with introducing the idea of "software studies".³⁸ Coming as it did after the dotcom bubble burst, Manovich's book was hailed as giving software/digital scholars concepts and a framework they could use to establish their own specificity or as Sean Cubitt said in his *Leonardo* review (quoted on the back cover): "we can argue on our own terrain".

Right at the start of the book, Manovich brings in the object:

A new media object may be a still digital image, a digitally composited film, a virtual 3D environment, a computer game, a self-contained hypermedia DVD, a hypermedia Web site, or the Web as a whole. The term thus fits with my aim

38. Of course there is more to Manovich's work than this text and indeed more to *The Language of New Media* than his account of the object, notably his discussions of representation, cinema and realism. My concern is not to provide a full account of these arguments but to draw out Manovich's particular, and influential take on the object. For his broader argument on the focus of software studies, see (2008; 2011b) In terms of particular software, see (2005a; 2006; 2011a). On cinema, see (2000) and Manovich & Kratky (2005). For his work on data visualisation, see (2010) and Manovich & Douglass (2009).

of describing the general principles of new media which would hold true across all media types, all forms of organization and all scales. I also use 'object' to emphasize that my concern is with the culture at large rather than with new media art alone (2001, p. 14).³⁹

He draws attention to the term's use in computer science and industry and how that aids in a discussion of "computerized culture". Objects for Manovich are products. They are the discs, films, data files, software environments, interfaces,⁴⁰ webpages and sites, even networks and digital images,⁴¹ Manovich adds real value by understanding these as material.⁴² He says:

Rather than imposing some a priori theory from above, I build a theory of new media from the ground up. I scrutinize the principles of computer hardware and software, and the operations involved in creating cultural objects on a computer, in order to uncover a new cultural logic at work (*ibid* p. 10).⁴³

39. Other critics have looked at concrete non-art digital objects such as gadgets and even digital fetishes particularly in terms of mobile. See for instance Itō, Okabe & Matsuda (2005); Richardson (2005); Goggin (2006); Levy (2006); Hawk, Rieder & Oviedo (2008); Ling (2008); Green & Haddon (2009) and Reading (2009).

40. An issue he had addressed as early as 1995 when "virtual reality" (VR) was all the rage. In (1995a) he sought to find a way to address the specificity of that object through an analysis of the "screen" through which it worked. For a more media archaeological account of the screen, see Gere (2006).

41. In (1992) Manovich had discussed the question of "what is a picture?" including the computational picture in his review of pictorial semiotics. He concluded that "the study of the mechanism of pictorial signification and the understanding of social forces responsible for these mechanisms should constitute a joint project". Here is an early sign not only of Manovich's interest in the specificity of the object but also his location of that object within its relations and context.

42. Lisa Gitelman questions whether Manovich is truly comfortable with the idea of materiality: "Even the most astute and exacting critics of cyberculture tend to signal a certain ambivalence about the bodies that electronic texts have, judging at least from the frequency with which the word material appears between scare quotes. Lev Manovich (2001, pp. 45, 48) writes that the 'basic, "material" principles of new media [are] numeric coding and modular organization,' and that hardware and software have "material" as well as "logical principles."' (Gitelman, 2008, p. 96).

43. Manovich's articulation of a form of "grounded theory", a methodological approach derived from the work of Barney Glaser and Anselm Strauss (1967), is of course open to the same criticisms, notably what does one count as "ground". This is particularly relevant when one is dealing with the sort of "weird" digital objects where ground could be the software, the source code, the electrical charges or anywhere in between. For critiques of "grounded theory" see Thomas & James (2006).

That materiality however is in the service of something more - the cultural logic, the field of new media relations. When he says that his method could be called "digital materialism" (*op cit.*), this is in a wholly different way from an object-oriented materialism that treats objects (whether real or virtual, human or unhuman) as specific, vibrant actants that exceed that broader frame and those relations. It is not just that Manovich concentrates on new media "works" (specific products, actual games), nor that he approaches it through an established discipline of film studies,⁴⁴ it is that that specificity and actuality are drawn in terms of a problematic definition of the object.

This sense of relationality as a defining theme can be seen in Manovich's formalist "principles of new media" (*ibid* pp. 27-48), the "general tendencies of a culture undergoing computerization" (*ibid* p. 27). His final principle, "transcoding" captures this sense of objects-in-relations. "Transcoding" is "the most substantial consequence of media's computerization... computerization turns media into computer data" (*ibid* p. 45).⁴⁵ Here the focus is on "computerization", data as related information. He argues that a

44. He says: "The theory and history of cinema serve as the key conceptual 'lens' through which I look at new media" (2001, p. 9).

45. In (1997, n.p.) Manovich had said, "[a]ll information becomes encoded in one code; all cultural objects become computer programs, something which is not only seen, heard or read, but first of all stored and transmitted, compiled and executed".

Wendy Hui Kyong Chun has problems with this stress on computerisation. She argues that the "problem with 'software studies' or transcoding, however, is this privileging of software as readable text; it ignores the significance of hardware and extramedia representation because it only moves between software and interface. Also, this notion of transcoding perpetuates the idea that software merely translates between what you see and what you cannot see, effectively erasing the many ways in which they do not correspond" (2006, p. 18).

For Chun computation makes differences rather than simply registering them. Simply opening a file can change it (see (Parikka & Sampson, 2009)). For Chun, "[t]he problem with Manovich's notion of transcoding is that it focuses on static data and treats computation as a mere translation. Programmability does not only mean that images are manipulable in new ways but also that one's computer constantly acts in ways beyond one's control. To see software as merely "transcoding" erases the computation necessary for computers to run" (Chun, 2005, p. 46).

She also criticises his account of new media spaces as ones of navigation arguing that such spaces are unnavigable insofar as users have no control over the path their (or anyone's data) takes (2006, p. 46). In her most recent work she says the notion of transcoding treats computation as "a mere translation" and focuses on static data rather than issues of programmability and computation (2011, p. 91).

new media object is defined at a formal level by its relationship to the computer, its database, its formal logics and structures.⁴⁶

Even if we extend Manovich's list of objects beyond discs, games and films to include protocols and standards, human actants such as engineers or photographers, unhuman actants such as what Bruce Sterling has called "spimes" (2005) and Julian Bleecker has called "blogjects" (2009) as well as the Apple App Store or Facebook's datamining strategy; even if we take his formalist principles and apply them to these new objects, we are still left with an account of the object that requires something outside - structural principles (the language) of new media, a contextual logic,⁴⁷ a picture of objects-in-relations.

Manovich says that "the new qualities of 'digital media' are not situated 'inside' the media objects. Rather, they all exist "outside" - as commands and techniques of media viewers, email clients, animation, compositing, and editing applications, game engines, and all other software 'species'" (2011b, n.p.). When Manovich talks of the inside and outside of media objects, he is using the terms in a different way to Harman. Here he is drawing attention to what he sees as a field of relations external to objects enabled by software *inside* those objects. For an object-oriented perspective, as we shall see, this is to move beyond objects and also to fail to account for software itself as an object. The objects Manovich raises as worthy of his formalist analysis derive their interest and their power from

46. In an earlier article, Manovich discusses databases as a symbolic form (1999) (a theme taken up later by contributors to Vesna (2007)). The database, as what Tiziana Terranova calls Manovich's "arch-model of the new media" (2004, p. 35), positions the new media object as a matter of relations. It is this sense that allows Terranova to criticise Manovich for not developing that (software) object-in-relations account with sufficient notice of power, a theme picked up in Chun's account of databases and control (2006).

47. It is perhaps interesting to see Manovich's latest work around data visualisation as a willingness to engage more fully with a wider field of objects. In (2002, n.p.) he wrote: "Along with a Graphical User Interface, a database, navigable space, and simulation, dynamic data visualization is one of the genuinely new cultural forms enabled by computing". He has since extended beyond considering visualisations as just cultural forms to approaching them as something more problematic. In (2010, n.p.) he suggested we "define information visualization as a mapping between discrete data and a visual representation". Here the visualisation is not a cultural form but a mapping, something beyond both data and representation - a weird object perhaps.

their relations within software, within databases or within a new media culture.

It is not, as N. Katherine Hayles says, that Manovich (and Kittler) “regard the computer as the ultimate solvent that is dissolving all other media into itself... This claim has the effect of flattening into a single causal line - the convergence of all media into one - social and cultural processes that are in fact much more complex” (2005, p. 31).⁴⁸ Rather, from an object-oriented point of view, the issue with Manovich’s identification of the importance of the object is that he does not take it far enough not only in terms of what counts as an object, but also how the object is understood. He presents a flat media but not a flat ontology. Bogost argues that “object-orientation and remapping are much subtler than Kittler and Manovich would lead us to believe” (2006, p. 40). The problem is that by defining objects as objects-in-relations (as Latour does in terms of his actants), one deals with actor networks or software rather than the specifics of the sort of weird objects, like protocol that I, and Alexander R. Galloway, argue are particularly powerful.

Galloway’s is a particular articulation of software studies. He focuses on a specific software component, protocol, rather than software packages or software practices. He also positions software within broader semiotic, material and historical frames notably in his later work with Eugene Thacker on DNA codes and codecs (2007). What is particular about Galloway and most notable in *Protocol: How Control Exists after Decentralization* (2004), is his focus on the “object”, a concern he returns to in his contribution to

48. Mark B. N. Hansen makes a similar critique when he says: “As I see it, digitization requires us to reconceive the correlation between the user’s body and the image in an even more profound manner. It is not simply that the image provides a tool for the user to control the ‘infoscape’ of contemporary material culture, as Manovich suggests, but rather that the ‘image’ has itself become a process and, as such, has become irreducibly bound up with the activity of the body” (2004, p. 10). More generally on convergence and media, see Jenkins (2006); Jenkins & Deuze (2008) and specifically in terms of convergence and media work, Deuze (2009).

The Object Reader (2009b).⁴⁹ His broader aim of showing how networks are sites of particular control and governmental discipline, enabled by particular configurations of software, depends on tracing the protocol-object as a key player in (as well as evidence of) those relations. Galloway needs protocol to be an “object” in order to be able to show that protocol does things in the world. Furthermore his perspective demands that object to be an object-in-relation in order to explore his real target, the “control society” as outlined by Gilles Deleuze (1992).⁵⁰

Refusing to see the digital object as a digitisation of the Marxist commodity or semiotic sign, Galloway expands on Manovich’s typology of objects (Manovich, 2001, p. 14) to include “any positive content-unit or content-description: text, image, MIDI data, VRML world, texture, movement, behavior, transformation” (2004, p. 74). Where he builds on Manovich is not only in his willingness to expand the definition of what counts as an object but also by giving the digital and in particular software object a form of autonomy - alongside Manovich’s specificity - an “objectness”. They are “radically independent from context” (*op cit.*). That autonomy however is drawn in terms of a network of relations within the machine. In the next section he says:

“Protocol is a language that regulates flow, directs netspace, codes relationships, and connects life-forms. Protocol does not produce or causally effect objects, but rather is a structuring agent that appears as the result of a set of object dispositions. Protocol is the reason that the Internet works and performs work” (ibid pp. 74-75 emphasis in original).

49. This object-focus can be contrasted with accounts of the values and power relations apparent in the Internet’s technical working explored by those looking at technical code. Andrew J. Flanagin, Craig Flanagin and Jon Flanagin say: “A technical code analysis, therefore, reveals the underlying assumptions and choices that become built into technologies, which would otherwise remain largely obscure” (2010, p. 180). Here the focus is on the broader system.

50. See Best (2010) for a discussion of perceptions of the “control society”. For a different account of the relation between “disciplined subjects” and interactive media, see Barry (2001). As I will argue, an object-oriented approach does not deny relations and can add real value to to a discussion of governmentality. The difference is that for OOP those relations do not define the object.

Here objects are drawn in terms of their relationality. Protocol, he says is “a technique [like the rules of the road] for achieving voluntary regulation within a contingent environment” (Galloway, 2005, p. 22). Protocol is a set of rules, a language that, as the structuralists taught us, is a field of relations. While in 2006 he loosens the language slightly by talking of protocol as “set of recommendations” (2006d, p. 319), he often frames protocol in terms of language. This textualist conception of protocol, characterising protocol as a language,⁵¹ locates the protocol object as an object-in-relations as well as in a privileged, foundational position with regard to other objects. There is no flat ontology in Galloway. Although he says that “[p]rotocol functions largely without relying on hierarchical, pyramidal or centralized mechanisms; it is flat and smooth; it is universal, flexible and robust” (*ibid* p. 317), this flatness refers to protocol not to the realm of objects as a whole. Galloway’s argument is that protocol as a digital object must, as a universal standard, lack depth. However, the control society within which it is enfolded, has structural relations that appear as layers with protocol acting as the logic of a particular conjuncture.

51. The relation between code and language (and ideology) has been a consistent theme within software studies. Matthew Fuller and Andrew Goffey talk about the “logic of programmed hardware and software... as something that more closely approximates the order of language” (2009, p. 142) while Adrian Mackenzie insists that “[o]ne way to resist an abstracting turn away from software is to attend to its code-like structure” (2006, p. 3). Michael Mateas’ discussion of “weird languages” which “tease apart phenomena present in all coding activity” (2006 p. 274) and Nick Montfort’s discussion of programming languages (2006) are further examples. Others have sought to address the form and ideology of that linguistic form. Hayles stresses performativity: “Code that runs on a machine is performative in a much stronger sense than that attributed to language. When language is said to be performative, the kinds of actions it ‘performs’ happen in the minds of humans, as when someone says ‘I declare this legislative session open’ or ‘I pronounce you husband and wife’. Granted, these changes in minds can and do result in behavioral effects, but the performative force of language is nonetheless tied to the external changes through complex chains of mediation. By contrast, code running in a digital computer causes changes in machine behavior and, through networked ports and other interfaces, may initiate other changes, all implemented through transmission and execution of code” (2005, p. 50).

Galloway (2006b) and Chun (2005) have discussed the relationship between code and ideology with Galloway arguing that “software is not merely a vehicle for ideology; instead, the ideological contradictions of technical transcoding and fetishistic abstraction are enacted and ‘resolved’ within the very form of software itself” (*ibid* p. 319).

It is not my intention to enter these broader debates about software and ideology or even code and language but merely identify the particular way in which Galloway articulates protocol as language, as a special kind of machinic language not in terms of its internal structure but rather its workings and role.

Galloway argues that protocols such as TCP/IP and DNS act as a “political technology” (2004, p. 115) which encapsulate the complex enfolded relationships between protocol and what Deleuze (1992) and Michael Hardt and Antonio Negri (2000) identify as control societies.⁵² Where one (TCP/IP) is to do with distribution, connection and decentralisation, the other (DNS) is built around centralisation and control.⁵³ For Galloway this dialectic is productive in allowing him to characterise the Internet as distributed, not decentralised but at the same time a space of control. In order to hold this tension, Galloway positions the protocol object (as rules and language) as the foundation of that control. He says his book “aims to flesh out the specificity of this third historical wave [Deleuze’s control society] by focusing on the controlling computer technologies native to it” (2004, p. 3). Drawing a parallel between the panopticon and protocol, he continues, “[p]rotocol is to control societies as the panopticon is to disciplinary societies” (*ibid* p. 13).

For Galloway, protocol must not be read as a tool of power or a simple manifestation of it, as we will see when discussing “the Exploit”. “The concept of protocol does not, therefore, describe one all-encompassing network of power - there is not one Internet but many internets” (Galloway & Thacker, 2004 p. 10). In an almost Actor Network Theory (ANT) sense he

52. For Galloway an analysis of protocol is a way of opening up the study of networks to reclaim the issue of power from an account of networks that have vied between what he calls gee-whizz accounts of progress (2004, p. 18) and descriptions of networks as cyberutopian arenas of anarchist freedom. Chun of course argues that “control and freedom are not opposites but different sides of the same coin” (2006, p. 71). As noted above, my concern here is not to engage with debates about networks but it is important to acknowledge that the network is Galloway (and Thacker’s) object of investigation.

Although Galloway is keen to move from “traditional” graph theory models of networks, he still draws heavily on the pervasive metaphor of the rhizome, drawn from Deleuze and Guattari (2004) (Galloway & Thacker, 2007, p. 29).

David Berry criticises Galloway and Thacker’s extended use of network as a metaphor (2008b, p. 367), a criticism echoed by Greg Boirarsky (2006, p. 108). The rhizomatic metaphor is also criticised by Conley (2009) and Buchanan (2009).

Given that, in *Protocol* at least, Galloway is talking of technological systems this is perhaps unfair. But even when dealing with the technosocial systems that are the focus of *The Exploit*, it is the very independent nature (in Galloway’s terms, the rule-based nature) of protocol that allows for exploit.

53. Recent attempts by the US Government to tackle Internet “piracy” have focused on using DNS as away of blocking sites that media owners complain are facilitating illegal media sharing (Lee, 2012).

draws attention to the authorship of protocols within “a self-selected oligarchy of scientists consisting largely of electrical engineers and computer specialists” (2005, p. 22).⁵⁴ Protocol is enfolded in powerful networks of individual and institutional actants through which power circulates.

Galloway draws a control matrix with Feudal, Modern, Postmodern and Future eras drawn alongside modes of energy, discipline and control with Protocol as the “control diagram” of the postmodern/Empire era whose energy mode is information, disciplinary mode is debugging and machine is computers (2004, pp. 114-115). Tracing the modes of this operation through processes of aestheticization, Galloway positions protocol as the latest in a long line of control diagrams from “violence” in the feudal era, through “bureaucracy” in the modern and on into “physics” in the future, a theme he picks up and develops with Eugene Thacker in his later work *The Exploit* (2007).

Protocol’s work within collaborative filtering software for example organises “real human people” (2004, p. 114) within hegemonic patterns. The biopower in operation works through objects-in-relations, protocols and other control technological objects connecting within “diagrams” or governmental regimes. He argues that “protocological analysis must focus on the possible and the impossible (the envelope of possibility), not a demystification of some inner meaning or ‘rational kernel’ within technology. *Protocol is a circuit, not a sentence*” (*op cit.* emphasis in original). It is this “envelope of possibility”, protocol as a “unique governing principle” (*op cit.*), a textualist picture of protocol as an object-in-relation to other aptly named “layers” of the Internet architecture, that is his focus. It is this structuring, relational nature of objects that structures and empowers control societies.

It is not that Galloway positions the protocol language in some abstract realm. Quite the contrary, for him these rules are enfolded in the real world,

54. Later in his discussion of “protocological institutionalization”, Galloway claims that “[l]ike the philosophy of protocol itself, membership in this technocratic ruling class is open” (2006c, p. 187) although admitting this depends on a certain level of technical literacy. For other perspectives on authorship and code, see Huber (2008) and Douglas (2008).

they are deeply social. “By formal apparatus I mean the totality of techniques and conventions that affect protocol at a social level, not simply a technical one” (*ibid* p. 55). That social enfolding however is drawn in terms of a formalist analysis. He says: “I move beyond the hard science of protocol and begin to consider it from the perspective of form. That is: How does protocol function, not as a material machine, but as an entire formal apparatus? What techniques are used by and through protocol to create various cultural objects? How can one define protocol in its most abstract sense?” (*ibid* p. 53). My argument is that by moving “beyond the hard science”, leaving the technical and particular realm of the object, one fails to address the specificity of the object and also the particular material and machinic ways these governmental relations are built.

This positioning of the protocol object in terms of relationality, connecting and enabling connecting between other digital and governmental objects, allows him and Eugene Thacker to develop their concept of the “exploit”, a form of counter-protocological struggle based on the idea of the protocol object as relational, located in a field or control society of relations (2007). Galloway and Thacker see contemporary struggles whether political, military or “terrorist” as symmetrical, networks fighting networks.⁵⁵ Their project is to find a new asymmetrical “topology of resistance” - an “exploit”. The protocol-object conceived in terms of relations is the key.

As objects-in-relations, protocols enable networks. With protocol seen as at the heart of networks, a depth ontology necessitated by a focus on relations and processes; resistance, change and struggle take place at the

55. For an interesting fictional exploration of such network struggle, see Roberts (2011).

“level” of protocol.⁵⁶ The challenge is to reconfigure it via “exploits”. They write:

[W]ithin protocological networks, political acts generally happen not by shifting power from one place to another but by exploiting power differentials already existing in the system... [by] discovering holes in existent technologies and projecting potential change through those holes. Hackers call these holes ‘exploits’ (Galloway & Thacker, 2007, p. 81).⁵⁷

Galloway’s view of the protocol-object as language enables him, like any scholar of language or ideology as a site of struggle, to see protocol as open to reconfiguration.⁵⁸ As I will come on to explore in my practice, that reconfiguration is possible, indeed more powerful, when objects are addressed in their specificity.

Galloway and Thacker use the example of the virus⁵⁹ as an example of counter-protocological struggle, an object that uses its relationality as its

56. Galloway argues that protocol allows new forms of politics and political struggle. His is not the only framework to explore the connections between politics and technology, Joss Hands for instance sees the digital as a space of resistance (2010) while Jodi Dean argues that the digital is such a “noisy” space that it “hinders the formation of strong counter-hegemonies” (2005, p. 53). What is particular about Galloway and Thacker’s account is that they start from the object. The issue is however whether that object remains the point of focus or merely the way into a broader field of relations, the control society that it somehow fuels. An object-oriented account would look across the technopolitical space and its flat realm of objects, seeking to reconfigure object connections including “noise”, rather than looking for a particular key determinant or a power full object to resist. I open up these questions in my conclusion.

57. In his analysis of the TV series *24*, Galloway discusses the show’s theme of “the circumvention of protocol,” or hacking. “In the control society informatic systems are always in a state of ‘self-exploitation’ and are defined not as an integral object but as a flexible network of command and control, which only becomes realized through its own transgression by another informatic force” (2007a, p. 19). Here again a protocological system carries within itself the potential for its unpicking. Earlier, Galloway had said “resistance during the post-modern age forms around the protocological control forces existent in networks” (2004, p. 160) and again, “techno-resistance is not outside protocol but at its center” (*ibid* p. 176).

58. This theme of sites of struggle and the possibility for critique and intervention appears in Galloway’s praise for Mehdi Belhaj Kacem as an intellectual willing to extend the boundaries of critique, to be “a self-styled outsider, a trickster, an autodidact, or, in his own words, an ‘anti-scholastic,’ an ‘anti-philosopher’” (2009c, n.p.).

59. Galloway had previously discussed the virus in (2005, p. 24-27). Thacker had also previously addressed the relationship between computation and biology (2004). For a wide discussion of new biologies and their relation to economics and power, see papers collected in Zylinska (2011).

weapon. They position the biological/computer virus as using the monopoly position of a control network such as Microsoft against itself.⁶⁰ It is the nature of the network that allows a virus to “resonate far and wide with relative ease. Networks are, in this sense, a type of massive amplifier for action” (2007, p. 84). Viruses “exploit the network” (*ibid* p. 85). They use the layers, movement and flexibility that protocol gives to networks against itself. They “piggyback on the global standards of TCP/IP and other Internet protocols” (*ibid* p. 96). “It is *through* protocol that one must guide one’s efforts, not against it” (Galloway, 2004, p. 17 emphasis in original). For Galloway and Thacker, counter-protocological struggle “must not be anthropomorphic (the gesture, the strike); it must be unhuman (the swarm, the flood)” (2007, p. 98).⁶¹ A virus does not fight the system, it overwhelms it.⁶² That struggle must be seen not as resistance but as “hypertrophy” - a desire for pushing beyond.⁶³ Viruses do not resist software they push it until it breaks. “We must scale up, not unplug” (Galloway & Thacker, 2004, p. 25). They clog up the server with too many requests. That critical power

60. Parikka provides an archaeological (as opposed to simply historical) account of computer viruses where they are characterised as “monsters”, “quasi-natural entities” (2007, p. 10) or as he goes onto address them: “anomalous objects” (Parikka & Sampson, 2009). Here viruses are more clearly object-actants in meshes, addressed in their specificity rather than positioned as a counter-protocological instantiation, a reworking of the protocol language. Such a focus allows Parikka to talk of the “micropolitics of code” and a form of struggle similar to the Exploit: “Tactical an-archaeology might then mean [...] not targeting operating systems or certain corporations as such but exposing the principle of how digital culture is framed through micropolitics of code” (2009, p. 119). This concept of framing is also taken up by Bogost (2006, p. 40).

61. This perspective can be read alongside McKenzie Wark’s positioning of the hacker as one who takes a system’s tools and turns it against power (2004; 2006).

62. Tiziana Terranova Criticises Galloway and Thacker’s terminology drawing on Sadie Plant (1997) to argue for a less masculinist language. “In the case of network conflict, what seems important to the authors is not so much resistance as ‘impulsion’, ‘a thrust’ and even a ‘hypertrophy’. And yet if the ontology of networks is that of relations - that is, as Sadie Plant has argued, a feminist ontology - why centre its political tactics around such masculine ‘thrust’? What about those processes of topological and ethical ‘invagination’, which also seem necessary for the purposes of collecting, nurturing and consolidating antagonistic network forces” (2009, p. 49).

63. Galloway had made a similar point in an earlier article: “The goal, then, is not to destroy technology in some neo-Luddite delusion, but to push it into a state of hypertrophy, further than it is meant to go. Then, in its injured, sore, and unguarded condition, technology may be sculpted anew into something better, something in closer agreement with the real wants and desires of its users” (2005, p. 30).

happens because the protocol object is drawn in terms of relations. Struggle happens in the spaces between the nodes,⁶⁴ in the relations, and the protocol-object's nature as enfolded in relations offers the way in. A virus or a distributed denial of service (DDOS) attack's power arises from the relations it enables, the overloads, the spam, the new configurations.⁶⁵ Protocol's language form, its rules nature enable the discourses and discursive practices in computational control societies to be reconfigured or overwhelmed, rendered meaningless. As an object that enables other objects and crucially software and governmental relations to work, to reconfigure protocol is to potentially reconfigure, perhaps "play with" the broader mesh.⁶⁶ I will come on to argue that to address objects as exceeding their relations, far from weakening their power as exploit, actually opens the network/control society up because governmentality becomes a matter of concrete (exploitable) things rather than diffuse or abstract relations or processes.

64. Galloway and Thacker discuss the model of networks built around "edges and nodes" as it developed from mathematical graph theory (2007, pp. 31-35). Morton offer a different perspective on edges and nodes in his view of the mesh: "Each point of the mesh is both the center and edge of a system of points, so there is no absolute center or edge" (2010a, p. 29).

65. In his discussion of interfaces, Galloway uses the language of exploits to explore political art making. He discusses World of Warcraft's interface as "awash in information" (2009d, p. 945) overwhelming an aesthetic of the window or door. Galloway connects this to the idea of "incoherent politics", the deterritorialization of Deleuze: "[T]he game displays an aesthetic of incoherence in that it foregrounds the apparatus (statistical data, machinic functions, respawn loops, object interfaces, multithreading, and so on), while all the time promoting a particularly coherent politics (protocological organization, networked integration, alienation from the traditional social order, new informatic labor practices, computer-mediated group interaction, neoliberal markets, game theory, and so forth)" (*ibid* p. 951). On spam, see also Parikka (2007).

66. In a discussion of the later Baudrillard's interest in games and play, Galloway writes of how for the French theorist, "both sovereignty and resistance are gamic" (2007b, p. 377). It is not surprising that, with his interest in gaming (2006a), Galloway should draw connections between his concept of the exploit and the metaphor of play, going as far as to identify our contemporary moment as one of "ludic capitalism" (Galloway, 2009d, p. 932).

It is also interesting that Galloway chooses a verb for the title of his study rather than the more usual noun "games" (Wardrip-Fruin, 2009; Tanenbaum & Tanenbaum, 2010) or even the journal *Games and Culture*. This focus on the process and practice rather than the object of the game may seem to go against my argument that Galloway is a theorist of the object but, just as protocol is for him important in terms of its object-work, so games are important in terms of how and where they function as particular forms. See also Galloway's discussion of Guy Debord's game Djambi (2009a).

Chun appears to be searching for a similar opening in her conclusion to *Programming Visions* where she asks whether software's anomalous position and nature can "enable freedom and movement" (2011, p. 177). At first sight Chun's account of "programmability" and "software as a metaphor for metaphor" would appear to provide an object-oriented approach to code objects. She stresses software's materiality as always embodied and not simply the fabled matter of ones and zeroes. She is also clear about the nature of software as object: "[S]oftware as thing cannot be reduced to software as a commodity" (*ibid* p. 6). Software is more than a particular programme or proprietorial or even open-source standard. Of course it can be bought, sold and fought over in the courts but there is a "vapory materialization" in play (*ibid* p. 2). Software has a "fundamentally ephemeral" nature (*ibid* p. 3). Chun traces how software has become thing (2011, p. 41), has "hardened", becoming an object of legal and governmental fixity in distinction to hardware. Like Galloway, Chun looks to trace the governmental enfoldings of software in terms of content but also in terms of logic (*ibid* p. 128). It is the nature of software Graphical User Interfaces (GUIs) that are governmental as much as the content. The way AJAX allows a web page to dynamically update, seemingly at the will of the user (Garrett 2005), creates what Tara McPherson calls "volitional mobility", the feeling of liveness, choice and freedom (2002). Regardless of what is on a webpage, the very ways that software, protocols and standards structure the user experience, hails them into a particular position and manages their interaction, generating fetishes and illusions of control and freedom that are deeply ideological.

The issue, from an object-oriented point of view, is that the object is once again drawn in terms of relations. Echoing Adrian Mackenzie's account of software as a "neighbourhood of relations" (2006, p. 169) and his exploration of wirelessness through a Jamesian focus on network as "nothing but concatenated conjunctive relations" (2010, p. 121),⁶⁷ Chun says: "Treating software as as a thing means treating it, again, as a neighborhood,

67. James argues that, "what really exists is not things made but things in the making" (1996, p. 263) .

as an amalgamation" (2011, p. 6). "[A]malgamation", "assemblage", "ecology", "actor network": the "simultaneous ambiguity and specificity" (*ibid* p. 6) of software is best drawn in terms of position in a field of relations. Software is "in media res - in the middle of things" (*ibid* p. 175). Such a position certainly inserts software and code into the techno-social/governmental mesh. It locates the digital object and undermines any claim to neutrality or apoliticism. What it also does however is remove us from particular software or digital specificity. We address "neighborhoods", the "infrastructure of experience" (Dourish & Bell, 2007) and metaphor, the relations not the objects that configure those relations.

For Chun, software has a second characteristic in addition to its relationality. Software has become memory as it "not only embodies the always already there, [but] also grounds it [...] It creates an enduring ephemeral that promises to last forever" (2011, p. 137). This software-memory "is not a static but rather an active process" (*ibid* p. 167).⁶⁸ "If our machines' memories are more permanent, if they enable a permanence that we seem to lack, it is because they are constantly refreshed" (*ibid* p. 170). Screens are redrawn, page components asynchronously refreshed, data compressed, images rendered on the fly, searches updated and data trails remarked. Software works and that working, software as process needs to be accounted for. This sense of the processural is our second theme.

The processural object

If relationality has opened doors for software studies in constructing a technologically informed and yet comprehensive account of technoculture and techno-governmentality, a second theme has helped ensure the technical specifics do not drag the account down to a static or determinist reductionism. The idea that software is dynamic, that it sets new relations in motion as it runs, that its character is change and becoming has allowed software studies to understand the relations between what appears to be a static component of software and a dynamic field of culture and power.

68. Chun discusses Brenda Laurel's (1993) work where human computer activity is understood as a "designed experience" akin to theatre. Here software can be seen as "characters" defined by their action.

As an example, Mark B. N. Hansen frames the digital image as processual. His argument that “the digital image demarcates an embodied processing of information” (2004, p. 12) allows him to explore how the image-object is framed by and through the body.⁶⁹ It is only by seeing a dynamism to the digital object, only by addressing it as process and change that its power and affectivity can be understood. Assigning movement to our picture of data and code allows us to understand its embodied as well as enfolded workings. A view of static, unchanging data, code or protocols cannot account for our phenomenological, psychoanalytic or even neurological relationship to computation (Berry, 2011b, pp. 119-141; Turkle & Sherry, 2004; Munster, 2011) nor the realtime stream of data and imag(in)ings (Berry, 2011a). This is a flux of code-data-subjectivity that we experience as the technosocial mesh at a bodily and material level. Those digital objects change as they are reinserted and revisited through the body and the body politic. They add and remove new dimensions and relations as they process and are processed.⁷⁰

It is important to stress that OOP does not reject change. It is not a philosophy of static objects. When it argues for objects connecting within objects, that movement is as dynamic as any complex adaptive system. Where OOP disagrees with the idea of the processual object in flux is in the idea that an object adds and removes dimensions. Rather, for Harman “[b]ecoming does occur: but in sudden jumps and jolts, not through a meaningless accretion of any-instants-whatever that float away in the canal

69. In a catalogue essay accompanying a German photography exhibition Manovich also discusses imaging as process. He says: “All of these and many other recently emerged technologies of image-making, image manipulation, and vision depend on digital computers. All of them, as a whole, allow photographs to perform new, unprecedented, and still poorly understood functions. All of them radically change what a photograph is” (1995, n.p.).

70. Galloway echoes this stress on process when he says: “[O]bjects are always derived from a preexisting copy (loaded) using various kinds of mediative machinery (disk drives, network transfers). They are displayed using various kinds of virtuation apparatuses (computer monitors, displays, virtual reality hardware). They are cached. And finally, objects always disappear. Objects exist only upon use. They are assembled from scratch each time and are simply a coalescing (of their own objectness)” (2004, p. 74).

of fluxions" (2011i, p. 301).⁷¹ This perspective runs counter to much of software studies.

Like Chun, Matthew Fuller explores the object in terms of its working. He begins his account of media ecologies by asserting that objects should be "understood to mean processes embodied as objects, as elements in a composition" (2007, p. 1). Here relationality is reframed in terms of processuality. Like Chun, Fuller is keen to problematise the "form–content dichotomy and places objects and processes in a constellation of interrelations" (*ibid* p. 46). The ecologies such as pirate radio and digital artworks that Fuller investigates are matters of objects in relations but those objects are characterised as dynamic, as processural.

Discussing the Cctv - world wide watch artwork,⁷² Fuller says: "In the comprehension of the image as an image in real time comes also that of the image as a process. Digital images - especially in such a visibly raw, low-bandwidth state - demand to be understood as a computational and algorithmic process" (*ibid* p. 156). This is not just that the image is the outcome of a process. Rather it *is* a process. The object, whether the image, the image file or even the imaging standard are moments of becoming - the rendering, the writing to disc, the encoding. As with Hansen's account, the image object is in movement as the code runs and renders and as the data is read by humans or software. The computational and algorithmic process is one of flux, with the object shifting and changing as it relates and works. Just as the code runs, so does the image. The objects share a processuality.

This stress on the process nature of software and software objects appears in Fuller's earlier work on Microsoft Word (2003). What was innovative about this work (and his role in developing software artworks with I/O/D and Mongrel (1998)) was the move from dealing with Word just as a commodity to the software as processural, as setting in motion practices, subject

71. This is discussed further in *The JPEG object in theory* chapter.

72. <http://www.irational.org/cctv>

positions and new relations.⁷³ Here software became, took on new forms as it worked (as a machine) and as a cultural, political, artistic and ideological practice. When Fuller programmed the “Web Stalker” he was using code’s processual nature to reconfigure the mesh: “A processual opening up of the web that whilst it deals at every link with a determinate arrangement has no cut-off point other than infinity” (1998, n.p.).

Later when Fuller edits *Software Studies: A Lexicon*, which can be read in part as a collection of papers on software objects, the “stuff of software” (2008, p. 1), he presents the collection’s analytical and political power as “not to stage some revelation of a supposed hidden technical truth of software, to unmask its esoteric reality, but to see what it is, what it does and what it can be coupled with” (*ibid* p. 5). Here “what it is” and “what it does” are intrinsically linked. This arises not just from his stress on the importance of understanding (and even practicing) programming (*ibid* p. 10) but from the nature of the code-object itself as processual.

When Fuller turns to what he calls “metaobjects” (2007, p. 95), expanding Alfred North Whitehead’s concept of the “standard object” (1989, p. 58)⁷⁴ to address the freight container and the technology of digital packet-switching, he argues that standard objects “have become crucial to the generation of media and communications networks and the organizations that handle them” (2007, p. 93). For Fuller these objects are constellations. “A constellation is a nameable ‘thing,’ but it is not simply a ‘cause.’ It is also a process of multiply interrelated movement through which emerges the apparently stable pattern by which we are able to understand it as a constellation - it must be understood as a process” (*ibid* p. 73).

Noah Wardrip-Fruin also explicitly locates software in terms of processuality. This drives his media archaeological work where he asks: “How do we engage a work’s processes?” (2011, p. 302) but most

73. Manovich takes a similar approach to another software package, Adobe Photoshop, seeking to “understand how software applications shape our worlds and our imaginations” (2011a). In a similar vein Paul Brafield discusses the relation between a software package (Adobe After Effects) and a cultural habitus (2010).

74. Galloway and Thacker also reference Whitehead when they say that “networks exist through process” (2007, p. 62).

specifically in his broader study of digital fictions and games (2009) where he looks to understand the Tale-Spin/Mumble text/game/story-generation system through studying processes in play. He says: “Studying processes [...] focuses on the design and operation of the parts of the mechanism” (*ibid* p. 164). The focus is on the objects, the parts of the mechanism but those need to be understood as things that are designed but also, always in operation. Wardrip-Fruin opens up the game and gaming mesh as well as broader technosocial relations of surveillance and governmentality (*ibid* pp. 200-203) by working with objects, but objects as processes - or perhaps processes as objects.

Far from focusing on the specifics of the “design and operation” of objects as Platform Studies does,⁷⁵ studying processes shifts the emphasis to both relations and one dimension of those objects, their operation. This neglects the work of the object when it is not running or when it fails to run.

When Wardrip-Fruin says that “the internal processes of digital media are designed artifacts, like buildings, transportation systems or music players” (*ibid* p. 156), he is drawing attention to this dual nature of his object, the continual binary oscillation of process-object.⁷⁶ The processes-as-objects Wardrip-Fruin calls “operational logics”, are not just the instances of software running but the components of the computational mesh itself. They are “distinctive”, “‘operationalized’ models” of other forces and practices such as human language or motivation (*ibid* p. 4). This idea of processes-as-objects or oscillation fudges the question, neither dealing with the specifics of JPEG compression through objects such as the Huffman table, nor the particularities of JPEG as object, an actant that is powerful beyond its work as process.

A stress on the digital or software object as a matter of process takes us some way towards addressing its relations to the computational mesh. It ensures a focus on software’s position within increasingly complex

75. A term coined and a book series edited by Nick Montfort and Ian Bogost (2009). See also Gillespie (2010).

76. Matthew Kirschenbaum makes a similar point when he discusses the “duality” at the heart of digital mechanisms: product and process (2008, p. 15).

computational trading, navigation, supply-chain and other governmental systems and as an engine of relations and governmental positions. In terms of JPEG in particular it opens up the protocol-object as active, a matter of compression - doing things in the pipeline. What it also does however is only account for that object's position and power when running or as part of a mechanism. Objects lose their specificity and ontological position. What is more, in terms of my practice, they cease to have a particular position and power as specific objects in my apparatus/assemblages, they are subsumed within something more - the assemblage, the system, the processes at work. As I will discuss in terms of my practice, when objects are addressed as having a position independent of process, one can image with and through them and use that imaging as a way of exploring their nature and their relation to issues and relations of governmentality.

The potential object

Closely related to this conception of processuality and a flux of becoming is that of potentiality. Again this theme has served software studies well. By positioning the digital object as harbouring a potential, software studies once again enfolds the object into the mesh, positioning it as empowering subjectivities relations and processes, setting in motion new formations. The flexibility, interoperability and dynamic nature of the digital object makes it the ideal vehicle for critical or disciplinary potential.

It is not just Galloway and Thacker who have used this potentiality as a way of positioning the object as critical tool. Although perhaps not a "software studies" scholar, Vito Campanelli uses the idea that digital objects harbour a potentiality to explore the DivX and MP3 experience (2010).⁷⁷ Here the particular codecs set in motion particular aesthetic (as well as socio-political) experiences as legitimate or "pirated" media is encoded, decoded, streamed or downloaded. His broader target of the web aesthetic

77. For a discussion of the MP3 protocol from an industrial (rather than technical/material) and psychoanalytic perspective, see Sterne (2006).

experience,⁷⁸ is an experience of hardware and software objects which harbour a dynamic potential to structure and restructure experience. Directors use that potential as do p2p media sharers. The digital object's potentiality is actualised in particular ways in particular configurations at particular moments.

Such a perspective clearly adds value in avoiding an over-simplistic essentialism - particularly when it comes to aesthetics. As with processuality, it draws attention to the seemingly paradoxical dynamism at work in what appears to be stable, defined and delimited code. Some within the object-oriented movement would agree. In particular, as I shall discuss, Levi Bryant has argued strongly for the power of seeing objects as harbouring potential arguing that "the domain of power possessed by an object is always *greater* than any local manifestation or actualization of an object" (2011, p. 89 emphasis in original). Harman however disagrees. For him objects do not hold anything back. They are always fully present and actual.⁷⁹ But to refuse to assign a potential power to objects is again to run counter to a dominant concern in software studies.

To speak of potentiality in software is not just to engage with its uses - the sort of potential of, and struggles around, free/libre and open source software (FLOSS) or creative commons licenses to destabilise political and economic relations (Lessig, 2002; Berry, 2004; Zittrain, 2004; Weber, 2005; May, 2006; Berry, 2008a; Chopra & Dexter, 2008; Kelty, 2008; Garcelon, 2009; Milberry & Anderson, 2009) as well as the potential of networks to rewire societies and markets (Benkler, 2002a; 2002b; 2004; 2007). Rather it is to approach potentiality as an ontological issue. From this perspective, the software object (as a process enfolded in relations) harbours a potentiality as part of

78. This specifically network aesthetic is different in focus to the digital aesthetic sought and discussed by Sean Cubitt (1998). For an historical perspective on new media aesthetics see Aristarkhova (2007); as a site of struggle, see Blackwell & Dodgson (2010) and in terms of aesthetics and user experience, see Engholm (2010). Specifically on code and aesthetics, see Cox, McLean & Ward (2001). In terms of digital aesthetics and affect, see Parisi & Terranova (2001). For a discussion of aesthetics and HD (High Definition) technologies in video as an issue of materiality, see Flaxton (2011). For a practice-research discussion of mobile aesthetics, see Baker, Schleser & Molga (2009).

79 As I will discuss, although they may be actual and present that does not mean that every dimension is accessible.

its nature. This is somehow realised, rendered powerful in a moment of becoming - at its running, at the moment of experience.

Mackenzie's "radical empiricism" locates digital (including software and protocol) objects as matters of relations and process but also as holding back, as having "more to come". He speaks of a complex network of relations whereby "[w]irelessness is thoroughly entangled with products and promises of economic value" (2010, p. 145). At the same time he uses William James' idea of conjunctive relations to add dynamism to the picture. James' account is one that emphasises movement and transition and the "practical inseparability of thinking and things" (2010, p. 14). For James philosophy needs to speak the language of "conjunctive relations" (characterised by words such as with, near, next, like, from, towards, against, because, for, through, my (James, 2010, p. 600)), the language of movement and transition, the "more to come" (*ibid* p. 2476). This focus on process, movement and the "more to come" is an antidote to "most social and cultural theories that tend to cut realities into things, selves, locations and relations" (Mackenzie, 2010, p. 39).

In terms of specific software objects he says that the Digital Signal Processing (DSP) algorithms, "[i]f acknowledged at all, [...] are treated as the most abstract aspect of electronic media and communication technologies, the part that lies closest to mathematics. We need a much more sensitive treatment of their becomings. They transduce realities" (*ibid* pp. 66-67). His use of the verb "transduce" is significant. In his earlier work (2002), Mackenzie draws on Gilbert Simondon's concept of technicity which Mackenzie reads as "a side of collectives which is not fully lived, represented or symbolized, yet which remains fundamental to their grounding, their situation and the constitution of their limits" (*ibid* p. 11). Technicity in Simondon "refers mainly to the systematic study of the transformations and correlations that characterize technical objects" (*ibid* p. 25 n. 3). The concept allows Mackenzie to deal with software objects as having a side that is not fully realised, that is open to issues of transfer, transformation, becoming, releasing or realising. He argues that algorithms are "relational situations concerned with transitions between states [...] They

connect movements to each other” (Mackenzie, 2010, p. 67). What is important is less his reluctance to use the term “object” but more his location of algorithm as a “situation”, a weird player with the potential to form multiple relations and take multiple positions. An object-oriented perspective would not have problems with this weirdness. What it would challenge is the idea of an object with “more to come”, with not being “fully lived”. From an OOP standpoint, objects are always fully present. Following Heidegger, Harman argue that dimensions of the object withdraw from all access but the object is present (if inaccessible) in the world.

This view of objects as harbouring a potentiality that is realised or made actual in material forms, technologies and regimes of power has been used to explore the relationship between visibility and discipline through scopic apparatuses and within particular (governmental) scopic regimes.⁸⁰ Writers such as Martin Jay have developed a historicised account of these regimes (paralleling in some ways Galloway’s “diagrams”). His account of “several, perhaps competing” scopic regimes of modernity (1988, p. 3) was designed, again like Galloway’s, to open the potential for new practices. He hopes “we may learn to wean ourselves from the fiction of a ‘true’ vision and revel instead in the possibilities opened up by the scopic regimes we have already invented and the ones, now so hard to envision, that are doubtless to come” (*ibid* p. 20). The regimes he maps constitute a field of potentialities for the development of imaging discourses and apparatuses. It is this field that is Jay’s focus.

He asks: “Is there a common denominator running through such seemingly disparate investigations of theories about vision, general visual cultures, specific visual artifacts like movies, and the role of visual metaphors in written texts?” (1996, p. 9). He concludes that there isn’t, but

80. Christian Metz is usually credited with first using the concept “scopic regime” (1981). Of course the term “scopic” has a different genealogy, taking in Lacan’s “scopic field” and the split between the eye and the gaze in *The Four Fundamental Concepts of Psychoanalysis* (1986, pp. 67-78), through feminist film theory (Mulvey, 2009) and on to Slavoj Žižek’s exploration of the gaze of the object and his realisation that “I can never see the picture from the point that it is gazing at me” (1989, p. 8) (an idea picked up by W. J. Mitchell in *What do Pictures Want* (2007)). It was Metz however who, while not rejecting the psychoanalytic basis of the concept, arguably broadened its reach, from the “scopic field” to the “scopic regime”.

what is interesting is what is missing from the list of themes he identifies - the technological. Here the focus is on the movie artifact rather than the film, projector, colorspace, codecs or protocols. It is not that Jay disregards the technological. He observes: "Insofar as we live in a culture whose technological advances abet the production and dissemination of such images at a hitherto unimagined level, it is necessary to focus on how they work and what they do, rather than move past them too quickly to the ideas they represent or the reality they purport to depict" (Smith, 2008, pp. 183-184). Rather the technological is positioned as the background. The focus is on the "work", the practices, the gaze. Jay's is a story of how technologies form "*enhancements of the ability to see*" (1993, p. 587 my emphasis), of how "*vision, aided by new technologies, became the dominant sense in the modern world, even as it came to serve new masters*" (*ibid* p. 45 my emphasis), the "*extraordinary changes in our capacity to see wrought by technology*" (*ibid* p. 113 my emphasis).

If Jay can be seen as highlighting the potential in the object relations at work within the scopic regime, Jonathan Crary, can be seen as doing the same for the scopic apparatus. His aim is to account for how the "camera obscura model of vision [...] collapsed in the early nineteenth century when it was replaced by radically different notions of what an observer was and of what constituted vision" (1988, p. 30). It is this powerful network of relations of observer, discourses of vision and scopic technologies which is his target.⁸¹ Crary characterises his work as around the "problem of the observer [which] is the field on which vision in history can be said to materialize, to become itself visible" (1990, p. 5). He maps this field of relations in terms of the apparatuses that the subject uses and is, to some extent, constructed by. Crary is keen to avoid "mystifying [the visual] by recourse to technological

81. For Crary the scopic and the scopic apparatus are only one dimension of the workings of power. The "scopic" just as "technology" must not be allowed to be the only actant on the stage. "I do not believe that exclusively visual concepts such as 'the gaze' or 'beholding; are in themselves valuable objects of historical explanation" Crary argues (2001, p. 3). In this later book he uses the term "perception" as a way of exploring how a subject has come to be defined "in more than the single-sense modality of sight, in terms also of hearing and touch and, most importantly, of irreducibly mixed modalities which, inevitably, get little or no analysis within 'visual studies'" (*op cit.*).

explanations" (*ibid* p. 2) but without an exploration of the instantiation of material apparatuses in specific historical conjunctures, he argues, that problem of the observer cannot be traced. Crary discusses the Camera Obscura, the Zootrope, the Phenakistiscope, the Magic Lantern and the Kaleidoscope⁸² not for their own sake but because of how this "constellation of objects" (2001, p. 5) was enfolded in and constitutive of the sort of governmental scopic relations that John Tagg also explored in terms of photography (1988; 1992; 2009). Those technological objects carried a potentiality that was actualised or realised in those governmental regimes.

"[W]hat determines vision at any given historical moment," Crary says, "is not some deep structure, economic base, or worldview, but rather the functioning of a collective assemblage of disparate parts on a single social surface. It may even be necessary to consider the observer as a distribution of events located in different places" (1990, p. 6).⁸³ It is this mesh, the complex enfolding of subjectivity and technology, that he is looking to unpack. His history is not one of "the observer" as opposed to "technology" but rather observer-technologies. Those observer-technological objects carry their potential disciplinary power into a field of relations actualised and articulated in different ways in different historical moments.

This concern for a layered picture of objects-in-relations, saturated with a governmental potentiality can be seen in the wider "media archaeological" project where "[d]ead ends, losers, and inventions that never made it into material product have important stories to tell" (Huhtamo & Parikka, 2011, p. 3). For the loose collective of authors concerned, following Benjamin in terms of writing media history in new ways, these objects whether material or immaterial⁸⁴ are enfolded in powerful relations but carry a form of potentiality.

82. For another media archaeological account of the kaleidoscope, see Christie (2007).

83 This stress on the "event" is echoed in Massumi (2011).

84. See for example Erkki Huhtamo's account of media archaeological topoi, the "temporary manifestation of a persisting cultural tradition" (2011, p. 41).

Siegfried Zielinski's exploration of "hearing and seeing" through an archaeology of scopic and sonic apparatuses (2006) includes the sort of engravings and diagrams of gadgets and devices that pepper Crary and Jay's work. Those objects are framed through relations and are present because of their potential. In his final chapter Zielinski draws "cartographies", maps (like Galloway's diagrams - visualised metaphors) of how seeing and hearing meshes have connected across the globe and time (*ibid* p. 262). Through a series of figures he literally maps out his story. Here geographies are overlaid with biographies. The object-actants on the network map are names: Empedocles, Eisenstein, Lombroso and Bruce Sterling, as labels on territories: Messina, Riga, Turin and Texas. The diagrams' lines link the "people and places". These lines are deliberately not arrows, not even double-headed arrows. They are more like synaptic connections. Trails and traces of influence, congruence and even coincidence. It is within and across these network relations that the scopic and sonic regimes, and their attendant governmental relations, emerge. The objects' potential are actualised in relations.

Others working within the field of media archaeology trace the potentiality within more particular software objects. Casey Alt explores how object-oriented programming languages "made computers a medium" (2011) arguing that the potentiality within the code and coding-objects was realised in new forms as well as practices of computing. The concepts of medium and interface were "embedded in computation at the material level of the programming language itself" (*ibid* p. 279). These objects (remember in OOP, concepts can be objects just as much as tables, chairs and code) became computational, changing the nature of the technology, space and now medium.

The potentiality that Wardrip-Fruin explores through his media archaeology of a 1952 software work of digital literature (2011) is not simply the potential of Christopher Strachey's "Love Letter Generator" to create texts, but the potentiality latent within the code to generate effects and affects, to become a particular instantiation of computation with all the attendant power relations that sets in motion. The potentiality is not just

realised in the text but in a new actant network, the technosocial space or mesh where Alan Turing and Strachey worked, struggled with their gay identities and marked out the fields of computation. Wardrip-Fruin looks towards processes as active players because they harbour potential, become in specific historic conjunctures.

The issue for these media archaeologists is not simply to historicise media or media studies but to address the potentiality within historically located media objects as realised in particular meshes. For Harman however such a pictures of objects as holding something back is to move away from “actuality”. For Harman conceiving of objects as always, inevitably fully present and actualised allows for an expanded, multi-faceted account of the object and its relations.

The protocol object

Aside from Galloway and Mackenzie, few leading figures in software studies have addressed the specificity of protocol and standards.⁸⁵ Although Joel Slayton, in the forward to Fuller’s *Media Ecologies*, talks of “the limits and excess of protocol” (Fuller, 2007, p. ix) as a theme of the text, the book uses artworks and pirate radio as instantiations of software, as a way into the broader techno-social mesh. The work is at a different scale. Similarly Berry’s work on open source (2004; 2008a; Berry & Moss, 2005) rather than moving in the direction of how protocols and standards are a site of the same legal and cultural battles over their role, ownership and position, as operating systems and software packages, has moved in the direction of a broader philosophical critique of the computational society (2011b). JPEG specifically is even more neglected. As Daniel Palmer says: “JPEG is strangely unknown, almost completely neglected in the critical literature around digital photography” (2011, n.p.). There are a few exceptions to this neglect and in many ways these accounts bring together the three themes that I have identified as running through discussions of the digital and scopic object.

85. Greg Elmer’s exploration of a protocol he sees at work within “techno-governmentality”, the robots.txt which excludes some web content from search engines (2008), is less a study of a specific technology than of a network of relations within which it functions, in his case the Bush White House/Google axis.

Coming from film studies, Sean Cubitt has approached the new distributed spaces of motion imaging such as YouTube through the H.263 codec which is enfolded with the Flash video (.flv) format. He says: “There is no internet without the standardisation of internet protocols” (2008, p. 46). Cubitt picks up on Mackenzie’s short account of motion imaging codecs in Fuller’s *Software Studies: A Lexicon* where Mackenzie argues that: “codecs structure contemporary media economies and cultures in important ways [... they] catalyze new relations between people, things, spaces, and times in events and forms” (Mackenzie 2008, p. 48). In particular Cubitt draws a connection between video codecs’ “transform compression” and “motion estimation”, the technique it uses to compress but also render motion, and a “relational ordering that articulates realities together that previously lay further apart” (2008, p. 45).⁸⁶ Cubitt has continued this interest in standards, drawing connections between colour space standards and an emergent 3D scopic regime (2010).

While Cubitt’s demand that film studies engage with the codecs and protocols that are now so important to the industry as well as the cultural practices and relations that run through spaces and businesses such as YouTube, Google and cloud computing (Cubitt, Hassan & Volkmer, 2011), is important, those objects remain components, actants in a troupe rather than the focus themselves. H.263 and HSV, LAB and RGB are enfolded with corporate interests (Adobe) and telecoms and non-governmental bodies (ITU, ISO etc.). He uses these relations as a way of mapping global and neoliberal relations and discourses of the public sphere, at the same time rendering those protocol objects as in an almost Latourian fashion, defined by those relations. The determination may be more than one way but the object does not exceed its relations.

At the same time those codecs are drawn as objects exhibiting a form of dynamism, enabling processes of visualisation and imagining as well. They are framed as processural in terms of how they work. Here compression

86. Fuller’s collection is interesting insofar as the series of very short chapters, all focus on very specific, even technical aspects of “software”: the copy function; import and export; the code library; the function; the interrupt or object orientation. Aside from Mackenzie however, the protocols and standards are surprisingly absent.

protocols or standards average data, codecs reprocess light as particular spectrums of colour. It is this standardised processing that, for Cubitt, is key to understanding the protocol's nature and its enfolding with capitalist and technosocial relations, not least insofar as standard-compressed data (including JPEG) allows management of bandwidth and security (2008, p. 48). That processuality is articulated through becoming, a potential "within" the standard. H.263 harbours the potential to encode data as well as drive YouTube as social space, journalism and business. As it is repositioned within new relations it is actualised as citizen-media tool, as part of an Apple-Adobe IP battle or as component in a video-on-demand (VoD) business plan.

While both Cubitt and Mackenzie have certainly engaged with protocols, they have arguably not approached those codecs and standards as specific objects requiring an account of their position and nature as objects. Rather they have been addressed as components in a computational, visual or techno-social mesh. They are defined and positioned by their relations with other objects, their becoming and their potential to realise new meshes. Just as Galloway positions TCP/IP in terms of its relation (as rules) to control societies, so Mackenzie locates wireless standards in terms of broader fields of experience⁸⁷ and Cubitt draws colour space standards as elements in a politically and economically charged scopic field and the history of the "standard observer".

Specifically in terms of the JPEG codec, Palmer argues that: "the JPEG format is part of the new computational logic of photography" (2011, n.p.).⁸⁸ For Palmer, JPEG needs to be approached as a rhetorical form. Following Manovich's linguistic turn, Palmer traces the ideological workings of JPEG as a matter of coding, with JPEG a powerful component in the processes of encoding at play in digital imaging. For Palmer, "the JPEG is rhetorically tied to the idea of democracy in an age of distributed imaging, in which the

87. Stephen Jones and George Thiruvathukal also discuss WiFi in terms of hardware in their discussion of the Nintendo Wii (2012, p. 11).

88. Technically of course JPEG is not the format but the standard that enables the JFIF or EXIF format.

image has been spatialised in global databases" (*op cit.*). He argues that "its persuasive power, lies in this same invisibility" (*op cit.*). While I would agree (and come on to discuss, JPEG's enfolding within governmental rhetorics), I would argue that it is precisely JPEG's visibility (admittedly in terms of its sensual rather than withdrawn dimensions - see next Chapter), that is important. JPEG's ubiquity as object in multiple connections depends on its sensual visibility and accessibility.⁸⁹ I look to an object-oriented focus on the object itself not its rhetorical or linguistic workings as a way into addressing its power.

Outside accounts of codecs, Raiford Guins has addressed another standards object (2009). Guins discusses how the V-chip is not only embedded in US TV sets but also enfolded in governmental practices and regimes of truth and power. Drawing on Paul Virilio's account of "sightless vision" (1994), Guins explores how the V-chip encapsulates "protocols of visuality" (2009, p. 28) and "embodies many tenets of neoliberalism" (*ibid* p. 44). Guins also brings together the three dominant themes discussed above. For him the V-chip object must be mapped in terms of its relations to other digital software and hardware objects as well as governmental practices and discourses. The control society he joins Galloway in describing, is a field of technosocial relations. The V-chip is best thought of in terms of process. Its processual nature, the way it changes as it is instantiated within and through particular regimes of biopower and visuality is central. It is through seeing the V-chip protocol (and hardware object) as an object that becomes, that Guins can address its working - whether censoring or more importantly setting self-censorship in motion. It is that generative power, the potential enfolded within the object that is most potent. It is the hidden capability to configure and reconfigure, to structure and position that renders it powerful.

The V-chip is a technology, an object enfolding software and hardware components or objects. Detecting and responding to the rating embedded in

89. Palmer points to the fact that Chun makes a similar claim, seeing software as "a powerful metaphor for everything invisible that generates visible effects, from genetics to the invisible hand of the market" (Chun, 2011, p. 2).

a TV signal, it clearly acts as a technical, and as Guins discusses, a governmental protocol, defining “acceptable” and “family-friendly” standards as well as practices of viewing. It also consists of sets of connected protocol-objects enfolded in TV standards and the software within the TV, receiver and chip itself. Guins’ discussion of governmentality and the V-chip does not unpick those material, technical, object-oriented issues. For him the V-chip “manifests a new visual protocol, it makes visible the positive effects of television that it enables: choice, self-regulation, interaction, safe images, and security” (*ibid* p. 48).

While his account certainly connects technological objects with governmentality in a direct way that, like Foucault’s panopticon, must be seen as more than a metaphor for the operations of power, the failure to unpick the technical enfoldings and workings of the software and hardware objects, undermines its reach. As I discuss below, Bogost and Montfort approach an embedded digital object - in their case the “Television Interface Adaptor” within the Atari VCS games platform through an analysis of its technical (object) structures and connections. The governmentality at play in the V-chip as technology, discourse and practice, appears to analysis and critique in the specific connections between the V-chip’s software and the ratings encoded in the “line 21 data area” in the TV signal as well as the debates in Congress, the media and legislation. There is a reality to the technological object that connects with other real and unreal objects - TV signals, moral panics, political rhetoric, TV boxes. These (and other) objects connect within the “neo-liberal-family” object. While Guins identifies an object at work, his unwillingness to address the technical alongside the political and discursive object connections blinds his analysis to some of the connections in play.

Other writers on digital objects can be seen as productively weaving the three themes together. Parikka and Sampson’s account of “anomalous objects” (2009) provides a similar bringing together of the three themes. Here the digital objects under investigation are addressed through their relations, as process more than essence and as harbouring a potential that media archaeology serves to trace. Parikka and Sampson use the term

“topology” to “address the complex assemblages of network society, which are not restricted to technological determinism, or the effects technology has on society, but encompass the complex foldings of technological components with other aspects of social and cultural reality” (*ibid* p. 5). Here “components” - the weird digital objects the authors and their collaborators explore - are approached via relations, enfoldings, actant-networks. “Assemblage” and “topology” signify not a background field of relations or context so much as as an active relationality with which objects are inevitably and inescapably entwined.

As an example, when Parikka says that he “primarily addresses noise in the context of telecommunications, networks, and digital culture” (2011a, p. 258), context is not some passive background or even determining space. Rather his noise objects (the sort of glitches that Steve Goodman (2009) and Rosa Menkman (2011a; 2011b) explore, as well as real technological noise objects such as the telegraph and imaginary objects such as the volcanograph)⁹⁰ cannot be understood outside their relations with sonic (and scopic) culture, shifts in capitalism and technosocial dynamics. These relations are not where our focus should solely be, the authors argue. We need to look at, for and through objects. But those objects cannot for Parikka be historically or theoretically approached outside those relations. Media archaeology’s mission to build a “nonsignifying take on media history” (2011a, p. 257) demands that objects are more than representations. It demands a respect for objects but objects-in-relations. In contrast, an object-oriented media archaeology would demand an account of those objects that did not depend on relations. Here a telegraph or an imaginary “volcanograph”, an audio glitch or a protocol have an existence and power beyond those relations. As I will discuss, this opens up productive ways of addressing the weird, anomalous character of protocol.

Similarly Parikka and Sampson draw those components in terms of process. They say: “We are not seeking out the (predefined) essence of the anomaly (whether expressed in terms of a representational category or

90. There is an interesting parallel with Harman’s willingness to account for imaginary as well as “real” objects.

intrinsic technical mechanism), but instead a process in a larger web of connections, singularities, and transformations” (2009, pp. 5-6). The component-object, they argue, is best seen as a process. In terms of specific digital objects, for Parikka the “imaginary” around the Morris worm, the metaphors and discourses in play were processural - invasion, vandalism, disease (Parikka, 2009, p. 113) but the object itself was also processural insofar as its position within the mesh (as well as the systems it “attacked” or related to) was as process. It ran. It replicated. It acted. Its power lay in its working.

Finally the anomalous object must be seen as harbouring a potentiality that is actualised in particular historical moments, holding something in reserve as a mesh or regime unfolds and enfolds. Media archaeology’s mapping of truth-power or discourse networks or scopic regimes explores that becoming. It is here where a philosophy of relations, process and potential meets history and practice. As far as actual objects go Parikka approaches viruses as “philosophical and artistic machines that create new perceptions and concepts” (*ibid* p. 122). He discusses viruses in play in the Biennale in Venice as well as within IBM. The potential viruses harbour is not just for “good” or “ill”, for “anarchy” or “art” but more fundamentally an inevitable potential to become, to be realised in different meshes and regimes. The fact that a virus harbours a potential to create, recreate and reposition foldings in the technosocial mesh means it generates new commercial, security and social practices and moral panics. Parikka’s media archaeology does more than historicise the object, it historicises the relations, becomings and potential through which that object must be seen.

This account of the object also has practice implications. In their work on “zombie media” and “circuit bending”, Parikka and Garnet Hertz explore the creation of the “punctualized object”. They say:

Punctualization refers to a concept in Actor-Network Theory to describe when components are brought together into a single complex system that can be used as a single object. We refer to the disassembly of these single objects as “depunctualization” – which shows a circuit of

dependencies that ties the owner to the corporation that manufactured the device (Hertz & Parikka, 2010, p. 6).

It is the position of components as elements in circuits of dependencies, active relationality and potential that opens up a space for what Galloway and Thacker term “exploit” and Wolfgang Ernst explores as “monumental” history (2005, p. 589).

Their media archaeological practice-research exploring and exploiting vibrant material undead digital objects requires that those object-component-actants are considered as at least in part defined through relations and process. It is only then that their potential for discipline can be understood and their potential for reconfiguration, exploit or depunctualization can be released. “For the arts, as a methodological rule of thumb, objects are never inert, but consist of various temporalities, relations and potentials that have been brought together, but can be broken apart again” (Hertz & Parikka, 2010, p. 8).

An object-oriented perspective works towards the same understanding and practice but remains committed to addressing objects outside of their relations and in terms of their presence. In this account the virus or spam, the undead technology (or even protocol) require and deserve a philosophical framing as present, complete and multipolar objects. This is not just for some theoretical coherency (I will come on to make that argument), but also for practical purposes. As I will discuss, a willingness to entertain as well as create work with objects as inevitably in relations but not defined by them; as fully present, multidimensional but still definite; and as holding nothing back rather than waiting to become or become actualised, allows me to engage in and learn from forms of object-oriented photographic practice. Without that perspective I could not have opened up the real-sensual and fusion-fission dynamics of the object, and their governmental implications or built my scopic apparatuses, imagined and imaged my photographs.

Within software studies itself the three themes often appear enfolded together. At first sight Berry’s *The Philosophy Of Software* (2011b) would appear to offer an object-oriented account of software objects. After all,

Berry draws on Bruno Latour's "philosophy"⁹¹ to argue for an account of power-full code actant-objects. "Code is striking in its ability to act as both an actor performing actions upon data, and as a vessel, holding data within its boundaries" (*ibid* p. 33). These actants' power is linked to relations. For Berry, "no code is 'bigger' or 'more important' than another, except to the extent that it has a larger number of connections" (*ibid* p. 62). His debt to Latour extends to his method for software studies. "[W]e have to be alert to following the code's genealogy to see how it is developed as an historical object and its influences on attitudes, movements and ideas" (*ibid* p. 33).

Furthermore, he explores code in its material specificity, moving beyond a purely linguistic approach to embrace a phenomenological account of the computational image, "how one know one's way around with respect to things in a computational image, and conversely, the computational way of making sense of the world and how it gives expression to that sensibility" (*ibid* p. 132). Whether looking at Perl poetry, Obfuscated C Code contests or high frequency trading, the code-object is the focus even if the technosocial mesh is the target. But again, Berry's objects are framed through the themes of relationality, processuality and potentiality that run through software studies. He says:

Code must then be understood in *context*, as something that is in someway *potentially* running for it to be code. Code is *processual*, and keeping in mind its execution and agentic form is crucial to understanding the way in which it is able to both structure the world and continue to act upon it (*ibid* p. 38 my emphases).

When he argues that "the ontology of the computational is increasingly hegemonic in forming the background presupposition for our understanding the world" (*ibid* p. 128), it is the code-object's connections, forming a hegemonic bloc within hardware/software meshes that is the context. It is the relations they enact, empower and enable that form the "condition of possibility for a device-dependent, co-constructed subjectivity" (*ibid* p. 160). The agency is in the running. Google and Facebook's data mining algorithms

91. The term is in quotes here to highlight Latour's reluctance to be seen as developing such a framework (Latour, Harman & Erdélyi, 2011).

are dynamic components in the infinite archive and its governmental praxis.⁹² They and their power-full actant positions in the mesh are actualised as they, and the databases they generate, become.

Berry's philosophy is certainly object-centred but it is not object-oriented in the sense in which I am seeking to use Harman's quadruple object. For Berry, objects do not exceed their relations. They precisely depend on them. Objects must be seen as dynamic and holding something back within a relational conjuncture. It is only by framing them in these terms that Berry can explore that field of relationality as well as our or any other actant's phenomenological relation to it. Code must be seen as the potential process that fuels the governmental as well as artistic praxis he investigates.

As I will come on to argue, Harman's object-oriented philosophy, by exploring the multidimensional nature of objects exceeding any relations and as fully realised and present and connecting within other objects to form new objects, allows us to remain focused on the protocol/code-object, addressing its specificity, even weirdness as a governmental actant as well as imaging technology.

For a more object-oriented approach to technology, we can turn to Ian Bogost. In his work with Nick Montfort on the Atari VCS platform (2009), Bogost takes an unashamedly technical perspective. The VCS is literally deconstructed down to the clock cycles of the "Television Interface Adapter" (TIA) (*ibid* p. 27) and the specifics of "sprite color (COLUP0/ COLUP1) and graphics (GRP0/GRP1) values between scan lines" (*ibid* pp. 105-6). This concretely technical focus is important for the authors because, they argue, the power, popularity and position of the VCS system was because of its particular technological configuration and innovations and the

92. Robert Gehl says: "the archival capacity of Web 2.0 allows for new centralizations of power, hidden away beneath the abstractions of the smooth Web 2.0 interface" (2011, p. 1240). While I would certainly argue for the importance of addressing power and the archive, I would contend that one needs to address decentralisation and circulation of governmental power through objects rather than look for a central location.

affordances they set in motion. One cannot account for the seminal position of VCS and VCS gaming without seeing how the objects connected.⁹³

Bogost provides a more explicitly object-oriented account of technical objects in *Alien Phenomenology* (2012a).⁹⁴ Here, unpacking the Foveon DP sensor object in Sigma cameras is not a desire for depth, to excavate some truth or basis for the object or position it as determinant. Rather a particular, specific understanding of the technical workings of the object (in an engineering as well as ontological sense) is necessary if one is to understand how the object works as actant, the “unit operations” in play. “[U]nit operations can help us expose and interrogate the ways we engage the world in general, not just the ways that computational systems structure or limit that experience” (Bogost, 2006, p. 40). When Bogost looks to understand “how the sensor sees” (2012a, pp. 67-72) he is not merely saying that “the experience of the camera cannot be reduced to the operation of its constituent parts” (*ibid* p. 68) as an ontological point. He is making a methodological point that the sensor “does work” in the digital imaging pipeline and so we need to account for it in its specificity, not only in terms of how its colour balance or focussing shapes what our perceived images are (a correlationist account whereby objects can only be understood as matters of human access), but also in terms of its machinic position and connections with software and hardware, human and unhuman actants. The fact that a Foveon sensor measures all wavelengths of light at each photocell, unlike a traditional sensor with its Bayer mosaic, means the digital imaging pipeline functions differently not just in terms of the final image and our semiotic

93. As noted above, Galloway (2006a) has also written on games and Thacker has published in a journal that looks at “gaming” in a wider sense (2001). Although Galloway is once again keen to explore how games relate to broader control systems and practices, he does this via a formalist account of the game using a film studies methodology. The material form, platform or object remains secondary. Thacker too uses games as way into exploring his themes of the relationship between the body and technology. Again simulation and gaming are the focus. The material platforms, technologies, consoles, gadgets and objects are not the focus. For a specifically media archaeological approach see Huhtamo (2005).

94. For a more ANT-derived account of “technical objects” see Akrich (1992) where although “technical objects [...] simultaneously embody and measure a set of relations between heterogenous elements” (1992, p. 205) the stress is on the relations rather than the object.

relation to it but also its connections with Sigma's brand, business, Flickr groups and social media imag(in)ing practices. A Foveon imaging pipeline creates different images but also different networks.⁹⁵

Bogost is determined to remain at the scale of the object. He says: "The difference between a unit-operational artifact and a system-operational artifact is far more important than the formal nature or cultural genre of the artifact" (2006, p. 28). This flat ontology of media and technical objects or units as he calls them opens up ways of exploring not just a particular platform and its enfolding within the digital/media mesh, but also broader fields of power and subjectivity. "[U]nit operations can help us expose and interrogate the ways we engage the world in general, not just the ways that computational systems structure or limit that experience" (*ibid* p. 40).

The units that concern Bogost (whether hardware or software) cannot be understood from a purely formalist analysis.⁹⁶ The task is to avoid the "transcendental signified", the process, context, network or sets of relations that pull one away from the real. The movement he advocates enables a history of platforms (Montfort & Bogost, 2009) as well as games (Bogost, 2007) that avoids a human-world correlationism and a techno-determinism.⁹⁷

95. A similar argument could be made around the emerging "light field" camera technologies <http://www.lytro.com> also discussed by Bogost (2012b) as well as my stereo photography, see *Epilogue*.

96. I discuss the critique of OOP as formalist in *The JPEG Object in Theory* chapter.

97. In their *Afterword on Platform Studies* (2009, pp. 145-150), the authors lay out a vision for a discipline that takes such details seriously. Using a diagram reminiscent of Galloway's account of the four nested layers of the Internet suite (2004, p. 39), and Mackenzie's similar exploration of the ISO's seven-layer *Open Systems Interconnection Reference Model* in relation to wireless technologies (2010, pp. 99-100), Montfort and Bogost outline "the five levels of digital media" (2009, p. 146). Platform studies positions itself as filling a gap: "If code studies are new media's analogue to software engineering and computer programming, platform studies are more similar to computing systems and computer architecture, connecting the fundamentals of digital media work to the cultures in which that work was done and in which coding, forms, interfaces, and eventual use are layered upon them" (2009, p. 147).

Bogost's list of objects in play is, like Latour and Harman, fundamentally inclusive:⁹⁸

[U]nits encompass the material manifestations of complex, abstract, or conceptual structures such as jealousy, racial tension, and political advocacy.

"When thought of in this way, units not only define people, network routers, genes, and electrical appliances, but also emotions, cultural symbols, business processes, and subjective experiences (Bogost, 2006, p. 5).

For Bogost systems are also units. "[A] *unit* is a material element, a thing. It can be constitutive or contingent, like a building block that makes up a system, or it can be autonomous, like a system itself. Often, systems become units in other systems" (*ibid* p. 5 emphasis in original).⁹⁹ Here Bogost echoes Harman's willingness to address even meshes at the scale of objects. Bogost's systems are just another form of unit. As an example, when he discusses intellectual property (IP) and games, IP is not some context or structure or background. It is a specific object/unit. "Like component software, game engines are IP.¹⁰⁰ They exist in the material world in a way that genres, devices, and clichés do not" (*ibid* p. 56).¹⁰¹ Intellectual property is a key component in the mesh and so is a unit in play. One cannot understand video games, their cultural position or the workings of the industry unless that object too is on the table. Just as I argue with respect to imaging standards, "[g]ame engines are no more transcendental than genres, in the sense that one cannot play a game engine but only a game that encompasses and integrates that engine to create a work" (*ibid* p. 57).

98. Bogost coined the term "Latour Litany" to refer to Latour's lists of objects. See for instance: "Golden Mountains, phlogiston, unicorns, bald kings of France, chimeras, spontaneous generation, black holes, cats on mats, and other black swans and white ravens will all occupy the same space-time as Hamlet, Popeye, and Ramses II" (Latour, 1999, p. 161). For a software Latour Litany creator, see http://www.bogost.com/blog/latour_litanizer.shtml.

99. Wardrip-Fruin draws a parallel between Bogost's term and his own account of "operational logics" (2009, p. 17). As I have argued however I see Wardrip-Fruin's stress on processuality as a move away from a more object-oriented focus.

100. For an alternative approach to software engines, see Helmond (2008).

101. Of course Harman's OOP would admit genres, devices, and clichés to the realm of objects.

Conclusion

I have sought to show that accounts of the software object and even protocol have worked within the three themes of relationality, processuality and potentiality. These have positioned the software, protocol or standards object as processes enfolded within powerful meshes harbouring a potential for critical or governmental engagement. The stress in these accounts is on the field of becoming and relations.

Such work has brought software to the fore as an object of analysis, critical engagement and creative practice. The willingness to engage with specific components of software such as protocols and codecs have further empowered the sort of specific, focused analysis and praxis that can begin the task of mapping the way Web 2.0 and Web 3.0 technosocial meshes enable and encode specific new forms of governmentality. My reasons for taking a different path in analysis and practice is not because these approaches somehow fail in these aims but rather that an object-oriented philosophy allows a new way of viewing objects and object-relations that opens up that governmental mesh to critique as well as opening up a creative imaging practice. Furthermore, it opens up a practice-research methodology that enabled me to develop ways of understanding my research questions.

Interlude: Sally Mann

In this confluence of past and future, reality and symbol, are Emmett, Jessie, and Virginia. Their strength and confidence, there to be seen in their eyes, are compelling - for nothing is so seductive as a gift casually possessed. They are substantial; their green present is irreducibly complex. The withering perspective of the past, the predictable treacheries of the future; for the moment, those familiar complications of time all play harmlessly around them as dancing shadows beneath the great oak (Mann, 1992, n.p.)

Part of the fuss around Sally Mann's collection *Immediate Family* (1992) was that she had turned her children into objects. In the images of their childhood in rural Virginia, parts of their pre-pubescent bodies that should only have been visible (a matter of concern) to their parents had been objectified. The girl or boy, the "child" maybe "childhood" had become an object for Mann the artist. Further, Mann's cumbersome view camera had become an object in their growing up, an interloper in the childhood where it had no right to be.

In her later work *What Remains* (2003), Mann was again accused of objectification. As the omniscient artist-subject she had violated another taboo, turning decomposing corpses in an FBI scientific facility into "bodies", objects of her art. Once again, she as subject turned her camera on objects.

But Mann is an object-oriented photographer in a real not a caricatured sense. Her images are of objects connecting: the sacks next to Virginia in *Virginia Asleep, 1988*; *The Yard Eggs 1991*; the adult earring and necklace around Jessie's neck in *Jessie at 5, 1987* - these are as much the "child" as the famous naked bodies. In Mann's object-oriented photo-philosophy, they are players in the "childhood" and the "family" objects. Hers is a democratic eye, but not an un-discerning one. Every object is carefully composed and connected. But more than just a litany of objects on the groundglass, Mann is object-oriented in her sense of her own objectness. Her work with objects is not as a separate subject, standing outside the flux of material things in the world. Hers is not a dispassionate eye secure in its

subjecthood and correlationist relationship to “the world”, “the family”, “the South”. Sally Mann is an artist-object enfolded in the mesh of objects, connecting within the heart of new objects: “the Mann family”, “the Civil War”, “death”.

Mann’s object-oriented sensibility extends beyond her democratic eye. She is fully present in her images. *Immediate Family* is as much a picture of her as of her children. She is modeling just as they model. Her images of Civil War battlefields are less of landscapes out there, than of the interior landscape she argues Southerners carry with themselves. She says: “To identify a person as a Southerner suggests not only that her history is inescapable and formative but that it is also impossibly present” (2005, p. 7). Mann knows that she is at the same ontological scale as her children, their childhood objects, her home and history.

Mann’s use of not just ancient cameras and lenses but also antique processes is also a part of her object-oriented sensibility. The glitches her technologies introduce, like the clichéd inclusion of the photographer’s shadow, inscribed the technology-object across the image. The “failed” coating of the wet collodion plate, the dust, the refracted light in the ancient lens, are themselves objects connecting with each other, with Mann, the thing being photographed, the gallery, the art market and... Mann is open to those objects. More, she embraces them and their connections.

Mann the photographer is co-present as an object in the mesh of her imaging in the shape of those glitches, faults, qualities. This is not some self-reflexive gambit simultaneously modernist in foregrounding the medium but also postmodern in playing with the death of the auteur-imager. Rather it is an object-oriented sensibility, a realisation and acknowledgement of the inevitability and power of object meshes within imaging.

In *The Quality of the Affection*, 2006 an image part of the *Proud Flesh* series (Ravenal, 2010), Mann’s naked husband Larry is an object. Posed, arranged, positioned he sits with his back to Mann’s camera, a parabola intersecting with a dark shadow on which other objects - a glass, a pencil shape rendered illegible by the camera. One encounter with the work places

Sally, Larry and the glass within a field of relations interwoven within the history of nude art, gender, the body (Larry suffers from adult muscular dystrophy) and power. But *The Quality of the Affection, 2006* is an object-work. It is created through and with objects - not in some value-laden sense of powerful subject, powerless objects and the gaze - but as a series of objects connections within the frame, at the moment of exposure, the moment of viewing and the moment of analysis. Larry's back, the lights falling on his spine, the glass, the streaks in the collodion, the glass, the gelatin in the print, the Aperture Foundation and the Virginia Museum of Fine Arts, Sally, her lens... connect and reconnect within the image object, the art object, the photographic exposure objects, the family object... This is not a photo of objects by a subject but a photograph with objects, by an object.

The JPEG object in theory

JPEG as an object

One thing all of those involved in the object-oriented ontology field, itself a subset of the broader speculative realist movement¹⁰², would agree is on the importance of objects. From within philosophy, Morton's "hyperobjects",¹⁰² Bryant's "subjectless object" and Harman's "quadruple object" all, in their different ways, advocate an attention to objects and emphasise that we can approach social reality through objects. Furthermore they open up a wider conception of what counts as an object. Bryant neatly sums up the stance in the title of his most recent book *The Democracy of Objects* (2011).¹⁰³ This call to take objects seriously and expand our definition of the object has been taken up outside philosophy notably in the work of Jane Bennett and her litany of "one large men's black plastic work glove; one dense mat of oak pollen; one unblemished dead rat; one white plastic bottle cap; one smooth stick of wood" (2010a, p. 4).¹⁰⁴ I will return to Bennett's work later in this chapter as well as when I discuss my practice. These writers would doubtless be happy to say that JPEG can be addressed as an object but in order to begin working (creatively) with the JPEG object, as my project demands, it is important to explore what an understanding of JPEG as object entails. What characterises an object? In what way is JPEG an object?

For Harman, an object is what "is or seems to be one thing" (2010d, p. 148). That addition of "seems" is important because it not only allows Harman to deal with imaginary, virtual and, I will argue "weird", objects like

102. Objects "such as Styrofoam and plutonium that exist on almost unthinkable timescales" (Morton, 2010a, p. 19).

103. A title reminiscent of William Eggleston's claim to a democratic photography (Sussman, 2008).

104. Bennett is clear that things do not have to be impressive or somehow deserve our attention. Anything is an object and can be lively. I would agree with Matthew Tiessen (interestingly a practice-research artist-ontologist) who says: "[I]f nature and things have to be exceedingly impressive to deserve our consideration we're left repeating the expectations that gave rise to our lack of recognition for thing-power in the first place. In response to Bennett's concerns about fear and respect my modest proposal is that things be encountered from a position of responsive humility – a position that recognizes that *things are all we've got*, whether they command respect or not" (2010, p. 234 emphasis in original).

unicorns, characters in books and protocol but also points to the fourfold character of objects that allow me to develop a JPEG-based object-oriented photography.

In his letter to a curious five-year-old, Harman gives us a series of “brief rules about objects” (*ibid* pp. 147-8). We can use this as a way of mapping the way in which JPEG can be seen as an object in Harman’s sense.

1. *Relative size does not matter: an atom is no more an object than a skyscraper.*¹⁰⁵ At one level this appears to have nothing to do with software. Where is size in software? The number of bytes in the programme? The number of lines of code? When it comes to JPEG are we looking for the relative size of the code fragment governing “export to JPEG” as against the rest of the code in Photoshop? Such investigation is possible but misses the more important point around scale that Harman is making. All objects are equal, on a flat ontological footing. This is important in terms of decentering the human. As Morton says: “It’s a mistake to think that the mesh is ‘bigger than us’” (2010a, p. 78). In terms of JPEG, it has an existence and interest as an object regardless of its scale within software or within photography. Its “objectness” does not depend on its scale or its relationship to something else - Photoshop, machine code, electrical charges etc.

2. *Simplicity does not matter: an electron is no more an object than a piano.* The JPEG standard is simpler than Photoshop but more complex than the specific Huffman table it uses. As we have seen JPEG is a “family of compression algorithms” (Lane, 1999a) each of which can be seen as an object, simply nested further “down”. This idea of nested objects must not be seen in either value or deterministic terms. Just because an object works at a different scale than another does not make it any less important nor any more powerful in determining that other object’s position or workings. Harman agrees with Bennett who speaks of “a nested set of microbiomes” (2010a, p. 113), and Bryant who talks of objects “nested in

105. Harman uses a curious negative way of framing his rules. One could perhaps reframe these objects as positive statements: “an atom is as much an object as is a skyscraper”; “an electron is as much an object as is a piano”; “a soul is as much an object as is cotton candy”; “helium is as much an object as is plutonium” and “mountains are as much objects as are hallucinated mountains”.

other objects while nonetheless remaining independent or autonomous of those objects within which they are nested" (2011, p. 152); or again as Ray Brassier said in one of the original speculative realism workshops: [T]here are nothing but objects, objects nested within one another, and the really significant metaphysical challenge is explaining their interaction" (Brasier, Grant, Harman & Meillassoux, 2007, p. 316). A Huffman table is an object, so is JPEG, so is a JFIF image. The thing to explore is how those objects interact *within* each other and other governmental objects. JPEG's position as object is in its position as having "some sort of unitary reality" (Harman, 2010d, p. 147). JPEG, as an industry standard, as a selling point for cameras and software, as something in software and hardware apparatuses or in discourse places it within the realm of objects.

3. *Durability does not matter: a soul is no more an object than cotton candy.* OOP's willingness to extend the concept of object to short-lived, ephemeral, even imaginary or fictional things enables it to address systems and structures as well as cultural practices. Monetarism and Harry Potter may not endure but in their capacity to effect and connect, they must be seen as objects in play. The Huffman table and DCT formula are mathematical objects, rules maybe. They also do things within the digital imaging pipeline. For some, as we have seen, that is the JPEG process working, realising its potential and then changing in the flux or plasma of becoming. Arguably the Huffman table and DCT exist after the power to the software in the camera is turned off. Perhaps at some scale JPEG continues to "exist" when there is no electricity enabling it to work. The important thing is that for Harman, the JPEG object connects and then reconnects with other objects - the next stream of data from the sensor, the memory card, the next upload or data-mining operation. The rule is that its objectness does not depend on its durability any more than on our ability to hold it in our hand.

4. *Naturalness does not matter: helium is no more an object than plutonium.* Again the democracy of objects demands that we do not divide natural things like atoms, trees and helium from tables, weapons grade plutonium and software. As things in the world doing things, being presences I trip over, use, am data-mined by - all are objects and therefore

worthy of study and necessary to account for. This is not the simple point that media and cultural studies made when it said that Homer was as worthy of study as Homer or that we needed an account of tattoos as well as Titian. Nor is it the far earlier establishment of literary or art history studies arguing for their objects being worthy alongside the natural sciences. This is not a flattening of hierarchies and categories for political, professional or academic interest. It is a metaphysical statement that all objects are in play whether we like it or not. One could debate whether cosine is a natural “thing”, a Platonic form, but from an OOP perspective such a debate is meaningless. The DCT demonstrably is present within JPEG and does something in the digital imaging pipeline.

5. *Reality does not matter: mountains are no more objects than hallucinated mountains.* Here of course Harman lays himself open to the common criticism that his framework is so loose as to be useless. But, he argues:

Imaginary things are not utter non-beings. They don't have independence from the one who is conceiving them as real objects do, but they're not just nullities or holes of nothingness. I don't think Raskolnikov is a real object either, but millions of people have read *Crime and Punishment* and been influenced by it. Raskolnikov needs to be accounted for by ontology (2011f, n.p.).

This is not to say that Harman sees every object as equally real. His whole perspective with real and sensual objects (see below) is designed to explore these different dimensions (2012a). What Harman is looking to leave out of analysis is the idea of any kind of “non beings”. If things are at work, then they are objects. JPEG is not imaginary but it is certainly difficult to see or find. It is a standard written or maybe woven into software and hardware meshes as well as business strategies and grandmother's dotting over a new baby. But even if JPEG was not “real”. Even if the idea that a standard that compressed data efficiently and effectively was an elaborate Capricorn One-like conspiracy perpetrated by mad scientists, Adobe and Google, it wouldn't matter. JPEG would still be worthy of study because it was still at play in people's photography, their photographic consumption and their

relation to images and imagespace, as I will come on to discuss in relation to Facebook.

In some ways JPEG is an ideal candidate to explore these rules. It does not really have a size; it is both simple in its role but complex in its form; it is ephemeral in its working but durable in its enfolding within imaging; it is unnatural and it is clearly real within the digital imaging pipeline but simultaneously unreal in its presence within the business plans of photo-network start-ups where it is designed to reassure venture capitalists of interoperability and flexibility¹⁰⁶.

JPEG can be conceptualised as an object. My practice has shown that JPEG has a unity, a presence and a power within imaging objects and apparatuses. What is more, as I will discuss, my practice demonstrates Harman's three key themes about objects: their existence beyond relations; their presence beyond process and their working beyond potential.

Overmining and undermining

As I have sought to show in *The JPEG object in the literature*, a view of the digital object built around ideas of relationality, processuality and potentiality has been a pervasive and, in many way, positive theme running through the development of software and critical code studies. This project's practice and research takes a different starting point. Following Harman's model of the "quadruple object" I work with a conception of the (JPEG) object as having a reality in and of itself,¹⁰⁷ not dependent for its power on its relations. It has an existence (weird though it may be) that is more subtle yet unified than a moment of working or becoming. Despite its withdrawal

106. Instagram's API documentation says: "You must first save your file in PNG or JPEG (preferred) format" (Instagram, 2011). This is not just instructions to engineers, it is a statement for the whole of the Web 2.0 community - including investors and partners, that Instagram works with the standards users (for which read customers) use. Facebook purchased Instagram in the lead up to its IPO in 2012 secure in the knowledge Instagram images and imagers would connect seamlessly with its services, technologies and I will argue governmental rationality.

107. While Harman consider his position as "realist", Bryant prefers to characterise his as "materialist" (2012a; 2012c), as I discuss below. In fact in a "personal" correspondence on Facebook he told "me" (the scare quotes signify my unease about the nature of the interaction and the correct terminology for it): "I find myself increasingly shying away from OOO and moving into the Bennett:materialist camp sans vitalism" (2012b, n.p.).

from human access, it has a fully present character within apparatuses, imaging and imagining.

To position JPEG as an actant defined by its relations, as a process or as awaiting realisation is to be guilty of what Harman calls “undermining” or “overmining”. These tendencies are not only philosophically but also practically problematic. Harman says:

The first critical response to objects asserts that they are not fundamental. All of the dogs, candles, and snowflakes we observe are built of something more basic, and this deeper reality is the proper subject matter for philosophy (2011g, p. 8).

This undermining of the object can be in terms of a materialism that sees a more basic element as the starting point or even the end point of analysis.¹⁰⁸ Here JPEG is just a collection of more fundamental algorithms or even electrical fluctuations. We must keep digging. For materialists, Harman says, “[o]nly what is basic can be real” (*op cit.*). The problem with this of course is that one does not account for the specificity of so-called aggregates, such as JPEG. If, as I argue, JPEG is a key player in governmental mesh-objects such as the Facebook Open Graph, relations and power, then such a reductionist argument misses a key player. Furthermore from a practice point-of-view to deny objecthood to JPEG removes a key player from my apparatuses and my practice of imaging and imagining the digitisation of light as data.

A second form of undermining happens with the argument that objects are just the crystallisation of becoming. Here the fundamental flux of becoming, the plasma of potentiality somehow stabilises as objects, abstractions from something deeper. From this perspective JPEG is the abstract name we give to the moment of encoding, the flux of processes, algorithmic workings and mathematical transforms. Again JPEG itself is

108. This form of reductive materialism must be distinguished from the vitalist or objected-oriented materialism that I come on to discuss in relation to Bennett and Bryant.

missed. If, as I argue JPEG is fully present¹⁰⁹ in governmental spaces - businesses, surveillance and data-mining operations, patents and business plans, then it needs to be accounted for. It cannot be bracketed in favour of ideas of scopic becoming or regimes of control. My JPEG-imaging practice shows that JPEG is fully present and realised within my imaging. It is not holding anything back, becoming and perishing or accreting new features. The specific, real and actual JPEG object is connecting and reconnecting within specific, real and actual new objects. That is how and why the mash-up works and parts of the eBooks “fail” to work.

Harman argues that these forms of undermining of objects is philosophically indefensible:

All are versions of reductionism in which objects only gain their reality from elsewhere. All are forms of *critique* that view individual objects in a spirit of nihilism, destroying them with bulldozers to make way for something more fundamental. They view objects as too shallow to be the fundamental reality in the universe (*ibid* p. 10 emphasis in original).

JPEG has a unity, presence and power as standard, imag(in)ing protocol and, I will argue governmental actant, outside of the particular electrical charges or code of which it is made. It has a presence and power in my practice and Facebook’s strategy beyond its particular moments of working.

Harman says the second tendency in the philosophy of objects is to “overmine” them, to reduce them upwards. He says:

On this view, objects are important only insofar as they are manifested to the mind, or are part of some concrete event that affects other objects as well (*ibid* p. 11).

Empiricist overmining says that an object of experience is just a bundle of qualities: “apple” is just a term for series of qualities we link together: red, sweet, cold, hard, juicy. Just as the brand Apple hopes to stand for values or qualities: trendy, user-friendly, cool etc. In both cases, the object has no reality outside its qualities. In this view, JPEG, is best thought of as shorthand

109. JPEG’s presence in a patent and in the software programmed onto a camera chip are different in kind of course, but from an OOP perspective they are equally important see the discussion of Raskolnikov above.

for data compression, interoperable data, flexible digital information. Harman points out however that there is always more to objects than just the qualities (the sensual dimension) that we encounter: the apple is not its redness; Apple is not coolness. Redness on a corpse or coolness in Miles Davis are different. Here JPEG is more than algorithm, compression or even ideologies of interoperability. We and other objects encounter those qualities but also, as I shall discuss, there are other real dimensions to the object that are withdrawn, dimensions that make it JPEG.

A second strain of overmining comes in the form of what Quentin Meillassoux has called “correlationism” (2009) - the folk devil that unites the speculative realist movement. This tendency within philosophy has argued that “we cannot think of world without humans or humans without world, but only of a primal correlation or rapport between the two” (Harman, 2011g, p. 12). Harman calls this the “Philosophy of Human Access” (*ibid* pp. 62-68).¹¹⁰ Following the correlationist argument, to consider JPEG is to consider a human relation to JPEG. It is inevitably human-object. We cannot deal with JPEG, only deal with our dealings with it. The human-JPEG relation is of course central to this project. JPEG imaging is a human-object thing.¹¹¹ But it is not the whole thing. JPEG has an existence and a reality outside of my thinking about it, using it or having any relation with it. It exists in software as well as Web 2.0 business plans, legal documents, marketing and surveillance strategies, databases and family memories. But to see those relations as defining the object is just another form of correlationism, one that Harman calls “relationism”.¹¹² Here he takes Whitehead and Latour

110. In *The Quadruple Object* and in his study of Meillassoux (2011h), Harman discusses various forms of correlationism and why, in his view, they are philosophically and logically indefensible. My aim here is not to enter into those subtleties but merely highlight the more general human-object formulation as a problematic.

111. I will come on to argue this human-object, JPEG-object relation happens within something that should also be seen as an object.

112. Relationism, the idea that objects must be understood in terms of their relation to other objects has a long history e.g. Gottfried Leibniz’s argument contra Newton, that time and space must be seen in relation to material events in the universe (Futch, 2008); Georg Simmel’s “Wechselwirkung”, or the “reciprocal actions and effects” (Milà, 2005, p. 44) and Karl Mannheim’s sociology of knowledge which held that: “there are spheres of thought in which it is impossible to conceive of absolute truth existing independently of the values and position of the subject and unrelated to the social context” (1955, p. 79).

head on for arguing that an object's power is defined by its field or network of relations or accidents. JPEG from this perspective is power-full because it is part of a scopic regime, apparatus or project. It is more powerful than Google's alternative WebP because it is in networks with Flickr, Facebook, Adobe, Nikon, data-mining and domestic memory management. JPEG is either an image in the mind or just its effect on other things: a bit player. Harman argues that to follow this through means the object disappears. He says:

If a house is encountered by three women, a child, a dog, and a crow in the same moment, each of these perceptions will have a very different character. And given a purely *relational* definition of what objects are, it would seem impossible to call all of them relations to the 'same' house. The house itself vanishes into a mob of house-perceptions (*ibid* p. 13 emphasis in original).

But that house, that JPEG, is real. There is a unity to it and not just in the standards written and posted by its developers. It *is* in relations - within my imaging and apparatuses as well as within the governmental scopic regime - but that does not exhaust its reality, its unity. The correlationist and relationist projects overmine the object. Empiricist or process philosophies undermine it. Both refuse to deal with objects in their multiple dimensions, connections, presence and reality. In terms of my project, they skip over JPEG entirely. Harman argues that undermining and overmining are not mutually exclusive but partners in shifting the focus from objects. "[E]very undermining philosophy needs an overmined component as a supplement, and vice versus" (*ibid* p. 14). A materialist call to find the basic building blocks then locates those blocks (atoms, sub-atomic strings or Huffman tables) in terms of relations or qualities - hardness, resistance, statistical chance, probability etc. Similarly a relationist picture of flux and becoming still demands a fundamental perceiver such as Whitehead's God to correlate all perceptions. In both cases "autonomous objects are [...] excluded as a

proper topic of philosophy" (*ibid* p. 15) and, I would argue, methodological tool.¹¹³

Harman's arguments against overmining and undermining are philosophical and logical, mine are methodological and creative. Harman argues that these approaches fail to ask the right questions and paint a picture of reality that does not make sense. He reaches these conclusions after thought. I argue that these approaches not only fail to provide a coherent account of JPEG but also that they do not match my practical experience of encountering and using JPEG. I reach these conclusions through practice.

The sensual object

At the core of Harman's conception of a unified, autonomous object is actually the idea of two objects: the sensual and the real objects (2009c, p. 190).¹¹⁴ These should not be thought of as two distinct things but rather two dimensions to the complex, powerful actant-object.¹¹⁵ Harman looks to bring together Husserl's framework of intentional objects, the objects present to consciousness, with Heidegger's account of real objects that withdraw from access.

113. Harman discusses this missing piece as "the third table" alongside A.S. Eddington's (1928) "scientific table that is mostly empty space and made up of rushing subatomic particles, and the table of everyday life" (2011j, n.p.; 2012c).

114. Karen Barad argues that "the primary ontological unit is not independent objects with independently determinate boundaries and properties but rather what Bohr terms 'phenomena' [...] the ontological inseparability of agentially intra-acting components" (2007, p. 33). For her, phenomena have a reality. Harman would agree. Where he would differ is in Barad's sense of objects needing something more. Barad cites Judith Butler's argument that matter is "fully sedimented with discourses" (1993, p. 29), arguing "'Things' don't preexist; they are agentially enacted and become determinately bounded and propertied within phenomena. Outside of particular agential intra-actions, 'words' and 'things' are indeterminate. Matter is therefore not to be understood as a property of things but, like discursive practices, must be understood in more dynamic and productive terms-in terms of intra-activity" (Barad, 2007, p. 150). Here it is when objects are "enacted" that they become things. For Harman, there is no necessity for anything outside the object. Objects do not lie in wait or in potentiality for enactment.

115. Harman is clear that this real/sensual objects is not the the same as a primary/secondary qualities distinction. He argues that what are seen as primary qualities, physical properties such as mass, shape, position are "not deep enough to qualify for the status of 'primary'". These qualities are no more "real" or basic than so-called secondary "mere qualities, such as 'sweet', 'red', and so forth" (2009c, p. 195).

Husserl, whom Harman calls “an *object-oriented* idealist” (2011g, p. 20 emphasis in original), held that objects do not exist outside our consciousness (2009c, p. 194). The camera on my desk, the CCD inside, the software “inside”, exist as intentional objects within my consciousness. When I sleep or fail to pay attention to them, in some sense they cease to exist. Intentional objects “exist only as passive figments encountered by something real” (*ibid* p. 213). It is this split and relationships between the real and the sensual that Harman’s quadruple structure seeks to unpick.¹¹⁶ In Harman’s reading of the philosopher, for Husserl:

We never see all faces of the hammer at once, but always see it from a certain angle and distance, in a certain colour and intensity of light, and always in a specific mood. In this sense the hammer only appears in the form of specific profiles or adumbrations [...] Nothing is ‘hidden’ behind the adumbrations for Husserl; the hammer itself lies within each adumbration, as an eidos encrusted with accidents (*ibid* p. 180).

For Husserl, the object present to us is always particular. It cannot be separated from its adumbrations, its existence is tied to those specific profiles as we (or, for Harman, any other object) encounter them. The Olympic velodrome-object I or my camera sensor perceived (or photographed) yesterday, perceive today and will perceive tomorrow always comes encrusted with particular qualities or accidents. This is after all the point of the decisive moment - not all photographic moments are the same. The velodrome is always perceived (by human or unhuman actant-objects) in a particular light, from a particular point-of-view or in a particular mood. In terms of encountering JPEG, I as a photographer-object and the in-camera

116. Harman prefers to use the term “sensual” for this dimension of objects. He says: “Husserl uses ‘intentional’ to refer only to the unified objects of consciousness, while excluding the shifting surface qualities of things from the intentional domain. So-called ‘sense data’ are not intentional for Husserl, precisely because they are not object-oriented. For this reason, a new unified term is needed that covers both the enduring objects of consciousness and the overly specific facades through which they are always manifest” (2009c, p. 136).

software-object “perceive”¹¹⁷ JPEG. That encounter happens as I press the shutter or the *Save As* button or software encodes light-as-data. What the software and I encounter is the particular qualities of JPEG, particular to the encounter. Those qualities shift and change as a particular “quality setting” is chosen, a particular Huffman table is accessed or a particular DCT is used.

Harman calls these adumbrations, the particular profiles, accidents, the object’s “sensual qualities” (SQ). The sensual object (SO) that human and unhuman actants encounter is in a relation with these shifting accidents. These profiles are how we access the object. But Harman points out that amid the myriad of possible views of the Velodrome or compression configurations, we recognise the 2012 Velodrome or JPEG. This he says is because the object has real qualities (RQ) that the sensual object forms a relation with.¹¹⁸ He says that if one were to strip away all the (SQ) accidents in a particular encounter or perception, “what remains is not merely an ‘empty pole of unity [...] a ‘bare particular,’ in the terms of analytic philosophy. Instead, we approach what Husserl calls the eidos of an object” (2011g, p. 27).¹¹⁹ There is something (the RQ) of the velodrome that means we perceive it as the Olympic velodrome, a sensual unity, no matter the light or the weather. These features mean we know we are dealing with the Velodrome not the Aquatic Centre or even the National Cycling Centre

117. Inevitably when dealing with objects as actants, one slips into anthropomorphic or worse anthropocentric discourse speaking of unhuman objects as “perceiving” when attempting to explore the way they connect. Bennett is not ashamed of the often very anthropomorphic language she uses. “We need to cultivate a bit of anthropomorphism - the idea that human agency has some echoes in nonhuman nature - to counter the narcissism of humans in charge of the world” (2010a, p. xvi). Harman echoes this when he says that “a bit of anthropomorphism may be needed to overcome anthropocentrism” (2011a, n.p.). Bogost explores similar issues as he discusses “metaphorism” and the “unknowable inner lives of units” (2012a, pp. 61-84).

118. It is important to note that just as with the “distinction” between RO and SO, so when Harman talks of real and sensual qualities, he is not saying that one is more important, fundamental, basic or even real than the other. Rather they must be seen as two dimensions at work within a unified object.

119. It is important to note that for Harman these real or eidetic qualities are not universal. These are not the ‘eternal objects’ of Whitehead. Rather they are always particular to an individual object. When I press the button and encounter the sensual JPEG (that dimension to JPEG that I work with), I encounter a particular running of JPEG, in a particular moment, within a particular apparatus (JPEG’s SQ). I also encounter JPEG’s RQ, its particular digital imaging pipeline that make JPEG particular.

Velodrome in Manchester. It has wooden banking, with a particular geometry, a certain length etc. In the same vein, there is something (the RQ) of JPEG that means an object (me as the photographer, the computer chip or software) knows it is working with JPEG. We know we are encountering JPEG because it use DCT not the Wavelet Transform coding that JPEG2000 uses (Marcellin, Gormish, Bilgin & Boliek, 2000; Adams, 2001). The particular Huffman tables may shift but the unity remains.

The real object

Harman's sensual objects exist only for another object that encounters them (2011g, p. 48). But there is a second dimension, what Harman calls real objects (RO). These differ from sensual objects in that they are autonomous from any object that encounters them and they withdraw from all access, all relations and each other. Here Harman turns to Heidegger's tool analysis (which he explored in more detail in *Tool Being* (2002)). Heidegger argues that the spectacles I use to look through my camera viewfinder, my heart beating, the computer operating system and protocols are "ready-to-hand" but are not present to me unless they break, stop working or fail. Objects disappear in favour of some purpose they serve (2011g, p. 38)... at least until they crash. These objects are real. They have an existence beyond the phenomenal realm. In Harman's reading, for Heidegger:

[T]he being of any object is always deeper than how that object appears to us [...] The hammer as a Husserlian intentional object is always already present as soon as we acknowledge it, and is merely encrusted with non-essential features. By contrast, the hammer for Heidegger is a real entity that invisibly does its work in the cosmos (2009c, pp. 180-1).

There is a real Velodrome. It exists in the world but we cannot access it and nor can any other object. Its reality, nature, even existence is withdrawn. We encounter its sensual dimension but unless the building collapses or the turnstile fails to recognise our hard-won ticket, it remains out of reach. Similarly there is a real JPEG, a unity, an object (as I have argued above) but it too is never accessible to us. We may glimpse JPEG when the upload fails

or, as in my work it is made to sit alongside RAW-encoding that breaks its transparency. The sensual instantiations we encounter do not exhaust JPEG because they are not what “do the work”. As I shall argue, that “work of JPEG” is deeply governmental, even disciplinary and the instantiation of JPEG (its encoding and decoding) we or even Facebook’s data-mining algorithm encounter are not the full story. JPEG’s “subterranean tool-being” is weirder and more power-full than that. Real objects withdraw from our consciousness and also from all relations. Harman talks of cats:

The real cats continue to do their work even as I sleep. These cats are not equivalent to my conception of them, and not even equivalent to their own self-conceptions; nor are they exhausted by their various modifications and perturbations of the objects they handle or damage during the night. The cats themselves exist at a level deeper than their effects on anything. real objects are non-relational (*ibid* pp. 194-5)¹²⁰.

As with cats, so with JPEG. It exists when I sleep or when I am using a paintbrush to image. It exists beyond its sensual presence in my or an algorithm’s imaging or processing or beyond the relations and connections within which it works. “Real objects exist ‘whether we like it or not’” (*ibid* p. 195).¹²¹

The “real object” (RO) is “autonomous from whatever encounters it” (Harman, 2011g, p. 48).¹²² There is JPEG without me, Olympus or JavaScript (which can only encounter or touch the sensual JPEG). When I pick up a pencil or switch the camera off, the sensual JPEG vaporises but the

120. It is important again to note that Harman (and I) are not denying relations. What he is drawing attention to here is that those relations do not define the object.

121. Harman is at pains to distance his reading of Heidegger from what he sees as a view that Heidegger’s withdrawn realm is a “deeper and unified system of reference” (2011g, p. 35) which he would see as a case of “undermining”. Objects withdraw not into some field or monastic lump of being but into themselves, into “private interiors, barely able to relate at all” (*ibid* p. 36). The reason we cannot reach JPEG, the reason it slips through our fingers and all we are left with are its traces in JFIF or EXIF files or our sensual encounters with its instantiations, is because, as with all objects, JPEG “does its work in the cosmos”. It has a reality beyond any relations or particular instantiations. This reality is not located in the specifications of the Joint Photographic Experts Group. It has a metaphysical reality: its status as object.

122. Here Harman draws on his debt to Aristotle in his debate with Plato regarding forms and substance (Harman, 2011c).

real JPEG does not. It still has an ontological reality, an object status. Although the object withdraws from access, Harman argues that the RO is in relation (or “tension” as he calls it) with the object’s sensual and real qualities. The shifting sensual qualities we encounter as we walk around the Velodrome or the particular Huffman table the software encounters in a particular imaging moment, cannot just be phenomenal. These qualities must emerge from something real. The object may withdraw or be inaccessible but it “emits sensual qualities into the sphere of presence, despite being withdrawn in its own right” (*ibid* p. 49). There is a relation between the RO and the object’s SQ. Similarly, the RO is not an empty unit. It is in tension with real qualities (RQ), those essential features that make the object what it is. As a cyclist I encounter the Velodrome. I ride a particular geometry in a particular temperature-controlled space. Those essential qualities define this as the Olympic Velodrome not the National Cycling Centre Velodrome. Those qualities are connected with the withdrawn RO. If the RO did not have those specific but real qualities, it would be indistinguishable from any other withdrawn object. In the case of protocol, JPEG is not an empty unit. It has real qualities Colour Transforms, Huffman Coding, DCT, the things that make JPEG compression the object it is. The withdrawn RO must have a relation to those qualities or JPEG would be no different than any other standard... and it is.¹²³

This is Harman’s fourfold: Real Object (RO), Sensual Object (SO), Real Qualities (RQ) and Sensual Qualities (SQ). These are four poles to the unified object, four dimensions that allow us to explore objects without recourse to fields of relationality, potentiality or process. To map JPEG as a quadruple object is to see:

- it as a real object present and active in the world, beyond relations, inaccessible

123. Harman draws on Leibniz’s argument that: “monads must have qualities, otherwise they would not even be beings” (Leibniz, 1989, p. 216). Or in other words, each monad “needs a multitude of qualities to be what it is, to differ from other monads rather than be interchangeable with them” (Harman, 2011g, p. 49). Harman’s whole quadruple model is designed to show how the qualities (real or sensual) are not all there is to an object. They are part of the picture but not the whole story.

- it as a sensual object present to human or unhuman consciousness or access, whenever energy is expended on it but always through
- sensual qualities - particular instantiations, particular Huffman tables or arrangements of coding and transformation algorithms
- having real qualities - inaccessible characteristics like Huffman Coding that make it specifically JPEG not JPEG2000, GIF or WebP.

In addition those four poles are “connected” through four tensions.

Fusion and fission

Harman’s fourfold structure allows us to understand a number of aspects of objects and the ways they work which are relevant not just for a comprehensive metaphysics, but also for our understanding of and work with JPEG. Furthermore, as I will explore in the next chapter, it offers a framework for a practice-research methodology and creative practice. Harman argues that the two poles and their two qualities allows an understanding of time, space, essence and eidos.¹²⁴

“Time” is clearly important for any discussion of social imaging. As I will discuss in terms of Facebook, the “infinite archive” of imag(in)ings is deeply power-full. Time in the form of Facebook’s “Timeline” and “Open Graph”¹²⁵ objects are integral to that practice and business, and my practice shows that JPEG is in turn deeply enfolded with those objects. For Harman time can be understood as a matter of the tension between the sensual object and its sensual qualities (2011g, p. 100). The Velodrome remains the same to us as it falls into disrepair, as the encrusted qualities or profiles shift and change. In terms of protocol, JPEG endures. The JPEG a human or unhuman object calls on in their camera or Photoshop or the upload to Facebook remains a presence even as its particular instantiations shift. Encoding my light-as-data today or yesterday, on quality setting 5 or 10 are different. We experience those imaging moments or encounters as happening in different “times” but

124. This theme has been developed over the past few years in Harman’s work. This chapter concentrates on that presented in *The Quadruple Object* but earlier workings can be see in (2009c, pp. 214-221; 2010b; 2010d). See also Harman’s developing thinking in (2010c).

125. As I discuss in the *JPEG: the governmental object* chapter, the “Open Graph” is a term coined by Facebook for its particular implementation, and it argues, extension of the term “social graph”, a term from graph theory designed to encapsulate the network relations between people (Facebook, 2012).

they can equally be seen as encountering different objects. The advantage of seeing them in those terms is we remain focused at the scale of the object and avoid falling into debates about the “arrow of time” or discrete instances, process and becoming. What is more, when we work with object-oriented imaging, we can build new (object) apparatuses that explore that tension at work in image searches and streams.

“Space” too is important to any consideration of digital imag(in)ing. The Open Graph’s geolocation data offers new dimensions to Facebook’s ad-targeting business but also its generation and “ownership” of social connections - my friends and I “checking in” and taking pictures in a particular Starbucks, “Liking” across continents¹²⁶. For Harman, what we understand and experience as space is really a matter of objects, specifically the tension between real objects and their sensual qualities. Recall that the withdrawn RO has SQ that project into the world. If it did not the object could not be accessible to thought or action. The real 2012 Olympic Velodrome withdraws from me. I cannot access its complete objecthood. But I do encounter its qualities, those aspects of its nature that project into my human or unhuman camera view as I walk around the Fence. That relation happens in Newham. When I sit writing or thinking about the Velodrome while I am in France, those sensual qualities are not present to me. Other sensual qualities are present to me - perhaps memories, photos even. What I understand and experience as a spatial difference, Newham-France, can be understood as a difference between the Velodrome (RO), forever withdrawn no matter where I am, and different sensual profiles.¹²⁷ “Space is not the site of relation, but of both relation and non-relation” (Harman, 2009c, p. 218). The Velodrome’s spatial location in Newham not in France can be approached by remaining focused on objects and their tensions. There is no need to talk of objects *and* space but rather a

126. Although JPEG (in its EXIF file format in particular) is related to issues of geolocation and geolative metadata, I chose not to focus on these issues in my practice as I was concerned with JPEG encoding, not with the file formats and the broader issues of metadata.

127. This is of course not to suggest that physical distance or space does not exist, merely that thinking in terms of objects gives us a new way of understanding what that means for us and other objects.

spatial dimension to objects. This becomes even more apparent when dealing with JPEG.

Traditional ways of thinking of space and spatial location do not work with objects like protocol. Where is it? Where are they? In legal and governmental terms, whose jurisdiction are they in? Where is that Open Graph data point? In California on a server? In London on a computer? In mid-Atlantic on an iPad? What seeing the spatial problems of distributed networked media in terms of objects does is give us a way of understanding JPEG's seemingly strange, singular but multiple, located but multiply present character - characteristics that the distributed web and the businesses and governmental relations dependent on it, require. As we shall see, Facebook's imag(in)ing archive requires that its encoding and decoding (through JPEG) as well as its "frictionless sharing" and Liking (again JPEG-dependent) is stateless and pervasive. Its (governmental) Open Graph demands a different sort of space and OOP offers us a way of mapping it.

From an OOP perspective there is one JPEG object, existing as a standard built into software, hardware, business plans and popular culture. Contrary to an ANT account of its genealogy, it does not exist in the documents of the Joint Photographic Experts Group (Wallace, 1992) or the language of the code. It can be seen as a unified object. It has a unity and power beyond relations just as Bogost's "jealousy" and "racial tension" and Harman's Raskolnikov are objects. Like these objects JPEG as protocol-object does not have a spatial location, or more correctly, it has multiple spatial locations, as a real object, in some sense everywhere, and as an accessible sensual profile wherever it works - in my camera, on Facebook's server, on the server that screengrabs my searches in the Mash-Up etc. These can be literally miles apart: metres from the 2012 Fence, on a server in California etc. What the software in my camera or in Facebook's algorithms or Photoshop connect with are the sensual profiles in those multiple spaces, the particular instantiations. The complex spatial dynamics (and governmental politics) of

stateless digital objects,¹²⁸ let alone protocols, can be seen as a matter of the JPEG RO and its tensions with its particular profiles SQ.

In Harman's model, the remaining two tensions (RO-RQ and SO-RQ) allow him a way of talking about "essence" and "eidos". Recall that both the withdrawn real and the phenomenal sensual dimensions to the object are in tension with the real qualities, the core features that make JPEG JPEG not JPEG2000 or WebP. The tension between those withdrawn qualities (Colour Transforms, Huffman Coding, DCT for instance)¹²⁹ and the withdrawn dimension (RO) is what we commonly call essence. That between those qualities and the SO we access, Harman calls eidos.

The difference between the two tensions is again useful in understanding (and using) JPEG. Harman's Heideggerian side demands that essence is hidden. The reality of the object is always beyond access by us and by any other object. The real Velodrome or JPEG (RO) and its essential characteristics that means it is a distinct object in the world (RQ) are both forever withdrawn. The essence of JPEG, that RO-RQ tension is withdrawn. That's in part what makes it a "weird" object. At the same time (following Husserl) Harman says there is a formal core to objects that can be approached through categorical intuition. If we strip away all the particular accidents encrusted on an object. There has to be something we perceive at the core of the shifting profiles, something that means we recognise the Velodrome regardless of the shifting light or point-of-view or JPEG alongside other protocols and standards. We may never phenomenologically access these features (hence their reality) but we can intellectually approach them. This is the tension between the Sensual Object (the JPEG we and other objects encounter in imaging, imaging business plans and governmental

128. Of course this idea of "stateless" does not preclude legal battles over digital objects see for instance struggles over Wikileaks, Pirate Bay etc.

129. These real (essential) qualities are different to the sensual qualities we encounter in particular instantiations or profiles of JPEG. A specific Huffman table is a sensual quality an object encounters. "Huffman coding" or "Discrete Cosine Transform" as a mathematical formula or algorithm is "real". It cannot be encountered in its totality. While this would seem to have Platonic formal overtones, as has been noted Harman owes far more to Aristotle. These formulae are not in the realm of forms, or abstract or phenomenal. They are real, present and are dealt with in terms of substance.

relations) and the Real Qualities (the algorithms and mathematical formulae that JPEG uses), what Husserl calls the *eidos*. We may never be able to fully access the Velodrome's geometry or Discrete Cosine Transform, as a mathematical formula in their complete reality, as opposed to their particular sensual instantiations for us, but we can intellectually identify them and recognise them as distinguishing characteristics.

In terms of JPEG this framework is useful because firstly we can embrace the concept of unreachable "essence" and intellectually approachable "eidos" without being accused of determinism or reductionism or a dependence on relationality as a way of working with objects. Secondly, we can see how, despite the fact that we can intellectually find the algorithms and compression formulae "within" JPEG (see the *Digital Imaging Pipeline* chapter) that enable us to see JPEG as different to other standards (RQ) and we encounter particular instantiations of those algorithms (SQ), the totality of the JPEG object always eludes us. The "reality" of JPEG as an actant in distributed digital imaging and social media businesses and governmentality is always more than these qualities. Unlike other perspectives on digital objects, it accepts the "weird" position of protocol.

For Harman these relations between the four different poles of the object are in "tension": what he calls fission and fusion. The relations between a SO (the Velodrome or JPEG we encounter) and its particular profiles (SQ) that we experience as time is characterised by moments of rupture (2011g, p. 103). At the moment of passing the Velodrome at dusk we realise that unified kernel has transient sensual qualities as the light sparkles on the wood panelling - "I never noticed that before". At the moment of encoding light-as-data we (or other software actants) are faced with various compression settings, the transient qualities, profiles or instantiations. The tension breaks: fission. The same break can happen in the tension between the SO and its RQ (*eidos*). The intellectual labour of paring down JPEG to find its real qualities. this "reverse engineering" through "theory" is a matter of fission, breaking down JPEG (as I do in the *Digital Imaging Pipeline* chapter). It is this process of fission I look to explore in my RAW/JPEG apparatus.

The other two relations, between the RO and its SQ (which we know as space) and its RQ (which we know as essence) are also best understood as tensions but this time characterised by “fusion”. Real objects and their sensual qualities only meet when they are fused (*ibid* p. 105). The real, withdrawn, inaccessible velodrome has sensual qualities in particular locations as I circle it. Its sensual qualities fuse with it as I look or take a photograph. Even in the non-locational space of JPEG, the SQ of JPEG that I engage with, the particular profiles, settings or instantiations, are fused to “JPEG” so I can image with it or write about it. Those SQ must have a connection but that connection is made or fused (locally in my camera or globally across the networks) with each use. Similarly, the relation between the RO and its RQ is again a matter of fusion. This essence is “fused” as the always withdrawn protocol/standard that we can never fully grasp is brought together with those RQ (the mathematical laws and algorithms) that can be intellectually grasped but never exhaust the totality of the object. That essence is fused, for Harman, through an outside entity, a mediating term. As we shall see, objects meet others within objects. They effect each other within/through objects which fuse them. Huffman coding or Discrete Cosine Transform (as JPEG’s RQ) are fused as a part of “JPEG” (the RO) by and within the Photoshop object as it encodes the data. They are fused as part of the JPEG standard that a Web 2.0 pitches as its new business model: “Our social network will use JPEG so users can easily upload, share and see each other’s images...” As we shall see, it is this process of fusion I look to explore in my mash-up apparatus.

The connection

As I have noted, Harman’s framework of autonomous, actual objects does not preclude the sort of actant networks that Latour talks about, and the sort of techno-social, computational meshes addressed by software studies. In fact the power of Harman’s quadruple object is that it offers a powerful way of addressing the relations between human and unhuman actants, the sort of relations within which JPEG is enfolded, that characterise scopic governmentality and that I notice and work with within my own practice.

Harman is clear that these relations do not define the object. Rather his model looks for an object-oriented account of relations.

Real objects withdraw and so cannot “touch”. “Their reality consists solely in their being what they are, not in some sort of impact on other things” (Harman, 2011g, p. 73). The tree, cat, velodrome, protocol or social network business are deeper and more mysterious than another object (whether photographer, CCD or search algorithm) can access. But objects do connect. We know this in our experience. My JPEG apparatuses, imaging practices as well as the governmental scopic regime demonstrate objects connecting and reconnecting in power-full ways.

The question for Harman becomes how do those objects connect. Following the quadruple structure, real objects cannot connect. They are always withdrawn and can only connect through a mediating sensual object.¹³⁰ Similarly, sensual objects cannot touch each other except through a mediating real object.¹³¹

The real human object (I as photographer) encounters the real Velodrome object only through the mediating sensual object of the accessible digital imaging pipeline. Remember that for OOP, pipelines or processes can be objects. They have a unity. They have a fourfold structure and they do things in the world. They have withdrawn dimensions and dimensions present to experience. Similarly, the sensual JPEG (the accessible profiles or runnings) acts as the mediator between the real light as data and the real Facebook software and algorithms.

The point for Harman is that these encounters, connections or relations do not happen in a field of becoming, plasma or potentiality but *within another object*. Why does that matter? Because it means we can explore it, critically (as I look to do in my account of Facebook and my *Conclusion* calling for an Exploit) and creatively (as I look to do in my practice). As I explored in *The*

130. Harman discusses the history of the idea of a necessary mediator in terms of “occasionalism” (2009c, pp. 112-116; 2011g, pp. 70-72). He calls Latour the first “secular occasionalist” (2009c, p. 159).

131. It is important to re-emphasise that real and sensual objects are not separate objects but rather different dimensions of the same object.

JPEG object in the literature, there are other ways of approaching digital, even “weird” objects that are productive and creative. My argument is not that Harman is somehow more “true” than other accounts, but merely that his framework of objects connecting with objects allows us to map network objects-meshes like Facebook and digital imag(in)ing and its protocols in ways that raise new questions and open new practices.

Similarly sensual objects cannot connect except through the mediation of a real object. Harman says:

[S]ensual objects consist only in being encountered, not in encountering. If I expend my energy in taking them seriously, they themselves have no such energy to expend; they are purely passive figments for an encounter of my own. Hence they are incapable of direct interaction of any sort, and belong to the same perceptual moment only through the mediation of me the perceiver (2009c, p. 208).

But this mediation extends beyond just the position of the human observer. Real unhuman objects act as the mediator. The datamining algorithm on a Facebook server that reads the metadata or even the faces in a JPEG-encoded image file has a sensual dimension. It is a SO insofar as it is present to human or unhuman consciousness or access. Similarly that data file has a sensual dimension that can be read.¹³² The two connect. We know they do because we see the ads served on our page or the Friends suggested. That connection happens within a RO, an object that has hidden dimensions, a deeper totality that is not available to full access. The Open Graph is more than a Facebook marketing term or even ideology. It is an object with a real dimension. Its reality as governmental actant (as I shall discuss) is deeper and more inaccessible than those dimensions present to my or any other object’s consciousness. It is this RO within which the algorithm (SO) and the image data (SO) connect. The connection is within objects not in some wider field, some psychological, semiotic or capitalist

132. Both actants have a real dimension too. There is always inevitably more to their nature and power than a particular profile, instantiation or access.

plasma, field of potential or relations.¹³³ This asymmetrical account of objects connecting within objects not only keeps the focus on objects and allows the actant-network to be mapped in its specificity and presence but also opens up a space for object-oriented practice, in my case imaging.

I object: relationality

Harman's focus on withdrawn real objects in tension with accessible sensual qualities is, for Steven Shaviro, incompatible with contemporary relational culture.

We live in a world where all manners of cultural expression are digitally transcoded and electronically disseminated, where genetic material is freely recombined, and where matter is becoming open to direct manipulation on the atomic and subatomic scales. Nothing is hidden; there are no more concealed depths [...] Our predominant aesthetic procedures involve sampling, synthesizing, remixing, and cutting-and-pasting. In such a world, the aesthetic problem we face is Whitehead's, rather than Harman's; its (sic) a question of beauty and 'patterned contrasts', rather than one of sublimity and allure (2011, pp. 289-290).

Framed in terms of my own work. JPEG and JPEG imaging are, for Shaviro, examples of a dynamic relational media reality. Mash-Ups, embedding, sharing, linking, tagging and even the colour sampling in software are relational. FlickrSpace, Facebook, the Live Web, Social Media... whatever we call the space we now image and imagine in, is a field of relations between software, hardware, humans and unhumans. Facebook's Open Graph as a computational-governmental space within which JPEG is enfolded cannot be seen through objects withdrawn from each other. Our remix practices and Facebook's Like economy show relations at the heart of media. Our "intense experience" (Whitehead, 1967, p. 263) of it is one of "interwoven patterned contrasts" (*ibid* p. 252). Like an ANT network, it is the interwoven relations that give the specific elements their power. Formalist (or as Shaviro calls it

133. Harman often talks about these connections as happening within the "molten" core of another object (2009c, p. 215). In *The Quadruple Object* he phrases it slightly differently: "*any relation immediately generates a new object*" (2011g, p. 117 emphasis in original). The point is the same. The "digital imaging pipeline", "photography" or "business plan" as objects are the site of connection. The enfoldings, relations and their governmental implications are located at the scale of objects.

“modernist” (2011, p. 289)) abstraction of a JPEG substance, demanding that it withdraws not only from human access but from other actants too is, for Shaviro, to render a static and abstract critique.

As I have said, Harman would have no problems with relations. He goes as far as to assert “the whole purpose of my philosophy is to show how relations happen, despite their apparent impossibility” (2011 i, p. 295). Objects are withdrawn but they also connect - hence his feting of the early Latour. Where he differs is in how that mesh of relations is drawn. For him it is a matter of objects. It is in fact only through addressing the fusion between a withdrawn, weird object like a remix or sample-object, and their accessible surface qualities that we can understand relations.¹³⁴ To re-emphasise, Harman does not reject relations, merely redraws them as matters of substances. As I shall report, such a perspective matches the operations and relational connections of the very objects Shaviro talks of. The advantage of making objects the focus and mapping the governmental implications of JPEG’s relations through objects is that one is driven towards addressing the Open Graph or Haystack¹³⁵ in their specificity. They are never subsumed under some broader field or context and nor are they dependent for their power on their relations. Their governmental power arises from the relations and connections they are enfolded with, but those relations and connections are at the scale of objects - the tensions between the four poles. By seeing them as such one is driven to an account (and a practice) that works with specific objects. The particular objects which the Facebook-mesh encompasses exist and must be the target of our analysis and critical intervention.

I object: processuality

Shaviro’s reading of Whitehead also demands a focus on processuality. He holds that “Becoming is the deepest dimension of Being” (2009, p. 17) and argues that Harman’s focus on actuality leads not only to an analysis devoid of relations but also of change. Without an account of objects as matters of

134. Here he differs from Manuel De Landa who speaks of the exteriority of relations (2006) where relations are exterior to the terms they connect.

135. Facebook’s photo storage system, see the *JPEG: the governmental object* chapter.

process, becoming actualised in particular moments and relations, one is not only left in a static universe, but also unable to deal with a media and cultural, technosocial reality clearly in almost perpetual motion.

This stress is echoed in Massumi's "activist" philosophy (2011). Drawing, as Mackenzie does, on William James' "conjunctive relations" as well as Whitehead and Deleuze,¹³⁶ Massumi's event-oriented ontology is distinctly anti-object (oriented). He says: "Activist philosophy's emphasis on the occurrent makes it a fundamentally *nonobject philosophy*" (*ibid* p. 6 emphasis in original). He cites Deleuze: "[T]he event of alteration [is] one with the essence or the substance of a thing" (Deleuze, 1988, p. 32), claiming "[t]his is another way of saying there is no essence or substance to things other than the novelty of their occurrence" (Massumi, 2011, p. 6). He also enlists Whitehead: "Wherever and whenever something is going on, there is an event" (Whitehead, 1964, p. 78). Massumi concludes:

The world is not an aggregate of objects. To see it that way is to have participated in an abstraction reductive of the complexity of nature as passage (Whitehead, 1964, pp. 74-98) [...] The reality of the world exceeds that of objects, for the simple reason that where objects are, there has also been their becoming. And where becoming has been, there is already more to come. The being of an object is an abstraction from its becoming. The world is not a grab-bag of things. It's an always-in-germ. To perceive the world in an object frame is to neglect the wider range of its germinal reality (*ibid* p. 6).¹³⁷

To frame it in terms of JPEG, the important aspect for Massumi is that it occurs. It is an event. JPEG, the argument goes is proof positive of the importance of process. It *is* a process. Where or what is it and its power if not as something becoming and enabling becoming? In its encoding and decoding; its work turning light into data; its rendering of images (and so

136. It is important to note that not everyone would agree that Deleuze is a "process philosopher". My aim here is not to engage with Massumi's reading of Deleuze but rather consider his implicit critique of OOP.

137. Shaviri too critiques OOP for what he sees as its failure to deal with change: "Harman tends to underestimate the importance of change over the course of time, just as he underestimates the vividness and the extent of relations among entities" (2011, p. 285).

data) within a Timeline, it is in movement. Abstracting a JPEG-object from that flux of becoming, is less a matter of pinning a butterfly to the page so much as a blancmange to the ceiling. Where JPEG is, there has also been its becoming. Any particular JPEG-encoding is an abstraction from its becoming. It is always-in-germ by its very nature as a process, bringing Huffman coding and transforms together in a particular moment to *become* data. If we are going to understand protocol we not only need to see it in a field of relations but as dynamic.

Harman is not denying process or change. For him, “object-oriented ontology (OOO) is the true philosophy of becoming and events” (2011i, p. 300). He goes as far as to say that “Whitehead (like Bruno Latour) should be seen not as a philosopher of *becoming*, but of concrete, individual entities” (*ibid* p. 291 emphasis in original).¹³⁸ For Harman, Whitehead and Latour are object-oriented philosophers insofar as they see objects doing things in the world. The problem comes for Harman in that they do not go far enough. For Latour objects derive their power and presence from their relations or alliances. For Whitehead they are moments of becoming. This is primary, entities are secondary.

For Harman a position derived from Whitehead and even from Latour *alone* cannot account for objects and change. Whereas Shaviro accuses OOP of denying relations and the possibility of change, Harman argues that an account of objects as constituted by their relations actually prevents an account of change. If there is nothing beyond relations, there is no “surplus”.

138. Harman reads Whitehead’s “occasions” as a way of understanding the object, not rejecting the idea of entity. Where they differ, he says, is that Whitehead sees those entities as clusters of relations whereas Harman works toward a non-relational model of objects. He says: “The reason they can be called ‘occasions’ is because ‘the notion of an unchanging subject of change is completely abandoned’. An entity is not a durable substance undergoing accidental adventures in time and space: instead, ‘actual entities “perpetually perish”’. They do not lie behind their accidents, qualities, and relations like dormant substrata, but are ‘devoid of all indetermination’ (Whitehead, 1978, p. 29). Actual entities are fully deployed in every instant and then instantly perish, attaining ‘objective immortality’ not by persisting over time (impossible for Whitehead) but by giving way to closely related yet new actual entities. In *Prince of Networks* I showed that the same holds for Latour” (2011i, p. 294 emphasis in original). Clearly this is a particular reading of Whitehead, one that Shaviro and many others would disagree with. My aim here is not to discuss the validity of that reading, but rather use it as a way of clarifying Harman’s own position with respect to objects and change.

“Every object would be exhausted by its current dealings with all other things” (*ibid* p. 295). But objects do have more. There are dimensions that are hidden, withdrawn. Where Latour and Whitehead may argue that change is possible as objects become and perish (Whitehead) or enter new alliances (Latour), this demands that change is a series of discrete steps - new occasions or new configurations. For Harman this moves away from a strict actualist focus on the object to either advocating a second realm of objects - the “eternal objects” of Whitehead (1978, p. 61)) or a realm of potentiality beneath objects (the “plasma” of Latour (2005, p. 244). Harman refuses to imag(in)e anything beyond the actual object. For him an object, if conceived as deeper than its relations, can account for change and networks without recourse to something else.

Again, it is not that Harman rejects “becoming”. Rather, he says:

I contend that becoming happens only by way of some non-relational reality. An object needs to form a new connection in order to change, and this entails that an object must disengage from its current state and somehow make contact with something with which it was not previously in direct contact. My entire philosophical position, in fact, is designed to explain how such happenings are possible (2011i, p. 300).

Again in terms of JPEG, the process is a matter of objects connecting, disconnecting and reconnecting as the pipeline works or as the upload and datamining within Facebook operate. Harman rejects Shaviro’s charge that OOP implies stasis when it rejects Whitehead’s “perpetual perishing” of entities. Rather he argues that a Whiteheadian account is one of stasis. In Harman’s reading, Whitehead’s stream of new entities is not a philosophy of change but of “frozen statues, which give the illusion of continuous alteration as we flip through them as if through those novelty card decks that allow children to watch moving cartoons” (*op cit.*). Change, process, becoming are not a matter of new objects or new networks but rather new object-connections-within-objects. Where Whitehead sees becoming as a series of discrete instants and Latour as a series of discrete alliances - both

alliances *outside the actuality of objects*, Harman argues that potentiality is only possible when the object and the object alone are the focus.

Clearly JPEG compression is a computational process but that can be understood as a matter of quadruple objects connecting within objects. New connections between particular profiles within particular imaging objects. The advantage of this view is once again that we remain focused on the particular and are forced to address the specificity of JPEG now, now and now - in that upload, in that failed "Like", in that particular data point. One is left at the scale of particular encounters and connections. One cannot escape that particularity by reference to a flux of becoming. Similarly Harman does not deny change. Change for him is a matter of new tensions (see above). When he says: "In order for something to change in the *status quo*, the bond between object and quality must be dissolved and a new one produced" (2011g, p. 102 emphasis in original) he draws attention to how change occurs *as a matter of objects* and their fusion and fission. This is not new objects being produced (as he reads Whitehead) but new object dynamics, the power of the "surplus" that the quadruple structure draws attention to. Such an account once again has the advantage of forcing an account of the particularity of objects in particular situations, configurations and connections. Change as a dimension of the Open Graph (object) is matter of particular object connections. JPEG changes as its sensual and real dimensions connect and reconnect with those of other specific different hardware and software, human and unhuman actant-objects, mediated by other objects in particular moments and spaces. The governmental mesh enfolds specific and particular Open Graph objects as they are made and remade in different object relations. Again we cannot escape particularity and specificity when mapping governmentality.

I object: potentiality

Levi Bryant, a strong advocate of objects as the starting point for philosophy has questioned Harman's rejection of potential, his insistence that objects hold nothing back. He says:

[I]t would be a mistake to conflate [...] potentiality with the concept of a *potential object*. A potential object is an object

that does not exist but which could come to exist. By contrast, the virtual is strictly a part of a real and existing object. The virtual consists of the volcanic powers coiled within an object. It is that substantiality, that structure and those singularities that endure as the object undergoes qualitative transformations at the level of local manifestations (2011a, p. 95 emphasis in original).

Objects do not somehow already contain what they will become but they do contain powers that can be actualised. He frames this in terms of a split¹³⁹ within objects which is very different to that of Harman, one that relies on a Deleuzian account of the “virtual”¹⁴⁰. Bryant’s split is between “their powers or capacities and their actuality [...] objects always have the power to manifest other actualities that aren’t manifested at the moment when entering into different (sic) circumstances” (Bryant, 2010, n.p.). It is here where Bryant diverges from and critiques Harman. For Bryant the idea that objects harbour potential to be actualised, rather than being already actual, is necessary to OOP (or “object-oriented ontology” as Bryant calls it) because it allows an object-oriented account of relations and of change. Actuality is not a given (as Bryant believes that Harman holds) but rather a product of relations. Bryant says: “the process of actualization requires the navigation and translation of exo-relations to other objects, creating a new product as a result. In short, the actuality is not there at the outset but

139. Bryant explicitly connects this idea of the split to Lacanian thought (2011, p. 131).

140. Bryant is more comfortable with Deleuze than Harman, arguing “[n]o one has explored this anterior side of substance - in the transcendental, not the temporal, sense - more profoundly than Gilles Deleuze” (2011a, p. 94). Harman, meanwhile argues that objects prior to their relations are not “virtual”. Rather they have a definite character prior to entering relations. That character can be described as a matter of objects and qualities. He says: “The much-discussed difference between potential and virtual, so often wielded like a billy club in our time by Deleuzian hooligans, is irrelevant here - both terms fail Latour’s standard of concreteness in exactly the same way” (2009c, p. 101). It is not my concern here to engage with their respective readings of Deleuze and debates around the potential and the virtual (Bryant, 2011a, pp. 94-104; 2011b; Harman, 2010f) but rather to address Bryant’s argument that the rejection of potential undermines Harman’s account of the actual. Bryant is not uncritical of Deleuze. He says: “What we thus get in Deleuze’s thought is a sort of vertical ontology of the depths. Rather than entities or substances interacting with each other laterally or horizontally, we instead get an ontology where difference arises vertically from the depths of the virtual” (2011a, p. 100). As with all object-oriented approaches, any tendency towards depth, foundations or context is a move away from objects.

requires a whole series of mediations to come to be" (*op cit.*).¹⁴¹ Agreeing with Harman that objects are actual, real and specific, he argues however that this actuality appears as relations unfold and those relations unfold because objects have powers "coiled within", a virtual dimension which "always belongs to a substance, not the reverse. Moreover, the virtual is always the potential harbored or carried by a discrete or individual being" (2011a, p. 105). This is an object-oriented potential. The potentiality is not outside or somehow contextual but built into the heart of objects, allowing new relations and so change. Harman's refusal to entertain potential, Bryant argues, can't account for change (*ibid* p. 68). Here he is not joining the Whitehead-derived perspective presented above where change is a matter of "becoming" or fluxion. Rather for Bryant change *is* a matter of objects. It can be addressed at the scale of objects but only if those objects carry within themselves a potentiality.¹⁴² This is not the fabled acorn containing the oak tree. Bryant says:

[T]here is no *resemblance* between a power, potentiality, or potency, and the actuality that it comes to actualize. Potentiality, power, potency is pure *capacity*, pure "can-do", pure ability. As such, it tells us nothing of the form that the actualized power will take when it becomes a quality or what I call a local manifestation (2011, n.p. emphasis in original).

Harman however, says he is an "unapologetic 'actualist'" (2011b, n.p.).¹⁴³ "Entities are nothing more than what they are right now" (2011e, n.p.). He reads any attempt to introduce a virtual dimension, a "coiled within"

141. Bryant separates "endo-relations" from "exo-relations" (2011, p. 68) as he does "endo-qualities" and "exo-qualities" (2011a, p. 120). The former are to do with the internal structure of objects, the latter refer to relations that objects enter into with other objects or qualities that exist in and through other objects.

142. Bryant also uses the terms "susceptibility" to translation using Latour's idea of the network relations that objects undergo (2011a, pp. 115-116)

143. He would perhaps appreciate Morton's feting of John Clare's "absolute 'therenes'" in his poem *Mouse's Nest* (Morton, 2010a, p. 50) but perhaps not Gertrude Stein's comment about Oakland: "there's no there there" (1971, p. 239).

potentiality as a retreat from the scale of objects.¹⁴⁴ For him, “[t]he recourse to potentiality is a dodge that leaves actuality undetermined and finally uninteresting; it reduces what is currently actual to the transient costume of an emergent process across time, and makes the real work happen outside actuality itself” (2009c, p. 129). For Harman nothing must replace the actual and the concrete. There are no “hidden overlords: whether they be potential, virtual, veiled, topological, fluxional, or any adjective that tries to escape from what is actually here right now” (*op cit.*).

Bryant’s object-oriented potentiality offers a lot to our understanding of JPEG. Bryant would argue that by seeing protocol as fully real and specific but also carrying potentiality coiled within enables us to see clearly how a standard achieves a form of “lock-in” (Liebowitz & Margolis, 1995; Arthur, 1989). JPEG’s hegemony within distributed imaging can be seen as a result of a potential to connect, to relate, to set new practices, business and technologies in motion. Acting almost as an API,¹⁴⁵ JPEG’s coiled potential as a governmental and imag(in)ing actant within its specific substance was actualised as Facebook and browsers and apps developed on and with it. That governmental potential was always there, but not as the fabled oak tree within the acorn, as fixed, determined thing.

144. This goes to a broader Bryant-Harman argument around how objects touch. For Bryant objects can and do touch and that is how they “unleash the forces of another object” (2011a, p. 71). The acorn’s coiled, potential to become an oak tree, a missile, food or an artwork are unleashed as it touches the soil, a child’s catapult, a squirrel or a canvas. JPEG’s coiled, potential to become an imaging standard, a data-mining tool or a social convention are unleashed as it touches in-camera software, a Facebook algorithm or an Instagram API. Harman is not against connection, let alone power-relations. What he says however is that objects cannot touch. Because they have a “real” dimension that withdraws from all access, they cannot touch except within objects, through a mediating object (RO with RO through a SO; SO and SO though RO). The acorn and the catapult connect in a weapon object. JPEG and the software within a Open Graph object. Each connection is different, actual, specific and now. For Harman, if objects could touch there would be no need for mediating objects or what Latour calls “translation”. For Harman this is philosophically difficult, not taking Heidegger seriously enough. In terms of my project, it is difficult because it fails to adequately account for mediating objects such as the Open Graph.

145. Application Programming Interface. A specification released by a service that enables other developers to build software services or products on top of the platform. Daniel Jacobson, Greg & Dan Woods describe it as “essentially a contract. Once such a contract is in place, developers are enticed to use the API because they know they can rely on it. The contract increases confidence, which increases use” (2011, p. 4). A form of lock-in.

Harman's framework however still allows for a mapping of that lock-in and governmental mesh but arguably demands that we address JPEG as it exists and works here right now (and here right now, and here right now).¹⁴⁶ The connection between JPEG and the Open Graph is not a once-and-for-all thing. It is continually remade as new tensions are fused and broken, new objects (Likes, Open Graph connections, new software services on top of an API, new state searches etc.) become the site of those connections. Harman's perspective not only forces that particularity but also draws attention to those new objects.

As well as critiques specifically around relationality, processuality and potentiality, there are two other points that OOP could be asked to address. Firstly the charge of formalism and secondly the question of whether it is material enough.

I object: formalism

Victor Burgin identifies two "pitfalls awaiting the art theorist with no grasp of semiology, 'the temptation to treat the work of art as a purely formal construction' [... and a] focus [...] on the internal life of the autonomous object" (1986, p. 1). Burgin picks up on a powerful tradition of anti-formalism within media and cultural studies that arguably has a new relevance when object-oriented approaches demand that everything starts from (and in Harman's case perhaps) finishes with objects.

Raymond Williams was clear. For him formalism's "predominant emphasis was on the specific, intrinsic characteristics of a literary work, which required analysis 'in its own terms' before any other kind of discussion, and especially social or ideological analysis, was relevant or even

146. Harman would of course say that "exists" and "works" are two different things, objects exist regardless of whether or how they work, I include both here because my concern in this work is with the relations (work) of JPEG which arises from its ontological existence.

possible" (1976, p. 138).¹⁴⁷ Had OOP been around in the early days of media and cultural studies¹⁴⁸ it would doubtless have faced charges of formalist fetishization of the object. How, therefore does OOP stand against the charge of formalism? Firstly one must show that OOP is formalist and then that formalism is, in itself a bad thing.

OOP demands that the object is the core focus of analysis and interpretation. Particularly in Harman's case, there is never any need to leave the object and look to a wider field, plasma, process or realm of becoming. The famous Latour litanies with which OOP is littered are testament to the belief that we can do philosophy and media analysis by concentrating on objects. Formalist approaches to literary texts began with a similar focus on objects, rather than the later preoccupation with systems. "The Formalists started out by seeing the literary work as a more or less arbitrary assemblage of 'devices', and only later came to see these devices as interrelated elements or 'functions' within a total textual system" (Eagleton, 1996, p. 3). These devices, discrete, particular formal components were the target of analysis because it was such elements (sound, imagery, rhythm, syntax, metre, rhyme, narrative techniques etc.) that did the work, turning ordinary language into literary language with all its effects.¹⁴⁹ "[L]iterariness' was a function of the *differential* relations between one sort of discourse and another; it was not an eternally given property" (Eagleton, 1996, p. 5 emphasis in original). It was this argument that powered the development of structuralism's focus on systems where, by looking at how the system was put together, one could address its workings and power relations.

147. Williams famously critiqued Marshall McLuhan along these lines. In *Television: Technology and Cultural Form*, he said: "The work of McLuhan was a particular culmination of an aesthetic theory which became, negatively, a social theory: a development and elaboration of formalism which can be seen in many fields, from literary criticism and linguistics to psychology and anthropology, but which acquired its most significant popular influence in an isolating theory of 'the media'" (2003, p. 129). Of course Harman would be happy to be associated with McLuhanism. He says: "[N]o one in the twentieth century, not even Heidegger, does as much as the McLuhans to retrieve the metaphysics of objects as a viable medium" (2009a, p. 122),

148. Let's leave aside Harman's claims that OOP can be traced back throughout the history of Western and Eastern philosophy.

149. For an account of narrative in new media see Murray (1998) and Bassett (2008).

There are clear parallels with OOP. The focus on “devices” and specific components mirrors OOP’s single-minded commitment to objects. Here ecosystems, computer games, indeed the whole universe is made up of objects connecting between or within objects. What we perceive as systems, meshes or assemblages are really just components clashing, connecting or relating. Just as language is not an eternal given property neither is the mesh, or, in my case the governmental scopic regime. In both frameworks the gap between objects is important. For Harman it is the sensual-real difference and the way the fourfold allows differential connection (what he calls “vicarious causation” (2009b; 2009c, pp. 146-147)) that characterises the mesh of objects. Sensual can only connect with real, real only with sensual. Objects withdraw from us and from each other.¹⁵⁰ That is what drives the mesh, creates new objects and new relations. It is the making strange of language in literature, the gap between everyday discourse and that of the novel, the withdrawal that creates art and culture. And by focussing on the technical devices, one can see that, unpick it, critique it and create it.

My OOP account of imaging and of JPEG can be seen as formalist. I look to understand the whole through the parts. Social imaging, the new scopic regime, the scopic mesh - however it is defined as a discourse - is different to “traditional” imaging, “top-down” media regimes because it uses different devices/objects. Hardware and software actants, protocols and algorithms have turned seeing into social seeing, photography into imaging. My OOP account looks to identify those objects and when I have found one of them (JPEG) I make the same formalist move. JPEG is different than WebP or GIF. Its position as an imaging form or practice, a “literature”, arises from its formal structure. The Huffman tables, the DCT transforms are devices it uses to do its particular creative and productive work.

My desire to understand my own imaging and that scopic and governmental regime within which it now works leads me to bracket the

150. This parallel is perhaps unsurprising bearing in mind Husserl’s influence on the Russian Formalists (Eagleton, 1996, p. 51).

referent¹⁵¹ and concentrate on the device-objects. My imaging and that of the Open Graph, like a poem is a matter of objects connecting, like metre and rhyme forms arranged in a particular way. And what is more, arguably, my OOP account of JPEG becomes even more structuralist. It's not that I ignore the wider system. I am looking to understand and perhaps even critique the Open Graph, the infinite archive, governmentality and techno-capitalism. I am looking through JPEG to those structures but from an OOP perspective I see them not as a context, a background or even a media ecology or actant-network within which objects fit or on which they play out their powers. Rather that structure is nothing more nor less than objects connecting within objects. The structure is objects. Like Claude Lévi Strauss approaching his tribe (1994) or Michel Foucault reading his "certain Chinese encyclopaedia" (1989, p. xv), I see an order of objects.

The critiques of formalism and structuralism are legion. It is not my concern here to engage in a defence of formalism or structuralism. From Mikhail Bakhtin onwards this focus on objects has been seen as technicist, reductionist, determinist and apolitical. Surely to collapse the complexities, political-economic and technosocial relations of advanced capitalist culture into a matter of protocols or even an assemblage of objects is to lose a macro focus, a sense of process and relationality that make sense of how *and why* that mesh works the way it does, and how it can be changed. My aim here is not to rehearse those debates but to reframe the question. To what extent does an object-focus (whether or not we call it formalist or structuralist) allow a coherent and critical account of the techno-social mesh, info-capitalism and scopic governmentally? Does a refusal to leave the scale of the object impoverish that critique or does it allow a new way of seeing complex realities and intervening in their power relations? My way of answering these questions, as I discuss in the next chapter, is through my practice.

151. I would of course say that while I dismiss the idea of a "referent" external to the object, I hold to the fact that those objects have real dimensions and qualities.

I object materialism

While I find an OOP account of JPEG a persuasive and stimulating one in terms of its capacity to remain actual, specific and particular while still mapping the complex computational and governmental networks within which JPEG operates, it is possible to see OOP as having a mystical dimension that undermines a materialist critique. It is important to re-emphasise that when I say “materialist” I am not referring to the undermining philosophy that Harman criticises, one that looks for something more basic and fundamental than objects, but rather a sensibility within an ontology to the world of material things.¹⁵² My project and the distributed imag(in)ing regime and mesh that it seeks to explore is deeply material. From the digital rubbish that Jennifer Gabrys (2011) and Ned Rossiter (2009; 2011) discuss, through the carbon footprint of cloud computing (Cubitt, Hassan & Volkmer, 2011) to the digital detritus stockpiled, as we shall see, in Facebook’s Haystack, there is nothing immaterial about the digital mesh.¹⁵³ While OOP provides a provocative way of mapping the nature of the objects in play, the way they are accessible and inaccessible and the ways they connect, it arguably underplays a very real materiality at play in both the sensual dimension we encounter and the real dimension forever withdrawn.

Jane Bennett has sought to rebalance an object-oriented approach in her exploration of *Vibrant Matter* (2010a) as part of what has become known as

152. Bryant refers to his own work as “object-oriented materialism”, saying: “The materialist need only claim that all entities are materially *embodied*, not that all entities are reducible to *elementary parts*” (2012c emphasis in original) See also n. 107 above. His debate with Harman is less to do with rebalancing OOP/OOO to focus on material objects than it is to do with their broader debate about potentiality (see above). As I shall discuss, Jane Bennett is aware of the issues around “materialism” and undermining that Harman identifies. When questioned on her relation to other forms of materialism in her interview with Gulshan Kahn she says: “Mechanistic materialism does not attract me; it implicitly returns us to the status of consummate agents who run the machine” (Khan, 2009, n.p.)

153. This of course does not even touch on the materiality of scopic and computational apparatuses discussed by Crary, Jay and those working in media archaeology (see above). For discussion of materiality and the digital image, see Sassoon (2004) and on materiality and technology, see Küchler (2008). I come on to discuss the seemingly immaterial software objects as in some sense “material” below.

“New Materialism”.¹⁵⁴ Bennett identifies an agentic capacity in material objects. When she starts from “one large men’s black plastic work glove; one dense mat of oak pollen; one unblemished dead rat; one white plastic bottle cap; one smooth stick of wood” in a gutter (2010a, p. 4) and moves on to the “quirky electron flow and a spontaneous fire to members of Congress who have a neoliberal faith in market self-regulation” at play in an electricity blackout (*ibid* p. 28),¹⁵⁵ Bennett’s litany of objects echoes Harman: “Instead of an objective nature filled with genuine realities and a subjective cultural sphere filled with fabricated fictions, there is a single plane of actors that encompasses neutrinos, stars, palm trees, rivers, cats, armies, nations, superheroes, unicorns, and square circles” (2009c, pp. 188-189).¹⁵⁶ For

154. A loose collection of authors who share a concern for expanding the conception of the material to explore issues of agency (see the papers collected in Coole & Frost (2010b) and Miller (2005a) as well as Parikka (2011b). For an overview, see Packer & Wiley (2012) and for a feminist perspective, see Van der Tuin & Dolphijn (2010). Diana Coole and Samantha Frost even make a point of talking of new materialisms in the plural (2010a). See also the work of Karen Barad who says: “Language matters. Discourse matters. Culture matters. There is an important sense in which the only thing that doesn’t seem to matter anymore is matter”. (2007, p. 132). For a Latourian approach to materialism, see Bencherki (2012). For one drawing, as does Harman, on Alfonso Lingis, see Introna (2009). It is not my intention to explore the different ontological positions, let alone the specific case studies, that have emerged under the label “new materialist” but rather to explore the connections between a particular politics-based articulation of that concern. It is important to note that as with speculative realism, there is a concern among its proponents that “new materialism” does not simply substitute one orthodoxy or hierarchy with another. As Daniel Miller says: “Having dethroned the emperor’s culture, society, and representation, there is no virtue in enthroning objects and materialism in their place. The goal of this revolution is to promote equality, a dialectical republic in which persons and things exist in mutual self-construction and respect for their mutual origin and mutual dependency” (2005b, p. 34). This concern for moving beyond representation can also be seen in the work of Nigel Thrift (2008), Brian Massumi (2002) and Rosi Braidotti (2002) among others. There are of course other strands to “new materialism” particularly as it applies to media. Parikka (2012) for instance traces the links to “German Media Theory” (See also Siegert (2007)). My decision to focus on Bennett is because of her ontological project to redraw our conception of the object as material. While many have taken a materialist look at media, there are few who have take a materialist and object-oriented approach to ontology.

155. Needless to say, some would query whether one can address “electron flow” and “neoliberal faith” as objects. As I have argued, following Bogost and Harman, one can. Furthermore the question should perhaps be not whether we can but what happens when we do.

156. Miller is also fond of the Latour Litany: “We start with the need for a theory of stuff as material culture [...] that can account for every kind of stuff: bodies, streaming videos, a dream, a city, a sensation, a derivative, an ideology, a landscape, a decay, a philosophy” (2010, p. 54). More broadly on approaches to “material culture”, see Hicks & Beaudry (2010)

both, objects are the focus. Like Harman she rejects the idea of objects as signs and demands an account of objects as more than the human object correlation. But Bennett adds a particular concern for the material that is underplayed in Harman's more philosophical account.

Bennett echoes Daniel Miller's argument that semiotics can be "as much a limitation as an asset" (Miller, 2010, p. 12) when looking at "the minutiae of the intimate" (*ibid* p. 41), the "stuff" or things people have, use and (in object-oriented terms) connect with (Miller, 2008).¹⁵⁷ The objects in her gutter are not some instantiation of an industrial process or structure. Of course the glove was made in particular social and economic system under particular modes of production. Its story can be read as one of globalisation and capitalism. It can be read as the trace or representation of those historical processes. But Bennett argues that the discourse of representation, of tracing the power and meaning of things as signs, falls short of what is needed. She says:

I caught a glimpse of an energetic vitality inside each of these things, things that I generally conceived as inert. In this mesh, *objects* appeared as *things*, that is as vivid entities not entirely reducible to the context in which (human) subjects set them, never entirely exhausted by their semiotics (Bennett, 2010a, p. 5 emphasis in original).

Just as for Harman, objects are never exhausted by their relations, qualities or accidents, so Bennett's objets trouvés are more than their relations to systems of meaning or signs of something outside themselves.

For Bennett, like Harman, there is also more to objects than the human-object correlation. Objects are material. But that materiality is lively and

157. A similar nuanced account of things can be seen in Sherry Turkle's account of "evocative objects" (2007) discussed by Harman (2008b). A concern for things could also be traced back through Arjun Appadurai's exploration of how things "move in and out of the commodity state" (1986, p. 13) and Pierre Bourdieu's account of the role of everyday things in socialization (2008). Similarly Alfred Gell sought to move beyond semiotics in account of how artworks "appear as, or 'do duty as', persons" (1998, p. 9).

active.¹⁵⁸ Bennett's objects are real and located. They are presences in the world but they "call to us" and have a form of agency, "agentic capacity",¹⁵⁹ a "thing-power" that animates the seemingly inert. Bennett draws on a history of vitalism (Fraser, Kember & Lury, 2005; Greco, 2005) in particular the work of Hans Driesch, a early twentieth century vitalist.¹⁶⁰ Driesch developed the concept of "entelechy" as a similar animator to explain what he saw as the question of the enfolded character of nature.¹⁶¹ Bennett says: "Entelechy is born in the negative spaces of the machine model of nature, in the 'gaps' in the 'chain of strictly physico-chemical or mechanical events'" (2010a, p. 70). She is keen to stress that Driesch does not see this animating force in terms of a soul or even simply a "vital energy". Rather it is located within materiality and its possibilities. Where Bennett moves beyond Driesch is in refusing to see matter as "so passive and dull that it could not possibly have done the tricky work of organizing and maintaining morphing wholes. [For Driesch] sometimes this matter is infused with entelechy and becomes life, and sometimes it is not and coagulates into inorganic

158. Shaviro draws attention to a similar idea of liveliness in his discussion of Gwyneth Jones' novel *The Universe of Things* (2010). He says: "[I]f we are to accept the ontological dignity of things, and do not reduce them to being just the illusory effects of quantum fields, then I think that we need to accept some sort of non-dualistic neo-vitalism, or what Jane Bennett calls *vital materialism*: the idea that 'every thing is entelechial, life-ly, vitalistic' (Bennett, 2010a, p. 89)" (2010, p. 15 emphasis in original).

159. See also the work of Barad around materialism (2003) and "agential realism" (2007).

160. Bennett discusses Driesch and later Henri Bergson in terms of Kant's insistence on the "unbridgeable chasm between life and 'crude matter'" in the *Critique of Judgement* (Kant, 1987, sec. 81, #424) and his invoking of a "formative drive" or *Bildungstrieb* (2010a, p. 65). She argues that Driesch and Bergson extend this idea by allowing the agentic force to be present in matter not just in organisms. This point is echoed by Morton who argues that we should "abandon all variation of Romantic vitalism - that is, believing in a vital spark separate from the material organization of life forms" (2010a, p. 68).

161. Driesch, whose work began with scientific experimentation, can perhaps be seen as engaging in practice-research.

machine" (*ibid* p. 75). For Bennett, matter is always "vital"¹⁶² and that vitality lies outside the human-object correlate.

One might criticise Bennett for mystical language (a similar charge could be addressed towards Harman's talk of sensual and withdrawn dimensions). Peter Gratton has said: "Bennett's position would seem to leave us bereft of any politics worthy of the name, and the reader may worry Bennett has brought us either to the edge of some pan-psychic New Age philosophy, or worse, to a nihilism that renders meaningless all human actions and common praxis" (2010b, p. 159).¹⁶³ But beneath Bennett's language is exactly the sort of reality and material concern that a purely philosophical account lacks. While both Harman and Bennett would talk of trees, gloves, servers, CCDs and JPEG, Bennett is more likely to argue that we need to take particular account of their concrete as well as ontological existence. Bennett's stress on how the quadruple object erupts into the world, how its sensual and real dimensions and qualities connect in material as well as ontological terms, challenges us to look at the CCD object as metaphysically fourfold but also material. What is more, Bennett's willingness to see vibrant materiality across the object spectrum means we can address objects like JPEG which, as we have seen, while seemingly abstract, virtual and unreal, are clearly actants and objects in material conditions of connection with software, the State, my camera and me as photographer. Harman is clearly a realist, Bennett adds a form of object-oriented materialism to that account of the real.

Harman, while embracing the commonalities between his position and Bennett's remains suspicious of "materialism". He says:

Bennett uses materialism in a way that could easily apply both to object-oriented philosophy and to the closely related writings of Latour. She takes materialism to be a suitable

162. Bennett also draws on Henri Bergson's "élan vital", a force, an "inner directing principle" (Bergson, 1998, p. 76) that underlies his idea of how life and matter are not fixed categories but tendencies of a cosmic flow. There is perhaps an interesting parallel with the idea of active and reactive forces discussed by Deleuze in his book on Nietzsche (1986, pp. 39-71).

163. For a broader discussion of pansychism see Skrbina (2005).

name for any philosophy that dissolves the usual strict opposition between free human subjects and inert material slabs. Naturally, I am all in favor of this dissolution; I simply doubt that 'materialism' is the best name for it (2010g, p. 774).

In his review of *Vibrant Matter*, Harman positions Bennett as remaining too close to Deleuze and what he sees as the latter's tendency to collapse objects into a "field". He reads her objects as "a pluriverse not of many things, but of 'one matter-energy' that is 'traversed by heterogeneities'" (2011d, p. 130).¹⁶⁴ I would argue however that Bennett's deliberate focus on specific objects (in her gutter) that, while all displaying matter energy, have very particular and specific positions, relations and strifes does not stray away from a concern with the object to that of an abstract field. Rather just as Harman's critical reworking of relationality, processuality and potentiality has demanded a focus on the particular, so Bennett's demand that we take account of material and the materiality of (quadruple) objects rebalances OOP as a philosophy and (as I discuss in the next chapter, a practice) of real material things.

164. In her turn, Bennett argues that Harman too readily associates "lump ontology" with Deleuze (Gratton, 2010a). As I discuss, others within object-oriented philosophy, notably Bryant, are, like Bennett, willing to read Deleuze as concerned with objects that are not exhausted by their relations, as a philosopher of objects not just fields. Bryant who unpicks what he sees as Deleuze's "schizophrenia: between monism and pluralism" (2011a, pp. 94-104), even goes as far as to list Deleuze as one of the "heroes of ontology" alongside Harman (2011a, p. 27). Bryant argues that "Deleuze's concept of the virtual provides us with the means of thinking substance as structured without being qualitative" (2011a, p. 31). For Deleuze as for Harman, substance is a proper subject for philosophy and, what is more, again like Harman, there is more to an object than its qualities.

For Harman however - as in his debate with Bryant - this is not enough. One needs to reject potentiality in order to remain at the scale of the object. He says: "Contra Deleuze we must champion individual, actual things as the protagonists of philosophy" (2011i, p. 292).

Interlude: William Eggleston

Bill at one time said to his great, highly-respected friend: 'Well what am I gonna photograph? Everything around here is so ugly.' And our friend said: 'photograph the ugly stuff' Rosa Eggleston (Wife) in Holzeimer (2008).

I've seen him stare for hours at a china set. And not a particularly valuable china set Andra Eggleston (daughter) in (*op cit.*).

In 1976 New York Times critic Hilton Kramer and MoMA curator John Szarkowski famously agreed that William Eggleston's style was "perfect". For the curator, Eggleston's saturated colour was a "snapshot aesthetic" taken to an extreme, perfectly attuned to a saturated imagespace and postmodern sensibility. To the critic, the images were indeed perfect: "[P]erfectly banal, perhaps. Perfectly boring, certainly" (Kramer, 1976). The important point about their reading of the show was that point of agreement, "perfectly banal". Eggleston embraces the banal by working with and through objects. His modestly entitled *Guide* (2002) is no catalogue to the exhibition, monograph of an oeuvre or photobook. More like a child's *I Spy* book or a throwaway pamphlet sold with an admission ticket, the *Guide* makes no pretence to be anything other than a tour of objects in Eggleston's South.

An unfinished jigsaw in *Tallahatchie County, Mississippi*; a creek in *Sumner, Mississippi, Cassidy Bayou in background*; a shower or a child's tricycle in *Memphis* - objects on Eggleston's tour. The bus stops, and on your left...

The objects' banality is not a value judgement so much as an ontological statement and a methodological or creative move. The *Guide* is not random. Eggleston selects the objects carefully, but without prejudice. The *Guide* is democratic¹⁶⁵ but never fully comprehensive. The objects admitted, drawn to the attention of the scopic tourist share an ontological banality but presence. Real but really withdrawn; sensual but never fully accessible.

165. The loaded terms keeps cropping up in the work of Eggleston. One of his collections was called *The Democratic Forest*, (1989) another (and the title of his retrospective at the Whitney Museum in 2008-9 was *The Democratic Camera* (Sussman, 2008).

Eggleston famously refuses discourses of interpretation or to answer questions. When someone says “you often photograph food. What does food say to you?” he replies: “Food does exist sort of like cars exist” (Kirby, 1996b). His is the photography of “if you meet the Buddha on the road, kill him”. If he refuses or is unable to find the depth within his work, so are his objects. The green shower tiles and nozzles in *Memphis* may evoke Psycho or Auschwitz but they are not *about* Hitchcock, the gaze, evil. They are tiles... in a bathroom... in Memphis. They get wet. The flashlight reflects off them. As dye, ink or pixel traces in an image they may re-present but that is not their totality. They may connect with memory-objects, undergraduate Film Studies essay-objects or MoMA brand objects but those connections forged in the molten core of objects cannot exhaust the tiles or the image of the tiles. Eggleston’s grumpiness is an ontological statement - needless to say, were I to present that thesis to him, he would quite rightly dismiss it.

When one sees Eggleston work (admittedly in the presence of another scopic apparatus) (Holzeimer, 2008), it is suffused with the everyday. Here there are no decisive moments snatched from the flow of time, no stalking and waiting nor even flânerie and chance encounters. Eggleston gets out of his car, stops, raises his camera before another object, clicks and walks quietly on. It is not just his age that means he moves and images slowly, elegantly, undramatically. When he says to the filmmaker “Grab any masterpieces yet?” before bending slightly to imag(in)e under a truck, it is another sly Eggleston dig. There are no masterpieces distinct from the banal. There are no decisive moments or perfect compositions to be captured or created. There is just this... and this... and this.

His refusal to title or date his images is more than just a Zen refusal of labels - fingers pointing at the moon. It is a sensibility towards the “this”, a willingness towards objects, a positive statement about their withdrawal yet very real accessibility as sensual presences, understood in terms of objects not fields of relations or time. When he rounds a corner and something catches his eye he does not dance around looking for the perfect position to take the image or shoot different frames or compositions. He raises his camera and... He says:

I do have a personal discipline. I've only taken one picture of one thing. Not two. I would take more than one and get so confused later when I was trying to figure out which was the best frame, I said: 'this is ridiculous, I'm just gonna take one that's gonna be...' (Holzeimer, 2008).

Photographer Martin Parr says Eggleston's vision is "about photographing democratically and photographing nothing and making it interesting" (Cocker & Holzeimer, 2009). I would agree with the first part but argue with the second. Eggleston is not in the business of making nothing interesting. For him there is no "nothing" only "something(s)" and they are already interesting.

The JPEG object in practice

Object-oriented photography (OOPh)

The practice upon which I built this practice research is object-oriented. My work seeks to use photography and writing as a way of exploring objects.¹⁶⁶ My object-oriented photography (OOPh), as I call it,¹⁶⁷ is informed by the work of Harman and Bennett. Firstly, it works with and within a flat ontology of objects. The objects I photograph, the apparatuses I use to photograph them, the spaces within which I publish them are all objects. Secondly, that ontology seeks to escape correlationism.¹⁶⁸ I am an object in my imaging mesh but not a privileged one. The litany of objects in play connect, reconnect, exist and work outside of a human-world relation. Thirdly I look to my images and imaginings as more than signs. Of course they have semiotic dimensions but the images and the imaging practices exist and do work outside of signification, at a technical or machinic scale. They cannot be reduced to signification. Finally I look to engage and work

166. This report focuses on my photographic practice but I have also explored what Kenneth Goldsmith has called “uncreative writing” (2011) including Tweeting and Facebook posting James Joyce’s *Finnegan’s Wake* backwards, 140 characters at a time allowing it to interweave or entangle with other status and link objects. A second project involved feeding algorithmically generated advertising copy as status-objects back into Facebook’s Wall and so the Open Graph where it would form the source material for new algorithmically generated ad-objects.

167. I make no claim for the originality of OOPh. Bogost has argued that Gary Winogrand can be read as object-oriented: “Garry Winogrand made photographs of the things themselves. Lots of them [...] His works are not commentaries, they are precisely the opposite. Garry Winogrand makes photographs not to capture what he sees, but to see what he will have captured. That’s what it means to take photographs to see what the world looks like in photographs [...] It’s too hard for most viewers to take Winogrand’s project seriously, because they’re too busy looking for social commentary in his photographs to see them for what they are: pictures that help their viewers see things in pictures. The object-oriented ontology project is just as simple, yet still just as hard: to see things in pictures and everywhere else too. To see the world of things as things in a world, rather than our world, with things in it” (2011, n.p.). My photo interludes in this work are a similar project.

168. In a sense photography is inevitably correlationist insofar it involves human access (unless we are talking of computer imaging). The key thing OOPh seeks to bring to that issue is not to refuse the human but refuse the human *Subject*. In OOPh as in OOP, the human is just another object.

with the vibrant materiality of the objects I photograph, photograph with and through.¹⁶⁹

There are two strands to my OOPh practice. The first (upon which the project I discuss here - an exploration of using Harman's quadruple framework as analytical and creative method - is built), is about photographing objects in "meshes" not in the sense of objects in context or with other objects as a background but in terms of how what are sometimes seen as a hierarchy of objects are best seen, and photographed as flat.

As an example I photograph discarded or forgotten human-made objects. I do not approach this as "litter"; an invasion in a natural landscape or a correlationist human intervention in a separate ecology; or as a sign of some wider process or history. The broken biro on the tarmac or the Kinder Egg toy my children played with then forgot, carry a history. They were made in a factory, in a country, in a system. They have carbon footprints, chemical presences and half-lives. But they also have a presence and actuality as I encounter them.¹⁷⁰ At the subatomic level, the object is in motion. Its relation to the tarmac or the toy box (within its own history) is dynamic as molecules react and inter-react. The pen and the pen/tarmac, the toy and the carpet mesh (itself an object) has an agentic capacity. It does things in the world semiotically perhaps but also materially. It changes the world, the chemical balance of the environment, perhaps the psychological or aesthetic balance of the pedestrian or the parent. As the photographer object in that encounter I am inevitably in object-connections with the biro, the tarmac, the toy, the light and a myriad of other objects.

Often I photograph human-created objects literally entangled with "natural" objects. Again this is not as a way exploring or representing ecology or relations of production. The disused mooring ring on the canal path near the 2012 fence can "signify" old East-End industry replaced by

169. OOPh as a practice concerned with materiality and actuality can be seen as engaging with Morton's broader conception of ecology. As he says: "Art is ecological insofar as it is made from materials and exists in the world" (2010a, p. 11).

170. I will come on to outline a more specifically quadruple OO exploration of my imaging - the encounter with sensual and real dimensions and qualities etc. At this stage I merely wish to establish the relation between my imaging and objects.

Olympic brands, security and “legacy”. But the ring is not just a sign of something more. Nor is it just the trace of historical and political economic processes or human impact on “the environment”. There is no background or context here. The ring does things in the world at an ideological scale but also at a material scale. It rusts or leaks chemicals into the soil (alongside the toxins released by 2012 excavations (Wells, 2009; Chapman & Wells, 2010)). But when the ring-object is addressed in a flat ontology with the grass, the long-forgotten ironworks, the canalboat, its moorings licence, British Waterways and its internal memos proposing changes to the rules for the Olympics (Griffiths, 2011) - that network of human and unhuman actants is real, present, actual, power-full and governmental.¹⁷¹

Finally I photograph the encounter between natural objects. Here there is even more pressure to address the object-connections as a network, an ecological mesh of objects. The leaf from one plant fallen on another can be read (in reality or in my image) as both a sign of, but also an example of, an eco-network, nature, Gaia. From an OOPh position however, whether seen as I walk along the path, seen in an image or never seen, the two objects connect within an object. Here the ecosystem is not the field within which objects connect but an object within which they connect. The system is just a special kind of object.

The second OOPh practice is based around remixing objects¹⁷². Here I use my mobile phone screen as an imaging apparatus remixing data objects with the “view” or image on the screen. I use an augmented reality app that overlays data from web searches and databases across a camera view as an imag(in)ing apparatus, screengrabbing the view as an image (encoded by the iPhone using the PNG standard, but re-encoded through JPEG when

171. The key distinction here between OOP and classical ANT is that for Harman these “separate” objects exceed their relations. They have an actuality beyond the network. Their power is not dependent on the network or their relations. Morton also draws attention to the importance of actuality within object-oriented creative practice when he draws on Giorgio Agamben’s phrase (2007, p. 49) to position “ecological art” as an art of “whateverness” (2010a, p. 105).

172. I come on to discuss Mark Amerika’s account of remixology as a methodology but for broader accounts of remix as cultural practice, legal issue and aesthetic, see Manovich (n.d.; 2005b; 2007); Lessig (2009); Tofts & McCrea (2009); Sonvilla-Weiss (2010); Amerika (2011a).

uploaded to Facebook). In a similar vein I conducted geolocate web searches for images as I walked around the 2012 Fence, again screengrabbing and uploading the results. In a third strand, I remix mobile phone photographs or screengrab imag(in)ings with the other data objects that my phone connects with every day - emails, notifications, alerts, news, webpages etc. I approach each of these remixes from an object-oriented point of view. The images, files, screengrabs, stream objects, protocols and apps I use are objects. My remix is a matter of connecting the various poles of the objects within new objects. Here I look to treat all the objects in my mobile phone use (the camera lens, the screen, the software, the touch interface, data packets, pixels and people) within a flat ontological framework again looking to move beyond a Subject-centred correlationism and a discourse or practice of signification.¹⁷³

I see the practice of OOPh as exceeding imaging. OOPh is more a sensibility towards objects it does not demand an (in)decisive moment of imaging or even an imager.¹⁷⁴ None of the objects and object-connections, networks or meshes I photograph require my presence as photographer. But as photographer-object I *am* present. My object presence changes the character of the mesh as does the object presence of my camera, its hardware and software or the Open Graph “onto” which I upload my images. That is true whether I press the button and take a picture or not, whether the mash-up conducts and encodes a web search or not; whether the mesh before the lens ever becomes an image (online or off) or not. Each of those possibilities are potential new objects, the site of new connections.

173. While this practice features in my mash-up apparatus, in terms of this project and its research aim of addressing JPEG, I concentrate primarily on my use of a (pinhole) camera to engage with the first form of OOPh. I chose to do this because, as I discuss, I was able to narrow down the range of object-actants in play. The latter practice was premised on multiplying the number of actant-objects at work.

174. This allows it to extend into the field of machinic vision as I explore in terms of my mash-up apparatus' imaging whether a human is involved or not.

OOPh is merely the sensibility to those connections and objects.¹⁷⁵ What is important is that that sensibility positions the photographer object at the same scale as any other object.

As well as deconstructing the privileged position of the photographer within imaging, OOPh seeks to undo that of the photograph.¹⁷⁶ The image could be seen as a report on my (and other photography objects') encounter with the objects before the lens. But the image is not the important thing. In fact it is not necessary. OOPh is a sensibility to encounters. If that becomes an image through the connection of other objects, so be it, but the photography is in the photographic encounter. As I will discuss, if that encounter is encoded in an inaccessible form (RAW) or by software machinic screengrabbing on a distant server "out of sight", it is no less an OOPh encounter.

My photography is object-oriented not merely because at the moment of taking I refuse the discourse of representation or a hierarchy of objects but because I refuse correlationism. I as photographer am object not Subject. I am implicated in that encounter. I connect (with) my objects within my photographic practice and ultimately within my photograph object. I cannot stop being human but I can stop privileging that position and rather address it as human-object. Within any photography practice or photograph object there are objects, object connections and objects connecting: the things before the lens and the things behind. While of course I am active in choosing what to photograph, where, when and how, all the other actants

175. Morton discusses "the environmental thought" in terms of it being a sensibility, a "kind of thinking [where]... the *form* of the ecological thought is at least as important as its *content*. It's not simply a matter of *what* you're thinking about. It's also a matter of *how* you think" (2010a, p. 4 emphasis in original). For him the ecological thought is a matter of "intimacy with the strange stranger" (2010a, p. 46; 2010b), his term for life form objects we can never fully grasp.

176. Bryant discusses the deconstructive power of object-oriented approaches when he says: "[O]ntology and object-oriented philosophy are both metaphysics or ontologies that thoroughly escape what Derrida refers to as ontotheology and the metaphysics of presence. Far from being a signifier that denotes presence or the fullness of being, the very essence of substance is to withdraw from presence and to be in excess of all actuality. However, this overturning of the metaphysics of presence occurs not through a demonstration of the manner in which being always harbors deferral and difference for us such that presence is forever unobtainable, but rather by showing that being as such, being in itself, withdraws in this way" (2011a, p. 86).

have an agentic capacity as they connect and reconnect. They are not passive tools of a photographic overlord but vital players in an imaging encounter. The human photographer is one object but so are other hardware and software objects... including JPEG.

JPEG imaging

The particular practice I discuss here emerges from that broader OOPh practice. It focuses on using OOPh to explore one of the objects in play, JPEG. The practices or works I discuss were designed to explore JPEG and also OOP as a method for investigating digital objects. I crafted the works (picking up on the language Bogost uses for his own practice-research, see below) to allow me to understand JPEG's existence and working (remember that for OOP, these are different), to expose and explore its quadruple form. In order to do this, I took photographs with a digital pinhole camera and a network, mash-up apparatus. I processed the data in a digital darkroom and produced a series of Photo eBooks.

My first apparatus was a digital pinhole camera.¹⁷⁷ My decision to use digital pinhole was part historical, part philosophical and part aesthetic. Pinhole has a long history in imaging. Eric Renner traces it back long before the image could be "fixed" photographically to naturally occurring apertures in nature and a fourth Century BC reference in China to "Aristotle's Problem" the question the philosopher raises in *Problems XV* about light shining through a rectangular peephole appearing circular (Aristotle, 1936, pp. 333-35; Renner, 1999). On through the history of scopic apparatuses and discourses discussed by Jay, Crary, Anne Friedberg (2006) and others, pinhole - the physics of light and aperture as an imag(in)ing technology has been an important scopic technology. It is important to note however that pinhole has never been a "pure" form of imaging, somehow more basic, objective even neutral. Far from it. What it has always done is highlight the very enfolded and necessarily powerful nature of imaging and imaging technologies. As discussions of scopic apparatuses have shown, the pinhole process has not somehow been outside scopic power and the gaze. Right

177. An Olympus E420 DSLR with the lens removed and a home-made pinhole body cap.

through to eBay listings for pinhole surveillance cameras, the simple action of light and aperture has never been outside power. Even when particular technologies, devices and brands are stripped away, leaving just a light and a hole, imaging is still scopic and therefore powerful. To imag(in)e with pinhole is to remain part of that historical enfolding, to foreground the connection to optics, optical toys and scopic problematics.

To marry that history to contemporary digital technologies is to perhaps engage in the sort of “circuit bending” that Parikka and Hertz talk about (Hertz & Parikka, 2010). For them literally deconstructing devices is to problematise the historical and the new, to engage in a practical media archaeology and enfold the old in the new. To remove the (very expensive) lens from my camera and replace it with a pinhole is not simply to problematise the consumerist megapixel arms race and built-in obsolescence of imaging technologies or even simply to bring historic techniques into the present but to connect the past and the present within an imaging-object.

I look to carry my object-oriented philosophy through not only the things I photograph but the way I photograph. Any photographic practice involves using a mesh, an object apparatus including hardware, software (or chemical), human and unhuman objects. Digital pinhole imaging enabled me to acknowledge that by bracketing out some of the actant-objects and foregrounding others. By refusing to use the camera’s electronic/software meter and timed shutter, preferring instead to simply use my experience to assess the light and opening and closing the shutter manually¹⁷⁸, I bracketed other software in play aside from that dedicated to encoding light-as-data. By handholding the camera and, because of the long exposures necessarily introducing camera shake, I brought the Photographer-object into full view. My breathing and so moving of the camera were written into the images as clearly as they are written into the mesh.

178. As noted above (n. 5) my digital camera used an electronic, rather than a mechanical shutter.

My final reason for working with digital pinhole is aesthetic. As I discuss in relation to other object-oriented photographers such as Sally Mann¹⁷⁹, I see “imperfections”, “ambiguity” and “accident” as not only visually pleasing but more in keeping with the themes of my work: objects, connections, enfoldings, memory and ecology.¹⁸⁰ Again there is a desire to get away from the hyper-sharp and mega-detailed imag(in)ings sold to us by some players in digital imaging. This is not a negative reaction against, so much as a positive move towards the potential of a more ambiguous, mysterious, “weird” digital aesthetic - an exploration of the potential of ones and zeros to be less distinct.¹⁸¹

My first “apparatus”¹⁸² used the digital pinhole camera to explore the limits of JPEG by using it alongside another standard. My digital pinhole camera could encode light-as-data using both JPEG and RAW standards at the same time. The results of these simultaneous encodings were written to the card in my camera and from there to the project “memory” card as well as Facebook and Evernote’s web servers as part of my eBooks. Here the newly encoded objects were available for new object connections: with browser software, upload and download protocols and device hardware and software. As I shall explore, those connections (and the objects within which

179. Anne Wilkes-Tucker reports Mann as saying of digital: “There is nothing whimsical about digital. No ‘gifts’ occur. It’s too predictable” (2009, p. 175). I would respectfully disagree. I looked to be open to those gifts by embracing the accident through handholding the camera as well as the broader vagaries of dust on the sensor. A commercial vendor of pinholes for DSLRs says: “If you have a Digital Single Lens Reflex camera, you should use a ‘No Dust’ pinhole or zone plate body cap. ‘No Dust’ means the pinhole or zone plate is surrounded by a very opaque black area on film; the pinhole or zone plate area is clear on the film. No dust can enter the camera -- dust on the sensors can be a problem with digital photography” (pinholeresource, 2011). As well as the desire to put nothing between the light and the sensor, it was that “problem” I looked to embrace.

180. For another photographer who sees the pinhole aesthetic as offering a way into exploring memory, see Ess (2001).

181. Such a concern is apparent in recent work in sound and visual art around “the glitch” (Menkman, 2011a; 2011b). See also the work of Phillip Stearns (2012) and Amerika’s *Museum of Glitch Aesthetics* (<http://glitchmuseum.com/>).

182. I use the term apparatus to refer not just to the material device but the scopic mesh or actant-network. See my discussion of the work of Crary. The “apparatus” is more than the camera. It is the scopic mesh of human and unhuman, hardware and software actants.

they happened) were different and differently powerful depending on whether JPEG had been involved or not. In short the RAW-encoded light-as-data was invisible,¹⁸³ the JPEG-encoded light-as-data was visible, networked and flexible.

My second apparatus was a software/machinic apparatus. I built a “mash-up” that brought the JPEG object together with other software objects such as JavaScript, HTML, web browsers, network protocols and search algorithms; hardware objects such as mobile phone screens, monitors and tablet touchscreens; human objects such as myself and other photographers; unhuman objects such as Apple, Google, Microsoft and Yahoo. Needless to say this litany does not cover all the objects in play, nor could any list. The apparatus consists of a webpage. When the page is loaded a JavaScript on the page calls on/connects with a service (artviper.net) that screengrabs a webpage of a real-time search for 2012 images on Google, Flickr, Yahoo and Bing as well as my own images on my server. The service then JPEG-encodes that screengrab as a JFIF file and serves it back to the webpage as a background image.¹⁸⁴

More than an installation, this apparatuses was designed to be an imaging device itself, allowing me or any other imager to “take a picture”. The “camera”/webpage encourages the viewer to screengrab an image (encoded depending on their system as PNG or JFIF files) which the viewer/user/imager can then upload to the Web where they would be re-encoded if

183. I use the term “invisible” rather than “invisibile” to draw attention to the fact that it was not that they could not be seen but rather that they were seen differently, outside the mesh of social imaging connections. RAW-encoded files appear as a broken icon or as a failed action. For discussion of the “invisible”, see Birchall (2011).

184. A second version of the apparatus used a similar arrangement of JavaScript, HTML and API objects to pull my JPEG-encoded project images from Flickr and load them alongside other JPEG-encoded “2012 images” in a Webpage (and the browser’s cache). The user could then swap the images and create different juxtapositions, or dialectic images as Benjamin might call them.

necessary through JPEG ready to be found by the search engines and ready to appear in the screengrabs.¹⁸⁵

The final apparatus I developed was a series of eBooks (in different formats, or encoded through different standards if you will) that attempted to bring together my images, my mash-ups and the object-oriented photographer interludes from this work.¹⁸⁶ I refer to the eBook as an apparatus because like the mash-up or my digital pinhole camera screen, the book (in its material instantiation on/in/through a device) offers a way of seeing whether through JPEG or through other standards. I crafted (as Bogost might refer to it) a series of five eBooks: an Apple iBook, a Kindle book, an Evernote “notebook”, a Facebook album “book” and a webpage “book”. I sought to create the same ePhotobook in each of these spaces. The aim was to create an eBook that included individual images/image files (encoded

185. This use of screengrabs as a form of imaging developed from earlier experiments with screengrabs and searches. While this apparatus raises issues of copyright, caching, search data trails and privacy, specifically around protocol, these are not the concerns of this project. Rather I look to use it to explore the quadruple structure of the JPEG object and its workings.

186. While my experiments have concentrating on JPEG’s position within photographic capture and viewing, it can be used to encode any visual data including text and text/graphic layouts. Adobe Illustrator, InDesign and Microsoft Office export via JPEG to JFIF/EXIF files. Indeed services I use as one of my eBooks, Evernote (www.evernote.com), blurs the distinction between visual and text. Any image uploaded to its cloud notebook service is run through an optical character recognition (OCR) algorithm, making any text in the image searchable. Like the other two apparatuses, this was scopic insofar as it offered a way of seeing through JPEG and failing to see through RAW and WebP.

through JPEG, RAW and WebP¹⁸⁷ standards); the interlude pages encoded through JPEG, DNG and WebP¹⁸⁸ as images/image files; and the “live” mash-ups. The “books” I created were different in terms of their affordances as they were read and potentially read/written on different devices and in different spaces. What is important in terms of my practice-research was that they connected or failed to connect with the protocol-objects in different ways. Those images or live mash-up images encoded through JPEG were visible, and usable, even shareable and embeddable - inter-operative and flexible across all the eBooks.¹⁸⁹ JPEG had connected and enabled object connections. Those encoded through RAW or WebP were not.¹⁹⁰ The formats could not connect with these images, rendering gaps in the Book, fails, broken icons etc. The reader, her devices, social spaces etc could not connect.

187. WebP is a direct competitor to JPEG developed by Google. To investigate WebP would be a completely separate project. Suffice it to say that Google developed the WebP standard for encoding and decoding image data as an alternative to JPEG. Google argues that WebP is more efficient at compressing data and can “create smaller and better looking images that can help make the web faster” (2011, n.p.). Google has even gone as far as to offer a user-friendly pronunciation: “weppy”. What is particularly important is that images encoded through WebP are visible in Google’s own browser (Chrome), email system (Gmail), photo-management software (Picasa Web Albums) and search engine but not other leading browsers or photo management systems such as Firefox, Safari, Internet Explorer, Aperture or Lightroom. WebP is supported by Pixelmator, ImageMagick and Konvertor natively while plugins are available for Adobe Photoshop, Windows Photo Viewer, Microsoft Office 2010, and any other application that uses Windows Imaging Component. A JPEG-encoded “publication” is visible on computers, tablets, phones and e-readers, a WebP-encoded publication is as invisible as RAW-encoded light-as-data - unless you are using Google objects.

WebP is an open standard (anyone is free to work with and use it) but it is also proprietary insofar as it can be read as part of Google’s larger (governmental) project to define and mine the Web. To encode the pages of my thesis as *.jpg* and *.webp* files is to render them both visible and invisible, to join the whole Web or just Google’s part of it.

188. While I could have encoded the interlude pages with the Olympus version of the RAW standard I used in my camera by photographing each layout and saving as a RAW-encoded *.orf* file, I chose to use a different RAW standard to save the text images as DNG files. See n. 23 above.

189. As I discuss in the Appendix, the JavaScript necessary for the mash-ups to work/connect meant that Kindle eBook could not access the JPEG-encoded images pulled in through the mash-ups.

190. As I discuss in the next chapter, Facebook attempts to re-encode image files uploaded to its service with JPEG. It can (or chooses to) do this with certain format files but not others and of course it cannot do it with “live” images such as my mash-ups.

My decision to “publish” my work as an eBook in social media space (Facebook and Evernote) as well as within particular proprietary and open digital ecosystems/meshes (Apple, Amazon, the Web¹⁹¹) was similarly historical, philosophical and also political. There is a long tradition of photobook publishing which like pinhole is enfolded in aesthetic, technological, political and media meshes and ecologies (Manghani, 2003; Parr & Badger, 2004a; 2004b; Baetens & Bleyen, 2010; Miles, 2010).¹⁹² Whether it is Nazi Germany or Soviet Russia’s use of the form for propaganda or contemporary media’s exploration of iPad apps, the interplay of image and design has been a part of photography’s history. As I discuss, Robert Frank’s *The Americans* is more than a collection of photographs, it is as Iain Sinclair says “a paper movie” (Kirby, 1996b). The book object is an integral part of Frank’s work. When *The Guardian* launched its iPad app in October 2011, it reserved a section for “Pictures” laying out photographs in the same modernist block format as the news content, a change from the fullscreen images of its first iPad app, evocatively titled *Eyewitness*. Here the design - as well as the haptic practice of viewing - are integral to the image-object consumption experience (Brockie, 2011). As photographer Ralph Pins reportedly said in conversation with Cas Oorthuys in 1969:

A photobook is an autonomous art form, comparable with a piece of sculpture, a play or a film. The photographs lose their own photographic character as things ‘in themselves’ and become parts, translated into printing ink, of a dramatic event called a book (Boom & Suermondt, 1989, p. 12) cited in Parr & Badger (2004a, p. 7).

This sense of nested objects, with photo-objects connecting within another object clearly resonates with my broader object-oriented philosophy. Working with the photobook form allows an exploration of OOP’s stress on the paradoxical autonomy but connectedness of objects

191. Of course the Web is arguably not open in terms of issues of access, digital divides and the necessity of proprietary technologies to access even open and creative-commons content. See also Jonathan Zittrain’s discussion of “appliancized proprietary networks” (2008, p. 25) and Eli Paris’ work on the “filter bubble” (2011)

192. More generally on eBooks, see Eraso, Ludovico & Krekovic (2006) and Ludovico & Muller (2007; 2008).

within objects. While of course an exhibition or installation¹⁹³ bringing images together can, and should be seen as objects, the bound (even electronically) and definite character of the photobook as an object-work foregrounds OOPh's object focus.

There is also a "political"¹⁹⁴ dimension to working with ePublishing. Following the lead of Bogost and Montfort's "platform studies", eBook publishing whether using ePub, HTML5, azw, mobi, PDF, iBooks or JPEG is a matter of platforms, protocols and standards that are inevitably and indelibly powerful.¹⁹⁵ Choosing to create and publish my OOPh as a book-object demanded an engagement with those platforms and powers. In the App Store or outside, through Amazon or on my website, on a particular device to a particular screen size or not - these decisions and practices create different objects (accessible or inaccessible, open or closed). They foreground the politics of objects and object relations. These are at one level protocol issues. It is important to note that my concern in this project is not with exploring them or even approaching them through OOP. Rather my aim is to explore how the JPEG object connects or fails to connect with those objects.

The three apparatuses can be seen as objects connecting within a single but multidimensional practice object.

Why practice?

Before exploring how I used this practice as a basis for exploring JPEG and governmentality and what I found about the nature of the quadruple JPEG object it is important to address why I approached my questions about the nature and workings of JPEG through practice. I chose not to approach

193. My mash-up can of course be seen as just such an installation object, or a publication or perhaps even a performance.

194. I am conscious of the loaded nature of this term. My decision to use it here is not to engage with debates about the nature of the political or even the politics of software or publishing but merely to draw attention to my desire to acknowledge and work with and through the real-world powerful nature of eBook platforms.

195. When Apple released their new iBooks format and *iBooks Author* software, there was considerable controversy over the End User License Agreement which, in its first iteration, said that any eBook created by the software regardless of final format could only be sold through Apple's iStore (Foresman 2012).

my subject via traditional social science methodologies. I could have engaged in qualitative or quantitative research with photographers to establish how they used JPEG or used surveys, interviews or discourse analysis to trace the changing way photographers (amateur, professional or somewhere in the middle) understand what it is they are doing now. Even given the sort of more modest approach that John Law (2004) calls for, such a method would be open to the standard criticisms of such work: questions of my position as researcher, the extent to which my research and research practice structures the network which I am exploring etc. I chose not to take these questions on by using an actor-network theory model. Following Bruno Latour's call to simply describe,¹⁹⁶ I could have sought to map the shifts and new understandings through an ethnographic account of all the actants (Coleman, 2010), not just interviewing the photographers but also interrogating the documents and technologies, the developers of the JPEG standard, the bodies, organisations and companies involved in its hegemonic struggles in a similar way to how Latour "describes" the development of the Aramis transport system (1996).¹⁹⁷ Such an approach would certainly have allowed me to amass evidence of the connections and processes in play, the way JPEG achieved a form of hegemony, the way photographers are enfolded with their technologies - hardware and software, as well as adding a diachronic account of networks and objects in process. What it would also have done however is locate those objects in terms of their relations, in terms of the network. The object would have become if not secondary to, at least dependent on its relations, the context or some meta-framework which was the target of analysis. Rather than studying JPEG, I would have been left studying "digital imaging". Such was not my target. I needed to remain focused on the object if I was to render it visible, open to practice and potentially to Exploit.

196. In the guise of a long-suffering PhD supervisor Bruno Latour tells his rhetorical student: "If I were you, I would abstain from frameworks altogether. Just describe the state of affairs at hand" (2004, p. 64).

197. For such an account of imaging and Flickr, see Cox (2008).

I also chose not to leave my discussion of JPEG-as-quadruple-object at the purely theoretical account of the previous chapter.¹⁹⁸ To simply describe JPEG using the vocabulary of OOP is important in terms of testing Harman's theory by asking it to account for protocol. As the previous chapter shows, OOP offers a coherent and stimulating way of explaining JPEG. As the next chapter shows, this enable us to map the contemporary governmental scopic regime in new ways. Such is the power of Object-Oriented Philosophy. What such a theory/philosophy-only account does not do however is test that perspective - the Real/Sensual poles and their relations of fusion and fission - in practice. Nor does it open up new object-oriented imaging practices.

It was only through the practice of using JPEG that its nature and workings could become "visible". Even exploring other photographers' work would not have given me access to all the objects in play within the "cameras" and processes and practices of photography. It would not have allowed me to assess to what extent Real-Sensual poles and relations of fusion and fission are really at the heart (sic) of JPEG and JPEG imaging. By making my own practice my laboratory, I had access to the full panoply of objects (including myself as imager) as well as the full sets of connections.

Carpentry and remix

The term "practice-research" has attracted a particular set of metaphors. Graeme Sullivan visualises a series of interlocking pieces, a "braid, with its infolding and unfurling form that disengages and reconnects with core themes while continually moving into new spaces" (2010, p. 112 fig. 4.4). For Sullivan the link between art practice and research is literally drawn as a fractal-like, 3d, dynamic visualisation where, "[i]rrespective of where visual arts research happens, the structure has similar qualities - it is simple,

198. I am conscious of the problem of using the term "purely" as if such an abstract, neutral, object thing was possible. I use the term here to imagine a position where the research question were addressed using theory alone.

complex, and dynamic all at the same time" (*ibid* p. 113 fig. 4.5).¹⁹⁹ For Sullivan, practice-research is best understood using both visual and conceptual metaphors. It is a dynamic jigsaw and the sort of "complex adaptive system" scientists use to talk of non-linear dynamics in natural systems and social scientists and cultural historians have used to both picture and also account for processes in social systems.²⁰⁰ For Hazel Smith and Roger Dean the metaphor is one of a circle and a web (2009). Where Sullivan pictures a folding/unfolding movement, here the image is one of an "iterative cyclic web" with a "research phase" and a "practice phase" connected, repeated and ratcheting each other up as a project moves forward.²⁰¹

Bogost too uses a metaphor in his call for new ways of doing, what is for him object-oriented, research. He discusses the "practice of constructing

199. Sullivan can be seen as located within the same discourse as Victor Burgin (2006) and Desmond Bell (2008) in seeing practice-research as a political struggle for arts' legitimacy. For Burgin practice-research emerged within an institutional and historical frame. Sullivan starts with an historical account of how art has always created new knowledge (*ibid* pp. 3-31) and when he gets onto the issue of contemporary discussions of practice-based and practice-led research, this is located in terms of responses to the OECD's *Frascati Manual* an internationally recognised guide for standards in research and development used to help develop policies and practices which includes a framework for defining research activity (*ibid* p. 74). He continues this contextualisation by discussing the "academic art world" (*ibid* pp. 79-82) before presenting his own model. That model emerges from an account of practice-research as a political-economic and historical form located in particular material and professional relations.

200. Within complexity theory complex adaptive systems are poised on the edge of non-linear chaos. The arguments is that the whole is more than the sum of its components. At large and small scales, systems have characteristics that are the same. They are "scale free", "self similar" or fractal. Within complex systems, small units, or "actants" (whether atoms, neurones, ants, populations, share dealings, bits within a computer etc) interact in complex ways and generate particular states. These states or "attractors" are poised on the "edge of chaos". The system settles but only temporarily around an attractor only to be moved on to another (not necessarily higher) level of organisation. "Attractors" act to stabilise these systems at particular moments which are never fixed but always in process. For introductions see Holland (1995); Urry (2005) and Johnson (2009). For its use in cultural analysis, see for instance De Landa's attempt to write a non-linear history (2000) where social structures (whether material or non-material, human or not) emerge from complex historical processes that cannot be traced to a founding essence or dynamic. Rather De Landa argues, ideas of social causality must include an understanding of the sort of feedback mechanisms that scientists find at work in chaotic and complex adaptive systems.

201. Smith and Dean position their metaphor in relation to Deleuze and Guattari's rhizome (2004) "in which any point can be linked to any other and there are 'multiple entryways and exits'" (2009, p. 21).

artifacts as a philosophical practice” which he calls “carpentry” (2012a, p. 92).²⁰² This is not creating interactive works, games (Bogost, 2007; Bogost, Ferrari & Schweizer, 2010; Tanz, 2011) or poems (Bogost, 2010) as an illustration of a philosophical concept, point or argument. The work itself is philosophical. He writes:

Carpentry entails making things that explain how things make their world. Like scientific experiments and engineering prototypes, the stuffs produced by carpentry are not mere accidents, waypoints on the way to something else. Instead, they are themselves earnest entries into philosophical discourse (2012a, p. 93).

For Bogost, this philosophical product is of course object-oriented:

Carpentry might offer a more rigorous kind of philosophical creativity, precisely because it rejects the correlationist agenda by definition, refusing to address only the human reader’s ability to pass eyeballs over words and intellect over notions they contain (*ibid* pp. 92-93).

Here the software, games and game poems that Bogost creates do (philosophical) work in the world - as objects. They do not rely on the human world correlate. The form is as philosophical as the content.

Mark Amerika too “practices” philosophy. His “remix the book” project (2011b) consists of a book but also an “open content platform”, a space for “digital remixes of many of the theories generated in the print book [it] features the work of artists, creative writers and scholars for whom the practice and theory of remix art is central to their research interests” (2011c, n.p.). Again these remixes are not, for Amerika, illustrations or even responses to his philosophy. They are not even distinct philosophical statements themselves. As objects his book (itself a collection of fragment-objects) and the remixes connect and reconnect within new objects. He talks of “artwork as a *spontaneous and continuous theory-to-be*” (*op cit.* emphasis in original).

202. Bogost acknowledges his debt to Harman’s “the carpentry of things” (2005) an idea Harman borrowed in turn from Alphonso Lingis (1998).

My own practice draws on both Bogost and Amerika's methodology and also their practices. Games for Bogost and remix for Amerika are not simply arenas for philosophy let alone ways of making it accessible or visible, they *are* philosophy. Theories and software, concepts and content connect within the molten core of the object. In a similar vein, my imaging practices and experiments are objects within which object-oriented ontology and protocol connect. My mash-up apparatus is a form of live imaging practice, a sort of photographic VJing or remix as well as a software work.²⁰³ My eBooks are live imaging practices and philosophical experiments as much as collections of images. In addition, as I have argued, for me OOPh is about imaging as well as images. The OOPh sensibility at work in my RAW/JPEG apparatus-object, like carpentry or remixology is about the practice and the practice-object.

Focus and practice

The specific OOPh project I used as the basis for my practice-research was around the liminal spaces around the 2012 Olympic site in East London. I had already been engaging in imaging around the Fence using mobile, geolocate and augmented reality technologies (Karppi, 2011; Uricchio, 2011) as well as having explored some of the implications of social imaging and protocol in an early paper (Caplan, 2010).²⁰⁴ It is important to note that even in these early practices, I was not attempting to explore The Olympics but rather the liminal Olympics spaces around the Fence²⁰⁵ as a site of objects, object connections and meshes.²⁰⁶ What I was interested in was how Olympics and non-Olympics objects connected - the Fence and the plants, the light and the litter. I could have chosen any space to explore. With that said, the Olympics site and liminal spaces offered a

203. In a sense it is also live coding (Brown, 2007) insofar as the mash-up is continually remade as new screengrabs are pulled in.

204. At this stage of my research I had yet to encounter Harman's work which, as I have discussed stimulated a particular theoretical and practical approach.

205. For a discussion of fences as artefacts of globalization, see Feigenbaum (2010).

206. I narrowed the focus even further, as far as my own imaging went, by working in a particular liminal space, the Greenway, a footpath and cycleway on the embankment containing the Northern Outfall Sewer and being remade as a pathway to the Olympic site as well as part of the Crossrail developments.

number of interesting objects and object meshes. Here was a concentrated spatial and temporal mesh - the Big Build, the secure site, the “Grand Project” as Iain Sinclair calls it (2012). Here were human and unhuman objects present by accidents and by design - Hi-Viz jackets and tabloid newspapers dropped by workers or security objects located by planners. Here were natural and unnatural objects brought together for a specific moment. The Fence would be taken down, plants would creep back. As I looked for a project to base my JPEG experiments on, 2012 again offered many advantages. Here was a specific space of human and unhuman imaging - tourists and sports fans with JPEG-ready mobile phones under the gaze of unhuman surveillance cameras and drones as well as human snipers (Taylor, 2012; Hopkins, 2012).²⁰⁷ 2012 offered a moment and space of distributed imag(in)ing. My mash-up apparatus could be set to manage (if not control) the range of those imag(in)ings through temporal and spatial metadata embedded in the image files.²⁰⁸

As I looked to explore JPEG as a quadruple object, and developed my apparatuses as a form of “carpentry”, I built on my existing 2012 OOPh project. I walked the liminal spaces around the 2012 site encountering (and imaging) objects and object-meshes. I photographed the natural-artificial, natural-natural and human-natural object connections before the lens with my digital pinhole apparatus. I created a mash-up imag(in)ing apparatus that brought my images into connection with the distributed web of social

207. For broader discussions of surveillance and the militarisation of urban spaces, see Graham (2011). In terms of the militarisation of online space, see Deibert (2003). For a different account of the machinic and the urban see Amin & Thrift (2002). Specifically around the digital and the urban, see Featherstone (1998) on mutable spaces and flânerie; Atkinson & Willis (2007) on overlapping realities; de Souza e Silva (2007) on mobile hybrid spaces; McQuire (2008) on architecture and contributions to Sutko & de Souza e Silva (2009) on urban location and gaming. For accounts of urban development around 2012, see Gold & Gold (2007) and Pointer (2009). For photographic explorations of urban space, see Burgin (1996); Atkins and Sinclair (1999) and the work of Stephen Gill (2004; 2007a; 2007b). For an historical account of visualising urban space and time see Clarke & Doel (2007). In terms of the gaze and modern urban imaginaries, see Jansson & Lagerkvist (2009). For a history of the rhetorics around surveillance, see Levin, Frohne & Weibel (2002).

208. As I discuss (Caplan, 2010), such metadata can of course be “fooled”, manipulated or otherwise Exploit-ed. As noted above (n. 126) my concern in this project was not with the geolocative metadata capabilities and implications of JPEG. Their use here was simply to define searches.

imag(in)ings organised by search engines and social media spaces. I finally created a series of eBook/PhotoWorks some of which could act as “imaging apparatuses” themselves as they housed the mash-ups, some of which were mobile book/cameras that could be taken into the Olympic site (Cheesman, 2012).

These experiments, works and PhotoWorks were my philosophical practice, the way I explored OOP, OOPh and JPEG. Furthermore they remain philosophical works for others to use to explore OOP, OOPh or JPEG... Or indeed other objects or issues of distributed imag(in)ing.

The report

JPEG as an object

My practice-research indicates that JPEG can be seen as an object.²⁰⁹ JPEG has a unity. This can be seen in its technical structure (as outlined in the *Digital Imaging Pipeline* chapter), in the documents and RFCs online but also in my practice. As I built my mash-up or eBook I could “call on” a unified JPEG to encode screengrabs and render them visible. Regardless of whether that encoding issued as a JFIF/EXIF image file, was accessed by me or other software, there was unified JPEG-object-actant in play. I will come on to address the relations within which I found it at work, but my practice indicated that a unified JPEG had an existence outside those relations. Regardless of whether JPEG is ever called (within Photoshop, my camera or my mash-up) it has a presence and existence. If it did not, I could not have built my apparatuses. Following Harman’s Latourian stress on objects as actants, doing things in the world, again JPEG can be seen as an object. JPEG does things. It encodes light as data, data as accessible data. What is more, as I come on to discuss in the next chapter, JPEG does governmental work. It enables image data to be viewable, shareable, linkable and efficiently archived as part of Facebook’s Open Graph. My attempt to use the RAW standard to do the same work indicates that standard-protocols such as JPEG are active creators of Open Graph-friendly data and data points. One could of course argue that JPEG is not the only object-actant doing that governmental work. Other protocols, hardware and software objects are also in play and necessary for the digital imaging pipeline to work. All my practice shows is that JPEG is a player in that mesh and is unified and exceeds any relations.

The sensual JPEG

My practice-research indicates that JPEG has a sensual dimension. A dimension of the unitary object which is accessible to me and to other

209. This does not of course exhaust the ways in which JPEG can be understood (or possibly imag(in)ed). My project is not claiming that objects is the only way of understanding protocols and standards, merely that it is an under-developed way of seeing such digital objects.

actants in the mesh. As I planned and built the various apparatuses, I had to work with specific accessible instantiations and adumbrations, different profiles.²¹⁰ In order that the mash-up could sample the distributed imaginings, my own photography could place the RAW and JPEG objects next to each other and collide my eBook formats, I needed to access dimensions of the JPEG standard (not just the JPEG/JFIF images) present to me, my camera, my browser. Specifically the plans I made and the devices I constructed were premised on access. As those plans were realised and the apparatuses worked, that sensual dimension became apparent. These encounters did not access the totality of JPEG, merely an instantiation, particular configurations of the transforms, codings and tables that form JPEG. I experienced these sensual dimensions as there as surely as I knew that the totality of JPEG lay beyond my and my other actants' access.

Specifically, as I set up my digital pinhole camera to encode my 2012 light as data using RAW and JPEG simultaneously, I depended on access not to a stable, total reality but to a particular profile. I chose the settings in camera.²¹¹ Just as when encoding the pages for the eBooks I accessed the "quality" settings - the everyday term for the particular transforms, coding and tables used in compression. This was a particular accessible profile, the sensual dimension to JPEG. As a second clear experience of that sensual dimension, depending on the balance of light and shade in the scene I captured, JPEG compressed differently - balancing the colour and the tonal range according to a different profile. This was apparent as I looked at the JPEG preview on the camera screen, on the iPad and in the save as dialog box in Photoshop or Aperture. It was not that there was different JPEGs but certainly different profiles.

The real JPEG

My practice-research indicates that JPEG has a real dimension. Although my imaging and apparatuses show a sensual dimension, there is always

210. Interestingly, this term is used in imaging software and digital photography to refer to different colour spaces configured for different screens and devices.

211. Another interesting legal-governmental phrase highlighting the hidden but powerful operations in play.

more to JPEG, withdrawn dimensions inaccessible to me or any other actant-object. As John Miano puts it, “the inner workings of JPEG compression remain something of a black art” (1999, p. 35).²¹² His choice of words is instructive. He talks of “JPEG compression” not “JPEG”. The thing itself withdraws.

If there was more to JPEG than the sensual accidents and profile that I and other objects encountered, then it must have a presence and existence when I (or any other object) stopped paying attention to it. My practices shows that the unitary JPEG had that existence.²¹³ This was most apparent in my mash-up apparatus. The service I used to screengrab image searches and encode them as image files to be sent back to my installation existed regardless of whether I or anyone or anything else called it to run. The JPEG object remained enfolded in that software service regardless of whether my JavaScript called it or not. Similarly the JPEG decoding object had a presence within the browser and eBook reading software regardless of whether it was in use. This was not some potentiality. It was not waiting to be realised, somehow non-present or unreal. It was actually built into software and systems but accessible only as instantiations or profiles. Similarly *Save As* in Photoshop or the in-camera software before or after I pressed the button had the JPEG on hand (present at hand). Whether I or any other object boot up those systems and access the sensual JPEG is a separate issue. My apparatuses and my practices depend on something real, if forever withdrawn. What became particularly apparent as I imaged was that JPEG not only withdrew from me but from other objects in my apparatuses. When I pressed the shutter button and set the digital imaging pipeline in play or

212. Miano’s evocative if problematic language is instructive, particularly when read in terms of Morton’s ideas of “dark ecology” (2010a, p. 16) which he likens to noir film where the narrator finds she is implicated in the narrative. Morton argues that “[a] more honest ecological art would linger in the shadowy world of irony and difference” (*ibid* p. 17). I aim to explore the shadowy world of JPEG through a form of object-oriented or noir photography.

213. One is of course in danger here of metaphysical speculation, the uncertainty principle and thinking of cats in boxes. One might discuss whether it is possible to prove something is withdrawn. My aim is not to enter those debates but merely show that there is more to JPEG than the (sensual) dimensions that are accessible when one uses or encounters the object, that JPEG exists even when the camera, the server or the human is switched off.

loaded my webpage I did not reach the totality of JPEG, but neither did any of the other objects. The silicon chip in the camera or the hard drive on which Photoshop ran, the JavaScript call or the Google algorithm accessed a dimension of JPEG - all that was needed to do their work. They had to encounter an instantiation in order to render search results. They had to encounter a profile in order to be able to render a file.

JPEG's qualities

My practice-research also indicated that JPEG was in tension with real and sensual qualities. As I worked as programmer, imager or reader, JPEG withdrew but it did not dissolve into a indistinguishable mass. It had real qualities. It was different from other real objects and protocols. It used Huffman Coding, DCT etc. These algorithms and mathematical formulae, whole inaccessible (except through intellectual work) were there in my work. If they were not I could not have developed a RAW/JPEG parallel imaging apparatus, there would have been no distinction to highlight.

Similarly my practice indicated that JPEG emitted sensual qualities "into the sphere of presence" (Harman, 2011g, p. 49). The instantiations and profile I experience in my practice were not phenomenal. The specific tables, codings, transforms and colorspace I encountered were more than experiences. They were rooted in a real protocol. The unity of withdrawn qualities and dimensions, those mathematical laws and hidden dimensions were in tension with their particular instantiations, tables, settings etc. Again the fact that my apparatuses worked, the fact they *did* compress data showed accessible qualities (particular tables and transforms) in operation. JPEG compression does not work by Huffman Coding in general or abstract but by using a particular sensual profile, a particular table. The reality of my imaging apparatuses and images indicate that there was a reality in play.

JPEG and time

If my practice showed that the JPEG object had a quadruple nature, it also showed that time and space in my imaging were matters of objects and that

quadruple nature.²¹⁴ I have already discussed how “time” is important for any discussion of social imaging. What I want to add here is an account of specific examples of that object-based time (as a tension between SO and SQ) that appeared in my practice.

There was no “arrow of time” in my mash-up or my eBook publishing. Of course images and imaging moments (taking/encoding, uploading, viewing/decoding) were timestamped. But even without hacking that metadata,²¹⁵ the “time” I and Facebook’s Open Graph were working with was flexible. JPEG’s particular instantiations at the moment of encoding or decoding, or at the moment of calling within a mash-up or Timeline appeared as not a moment from a linear flow of time but rather a tension between a sensual profile (the accessible dimension), in a specific moment and particular qualities or settings set by me, server software, in-camera or iPad apps etc. “Moments” (decisive or otherwise) were a matter of objects and their qualities. When my mash-up seemed to collapse and telescope different times from and for different imagers, what appeared as a stream of images, a cinema-style linear trail of frames, was in reality a Benjamin-style montage of instantiations, not abstracted from a linear flow of stable “time” but rather a series of object tensions - particular and specific. The sensual object JPEG “within” my app/eBook called particular qualities (particular, specific settings of JPEG compression) to render particular image moments on the page. What is clear from my practice is that JPEG is about specific and particular profiles and compressions. Each instantiation in encoding or decoding are actual and particular. Each SO and SO/SQ tension is specific as the object within which JPEG works is encountered by me, by the eBook or an other object. Here the tension between the SO and SQ of JPEG

214. For a different account of time and software, explored through artworks see Raley (2008). On distraction and experience of time, see Cubitt (2007) and more broadly on time and new media, see Lee & Liebenau (2000) and Leong, Mitew, Celletti & Pearson (2009). For an exploration of time compression and visibility, through the work of Virilio, see Bartram (2004) and more generally on mobility and time and space, see Green (2002).

215. The timestamp-object is not fixed or necessarily “true”. That EXIF metadata can be edited. The time of the image or the geolocation can be changed. Of course forensic methods can be used to show that such changes have been made but that does not change the fact that the time-object is not related to some fixed temporality.

appeared as different moments in time, as a flow of (in)decisive imag(in)ing moments but on closer inspection could be addressed as a matter of tensions within a unified JPEG object.²¹⁶

This is not to suggest that there is no such thing as “time” or that it is no more than an illusion caused by objects. Rather it is to suggest that my practice with JPEG indicates that our *experience* of JPEG imaging time arises from the tensions within that object.²¹⁷

JPEG and space

My practice also highlighted the way in which “space” can be seen as object-oriented, for Harman a matter of the tension between RO and SQ.²¹⁸ Again, I have discussed this perspective in theoretical terms but I turn here to examples of where I found that object-oriented sense of space in my practice.

As noted above, my practice highlighted JPEG’s sensual qualities, the particular instantiations and profiles I and other objects encountered. My aim again here is to present an account of where that object-oriented sense of space appeared in my practice.

When a reader opens my eBook and turns²¹⁹ to a page with a live feed, she experiences a window into multiple spaces (just as if I had embedded a

216. This is not to suggest that this is the only object tension in play or setting experiences of time in motion. Other imaging objects were similarly split and so enfolded in those experiences.

217. This is not to institute a correlationist agenda, privileging human relation to time. Object-oriented approaches do not deny the human and her experience (in relation to time), they simply refuse to privilege it.

218. For a different account of space and software, see Kitchin & Dodge (2011) who identify new flow spaces enfolded with and in many ways dependent on, information and software. For another account of flow and new media, see Hepp, Krotz, Moores & Winter (2008). For work around locative media and visualisation of space, see Tuters & Varnelis (2006). See also Zook & Graham (2007) on the relationship between code and place; Stromer-Galley & Martey (2009) on the relationship between online space and offline norms; McGarrigle (2010) on the influence of situationism in locative media and art, and Lapenta (2011) on locative and augmented reality “geomedia” and collective image production as commodified objects of exchange. As noted above in terms of time, such discussions are, from an object-oriented perspective, built around a correlationist agenda, discussing as they do our (human) reframing of space in and through code.

219. An interesting term in terms of my iPad and Kindle’s different haptic interface (whether serving eBooks or Evernote/Facebook app-books) in contrast to those eBooks on the Web.

live CCTV camera or webcam, but with the added complexities of the times discussed above).²²⁰ In terms of the mobile eBooks, these spaces are further overlaid (or underlaid or inlaid) by the spaces of reading - in the Olympic stadium, in France, in the office of my examiner etc. Like a form of augmented reality, multiple reading and writing spaces appear. The experience of space set in motion by my apparatuses is not simple, or stable. JPEG plays a crucial role in that spatial experience, rendering window views visible, rather than the broken invisible, perhaps opaque view of a RAW-encoded window. The same experience of multiple spaces occurs when I scroll back through the images on my camera screen.²²¹ It is not just different times I encounter but also different spaces, not just where the image was taken but, when viewing on my phone's Facebook app, the server space in the US or wherever the Haystack server is, in whoever's jurisdiction and tax regime it sits.

These complex spatial dynamics and spaces are not just a matter of different geolocations where images were taken but also where that data is held, cached and read, where it is encoded and decoded potentially in multiple spaces simultaneously. These dynamics, for Harman, are the result of the tension between a withdrawn standard (RO) which is some sense locationless ("in" the US, UK, the Web, the standards body) and those profiles which I and other objects encounter as pages are turned, image-data accessed/decoded, screengrabs encoded, Timeline's rendered. The tension between the withdrawn JPEG (RO) - that object that always exceeds our access and its relations, the unfathomable object always just out of reach in my apparatuses but ensuring that they work - and the (SQ) the particular Huffman table or settings accessible to me and other objects, sets up those

220. For discussion of the "window" and discourses of space, see Friedberg (2006). For an account of the relationships between screens and space/experience, see Cubitt (2010). For a materialist exploration of the screen, see Patterson (2010).

221. The fact that I can scroll back through and see RAW-encoded data and so encounter particular spaces is purely because my camera embeds a visible JPEG - encoded preview into the RAW data. The RAW-encoded data remains invisible, the window opaque. Pavel Büchler discusses the implication of the camera's "real-time Live View" on the rear screen for our understanding of time and space, concluding "the uninterrupted flow of information on the 'live' preview screen blocks the view of the moment 'out there'" (2010, p. 17).

spaces. That tension renders the multiple spaces and disconcerting experiences of spaces as JPEG as a unity does its work and the particular qualities I experience are fused. Here we are not faced with different spaces so much as different experiences of space in particular, actual object meshes. This is not to say that there is not real space - geographically distinct and politico-legally defined bordered spaces but simply to argue that the complexities of how that is enfolded in the digital can be seen through objects and that my apparatuses show that the experience of space in digital imag(in)ing can be understood as a matter of objects.

If my practice showed a quadruple form to JPEG and the spatial and temporal dynamics of distributed imag(in)ing appeared as a matter of objects, the next question become: to what extent did I find evidence of an eidos and essence to JPEG through my practice?

JPEG: eidos and essence

Recall that, for Harman, following Husserl, the eidos of an object is intellectually accessible and is the result of the tension between the sensual object and the real qualities that delimit it. In contrast the essence of an object remains inaccessible, the result of a tension between the withdrawn real object and its withdrawn real qualities. Such an intellectual eidos and mysterious essence can be argued theoretically, but my practice offers evidence of their presence within objects.

I and other objects intellectually approached JPEG as the apparatuses worked. This is not to anthropomorphise the way objects work²²² nor yet to engage in a correlationist account of human privilege and intellectual access. When OOP says “intellectually accessible” it merely means that an object can be aware of qualities that cannot be reached. I as apparatus programmer can be aware of JPEG’s RQ such as Huffman Coding or DCT. Similarly a browser can “know” that those qualities are present and can be depended on to deliver data in a usable way. But that (intellectual) or eidetic knowledge does not take me or the browser to the essence of JPEG. In one sense we do not need to. Both I and the browser only need to encounter

222. See n. 117 above.

specific dimensions and particular profiles in order for the (governmental) connections to work.

Such a distinction was obviously very clear as I planned and built my apparatuses. I worked with real qualities and accessed the sensual object - I used the eidos of JPEG as the basis for the apparatuses and this report. But I also failed to work with the essence of JPEG. There was always something more, more withdrawn, more inaccessible. There was always more to JPEG than Huffman Coding and DCT (let alone specific tables and settings). JPEG's existence in scopic and governmental meshes was always more than a matter of algorithmic compression or even software. Its power and position as actant as well as object was always extra, always withdrawn. This became particularly apparent as I explored the governmental implications of my practice through my Facebook eBook, as I shall discuss.

This sense of an eidos and essence to JPEG was not only apparent to me. It also appeared for other objects in my apparatuses which worked by and through a series of dependencies. The browser object depended on JPEG-encoded data to create a visual page and RAW-encoded data for an invisible one. Facebook's algorithms depended on JPEG's compression working to make the millions of uploaded pictures manageable (as I discuss in the next chapter). These unhuman actant-objects were created with the knowledge that Huffman Coding and DCT were at work, just as they were built in the knowledge that an iPad user would see and interact with them in a particular way. The engineer and designers' categorical intuition was built into those objects. They "knew" the eidos of JPEG. But just as those engineers did not, could not and did not need to know the full essence of JPEG - the governmental implications and powers - so those unhuman objects too remained unaware of that hidden essence.

For Harman the tension between the poles within the quadruple object are matters of union and/or fracture. As I have said above, I find his account theoretically convincing but I needed to see if that framework fitted with my imaging practice.

JPEG: fusion and fission

For Harman, space and essence are issues of fusion and time and eidos matters of fission. The former occur as the tensions are held together, the latter as they break. These are matters of practice and I looked to my imaging practice as a way of exploring their dynamics and seeing them in operation.

What Harman discusses as relations of fusion between the withdrawn real objects and its sensual and real qualities, what we understand as space and essence, appeared in my JPEG and RAW/WebP imaging. While my imaging with JPEG and other standards displayed the withdrawn character of the protocol object, it also highlighted the particular profiles (SQ) and fundamental characteristics (RQ) of the object. These had to be fused. If they were not kept together then my imaging would not work. If these tensions were not kept in operation - if DCT or a Huffman table failed to be a part of the object, the compression would not work, the data would be invisible, the governmental Social Graph disrupted. It was just such a breakdown in the fusion that introducing the RAW standard into the social imaging apparatus achieved. The essence of JPEG appeared in my practice as those real qualities and particular profiles were fused. Similarly the complex spaces apparent in my imaging and eBooks were a matter of the fundamental characteristics (DCT, Huffman coding) being fused with a particular profile (a particular transform or table), rendering the imag(in)ings visible and social.

Similarly, the relations of fission between the sensual object we encounter and its sensual and real qualities, what we know as time and eidos, appeared in my mash-up and eBook imaging. The social stream of imag(in)ings in the mash-up and my own pictures in the eBooks (with their temporal complexities) was achieved through particular profiles (SQ) and specific fundamental characteristics (RQ). Each encoding (and decoding) that we or other objects encountered was according to a particular profile dependent on withdrawn characteristics. But each accessible object (whether image or JPEG-encoding) demanded an actual, specific, particular arrangement. It demanded fission, breaks. There was no stability or continuity here. Each rendering or mashing of data was particular, a moment

of breakage between an overall sensual dimension and particular instantiations or configurations of qualities. If there had not been those breaks or fissures there would not have been particular dialectical images (as Benjamin would talk about them),²²³ particular image montages or page layouts.

JPEG and connections

In the next chapter I come on to explore the governmental implications of the JPEG object, how it is enfolded in the governmental work of Facebook's Open Graph. I trace this as a matter of objects connecting within objects. Before moving on to those discussions however it is important to report on how my practice displayed objects connecting, as OOP argues, within objects.

The first thing to note is that I designed my apparatuses from an OOP perspective. I looked to identify and then connect objects together. When I built my mash-up and eBook using JavaScript, HTML, CSS, JPEG etc, I connected them within a mash-up/eBook object. I designed or crafted those objects to connect with other objects: Facebook's server software, Google algorithms, Evernote database objects, the iPad haptic interface. Those connections were designed to happen within the governmental objects I was interested in: the Social Graph etc. At one level then, those nested connections were apparent because I had built them in from the beginning. The question is whether that was the nature of object connections regardless of my design intentions. My practice suggests it was. Even those parts of my practices that were beyond my control and design (the encoding of the screengrabs on the server, the creation of the Timeline and its interface on Facebook, the database of Evernote notes as well as the in-camera digital imaging pipeline) were nested objects. The CSS and MySQL database entries connected within a webpage object not in some fluxus or plasma but in an object. The eBook connected with the reader or the datamining algorithm within a specific and particular interface object. Wherever one looks in the

223. This is discussed further in my Conclusion.

digital imaging pipeline one sees objects and objects nested within objects as their different dimensions connected.

What is also apparent from my practice is that the mediating object within which those connections happen follows Harman's logic. As noted above, he argues that: "[r]eal objects can touch only through the medium of an intentional object, and intentional objects can touch only through the medium of a real one" (2009c, p. 208). My research indicated that this asymmetrical relation appears in practice. The real, withdrawn dimensions of the JPEG object and the real browser software object could not touch. There was always an excess, something held back. There were dimensions of each object that were not accessible to each other: JPEG's governmental nature (as I discuss below), the browser's position as a software assemblage with legal, political, IP and disciplinary implications for instance around cookies and datatracking (Elmer, 2002). These dimensions were never fully present or accessible not because they were in some way hidden by design so much as withdrawn by nature. But JPEG and the browser clearly did connect. What became clear was that they were mediated by a sensual object, an accessible browser interface object, the "window" on my iPad or in my eBook. It was this sensual object that served as the object and plane of connection. Similarly with JPEG's sensual dimension, a particular instantiation connected with a particular profile of the camera hardware, a particular material dimension of the chip and sensor accessible to electrical charges and data as information. This encounter was mediated through a real object, the camera's hardware. This object had hidden depths, withdrawn dimensions which these objects could not and need not access but that real object served as the asymmetrical plane of connection for the accessible sensual objects.

While my practice-research shows a Latourian actor network in operation as JPEG circulates within industry groups, businesses and photography, governmental and disciplinary networks, it also shows that the specific and particular connections happen not in some field of becoming, potentiality or relationality (ANT's network) but *within* other objects.

JPEG and materiality

The final theme of an object-oriented account of JPEG on which to report from my practice is that of materiality. As I argue above, perhaps Harman's theoretical framework can be usefully expanded when dealing with digital objects through the work of Jane Bennett. The question then become to what extent did a material dimension to the quadruple JPEG object appear in my practice?

It may seem odd to argue that my practice bore out my argument for a materialist strain of OOP. After all, I was looking at and working with immaterial protocols and standards, developing immaterial eBooks and image works and even building cameras from immaterial software apparatuses (such as screengrabbing). With all those seemingly immaterial, digital and machinic objects, where was the materiality? My practice indicated that those objects had and have a form of materiality through which their vibrant agentic capacity worked. The first and most obvious sense in which that appeared was in the carbon footprints of those technologies and the material traces of their manufacture. JPEG, JavaScript, Facebook's Social Graph are not carbon-neutral. They can never be fully immaterial. They are always enfolded within devices, technologies and chemicals, just as they are always enfolded in labour relations and globalisation. But in a second sense the objects I used in my work had a materiality. That materiality was different than Bennett's discarded glove or my iPad but the light-as-data-as-information flowing through my apparatuses and the global network was real and material like the photons that transgressed the Olympic Fence.²²⁴ That data excited sensors. That information excited algorithms. That information was bought and sold in marketplaces²²⁵. It was "farmed" and stockpiled in archives. This is not just an extended metaphor. The information, the software standards I was

224. In a number of images, I simply opened the pinhole to the sky over the Fence. For a discussion of photography and the sky, see Beck (2011).

225. Had I chosen to sell my Kindle and eBooks publications, that data and JPEG-encoded data would have had a material position within the information economy. Even as a "free" Book, that information had a position within that economy, not least in terms of its position within my PhD, my career and my University department's REF.

working with had a material charge as they worked and connected. Their agentic capacity and quadruple form was enfolded with the material technologies of distributed imaging but also the material physics of information and data.

Conclusion

By approaching JPEG as an object and then building and using apparatuses through objects, I found that objects, even “weird” ones like JPEG, did have real and sensual dimensions, that the relations between those dimensions were tensions characterised by fission and fusion and that while particular and discreet, objects *did* connect, relate if you will, but within other objects. While I hold that an object-oriented, quadruple account of JPEG provides not only an imaging but also an analytical methodology, it is important to show how an account of JPEG based around relationality, processuality and potentiality fails to account for my experience in practice.

I certainly found evidence of relations. Wherever I worked with JPEG I found the sort of connections that ANT draws attention to. Black boxes opened, relations expanded across the technosocial mesh of social imaging. What I did not find was these relations as outside objects. My apparatuses, the space of Facebook, my iPad were the sites of those relations and connections but they too were objects. They had a unity a multi-dimensional character, withdrawn and sensual dimensions. In Morton’s terms they too were “strange strangers” (2010b).

At first sight my practice seemed to show that the JPEG object has a processural nature. After all it was apparent in its running or instantiations. What became clear though was that the running was a matter of new tensions and connections not the smooth movement of a continuing process. Just as the evidence of my apparatuses within the mesh shows that objects connect, so the different JPEG encodings within the mash-up appeared as new objects. Each screengrab JFIF pulled in, each frame in the stream as a result of JPEG’s running was an object but so was the specific JPEG arrangement that gave rise to it. The dynamic form and content of the mash-up process was a matter of specific, discrete objects not the flow of process.

A processural account of the JPEG object could not account for the specific discrete operations of encoding in the apparatuses. Once again it is not that there is no “process” but rather than this must be understood as a matter of objects.

Again an account of object potentiality would seem to offer value. After all, as I discuss in terms of governmentality in the next chapter, JPEG, like Galloway’s TCP/IP - while seemingly a neutral standard - is run through with relations of power. Surely this is the character of objects that they harbour a potential that is realised in particular governmental situations and spaces, such as the Social Graph? This is of course where Harman and Bryant part company. It is clearly not a problem for Bryant to hold to an object-oriented ontology and still entertain the idea that objects hold something back. Harman differs and my practice bears him out. As I discuss above, Harman holds that objects do not hold anything back. There is no reserve. They are always and irredeemably present and actual. This is clear from my practice. JPEG is fully actualised (if never fully accessible) in the apparatuses. Even when it is absent (in the RAW or WebP encoding dimensions), it is fully actualised as an absent object. If it was holding anything back, harbouring future effects, the instantiations and connections could not happen. JPEG’s essence and eidos are actual in the present imaging and imagining. Governmental rationality as a matter of objects is actual now in JPEG’s relations and running. The only things the objects I worked with held back was their withdrawn real nature.

My practice-research has shown that Harman’s framework of a quadruple object that exceeds relations, approaches process as a matter of new objects and is actually powerful in its presence offers a coherent, powerful and also creative account of JPEG as well as powerful stimulus to creative practice. It is to that issue of power that I now turn.

Interlude: Robert Frank

'The photographing of America' is a large order - read at all literally, the phrase would be an absurdity. What I have in mind, then, is observation and record of what one naturalized American finds to see in the United States that signifies the kind of civilization born here and spreading elsewhere [...] I speak of the things that are there, anywhere and everywhere - easily found, not easily selected and interpreted. A small catalog comes to the mind's eye: a town at night, a parking lot, a supermarket, a highway, the man who owns three cars and the man who owns none, the farmer and his children, a new house and a warped clapboard house, the dictation of taste, the dream of grandeur, advertising, neon lights, the faces of the leaders and the faces of the followers, gas tanks and postoffices and backyards... *Robert Frank's original Guggenheim application* (Greenough & Alexander, 2009, p. 362).

Robert Frank's paper road movie *The Americans* (Frank & Kerouac, 2008) is a picture of American objects and those objects are, by the necessity of his project, ontologically flat, democratic - present but distinct and withdrawn. There are people yes, but also flags, jukeboxes, crosses, cigars, hats and cars – a Latour litany of human, non human and unhuman objects, vibrant, doing things in the world, material. The flat ontology, the materiality was necessary because Frank's project was a different sort of documentary. He was after "the Americans", not just American people or some abstract "America", but the Americans (human and unhuman) that as objects made up that mesh.

These objects were the presences he encountered on his journey and he made re-present in his book. These real objects had histories, material conditions of production and consumption. They had pasts but also presents and presence as the jukebox watched over the crawling baby, as the cars watched over the kids making out. Most of the photographs Frank chose for *The Americans* included people but this was no humanist or correlationist story. Where Edward Steichen's *The Family of Man* (Steichen & Sandburg, 1983) led with people, privileging the human over a material world of objects with which he struggled or for which she cared, Frank's people are

actants in a complex mesh of objects. The working class lift operator and waitress or the society aristocrat or movie mogul are objects alongside a Santa Claus sign or a fur stole. These objects are not semiotic markers of an underlying class relation any more than the human is an archetype. They are all objects in the complex assemblage of 1950s America connected and connecting not at some external representational scale but in real world materiality of serving drinks, being ignored by commuters or forging social and business networks. Frank is not external to this. He too is an actant. His shadow or gaze is woven into these object relations as it falls on windows or is returned suspiciously. There is no objective recorder or photo-journalistic position. There is only the position of object.

The Americans is a nested work. The objects in the coffee-bar or on the street are connected within other objects. The sousaphone-object, the flag-object and the Adlai-badge-object connect as object within the parade-object. There is no decisive object, no punctum driving the story or the meaning. These objects connect again and again with Frank within his camera-object, with the book-object. These connections are not located in some external realm of signification or practice but within objects that are themselves actants reconnecting within other objects.

The image-objects are not somehow different to the objects in the images. They are not more or less than those objects. They are just different. The photographs (or the reproductions of the prints of the negatives...) are objects now positioned in new object-relations with the bookmark on my desk, my words on the screen, the image search, the print-out of my chapter, the code of my own images, the protocols enabling those images.

Frank approached the objects in *Cafe - Beaufort, South Carolina* as actual presences. The jukebox, baby, chair, light and mat were fully present but exceeded their relations, qualities and accidents. He could not see nor photograph the quantum dance at the subatomic level within the jukebox glass, the baby's hair or the photons of light. He could not see nor photograph the rear of the jukebox. There was more to each object than the particular manifestation before his lens. The objects withdrew but it was in

that withdrawal that Frank could work. It was the fact that those objects were all equal ontologically and photographically that enabled him to take this photograph and make it work with all the others in *The Americans*. Most importantly each object was actual. It was not defined by its relations to any other, a plasma or a potentiality. The jukebox. The DNA in the baby. The wooden chair leg were all real, material and vibrant regardless of any other object. But there were connections. They connected with each other in the heart of other objects. The real baby object connected with the sensual floor object (a dimension of the floor object) within another object - the cafe-baby object that Frank connected with as he pressed the button and exists now as part of *Cafe - Beaufort, South Carolina*, the Google search for "Robert Frank" and this chapter. The objects are not just compositional building blocks, they are ontological ones too. And Frank's practice depends on them so he could create image-objects.

JPEG: the governmental object

Facebook and photography

It is possible to see, even from Facebook's own publicity, the importance of photos to the business. In 2008, Facebook announced users had uploaded 10 billion photos or 2-3 Terabytes of data-objects every day. The site had over one petabyte of photo storage and served over 15 billion photo images per day or 300,000 images per second (Beaver, 2008, n.p.). When it announced its new Haystack storage and management system in 2010, the company said:

Sharing photos is one of Facebook's most popular features. To date, users have uploaded over 65 billion photos making Facebook the biggest photo sharing website in the world. For each uploaded photo, Facebook generates and stores four images of different sizes, which translates to over 260 billion images and more than 20 petabytes of data. Users upload one billion new photos (~60 terabytes) each week and Facebook serves over one million images per second at peak. As we expect these numbers to increase in the future, photo storage poses a significant challenge for Facebook's infrastructure (Beaver *et al.*, 2010, n.p.).

In 2011, Pixable, a company building its own photographic social media business on the back of Facebook, claimed that 6 billion photos were uploaded each month, with 750 million posted over the New Year's eve weekend 2010/11. The company estimated Facebook had 100 billion images (compared with 5 billion on Flickr and 7 billion on Picasa). The company extrapolated this data (based on its 100k users) to claim that an average user had 97,000 images in their network (pixable, 2011, n.p.). Facebook's latest development "Timeline" (Lessin, 2011) is quite literally photo-led. The new design features a large photo across the top of the page.²²⁶

While of course Facebook is focused on textual data as raw material for its Open Graph (and therefore advertising strategy), image-data, particularly in the massive quantities it is processing, is increasingly important.

226. Daniel Rosenberg and Anthony Grafton trace the history of the timeline as a visual and discursive device, although the book was written before Facebook's particular imag(in)ing of the idea (2012).

In the Facebook Open Graph API, photos are an object which developers can access alongside any other data on Facebook.²²⁷ This is particularly true in terms of how Facebook allows and encourages users to add metadata or tags to that scopic datastore. Tagging has always been important to Facebook. Bret Taylor, formerly co-creator of Google Maps and the Google Maps API, CEO of FriendFeed and now CTO at Facebook said:

Facebook Photos [...] was not a great photo product by any standard measure. There were no original-sized photos. There was no printing. It wasn't developed like a traditional photo service. It just had this core piece of functionality - tagging - that made it the biggest photo product on the web (Cutler, 2010, n.p.)

The centrality of images, imaging and metadata to Facebook is also apparent from the patents it has filed and the lawsuits in which it is involved. In 2011 Facebook received a patent for tagging photos and other digital media.²²⁸ The patent, in a list reminiscent of Manovich's taxonomy lists the digital media "embodiments":

[D]igital media may include digital images, digital video, digital audio, digital audio visual media, computer games, digital books, digital text, and/or the like (Zuckerberg, Sittig & Marlette, 2011, col. 1 lines 57-59)

With this patent, as Goncalo Ribeiro puts it: "Static pictures have essentially been made social" (2011, n.p.). The patent moves from discussing tags within photos (as metadata) to how that facilitates interaction, social connections and the broader work of the Open Graph:

227. Facebook began using the term "Open Graph" for its particular understanding, and arguably exploitation of, the human "social graph" network at its f8 conference in 2010 (CBS News, 2010).

Facebook refers to the data it holds and allows developers to access and build applications around (and so feed new data back to Facebook) as "objects". Clearly this is drawn from the use of the term in computing rather than philosophy. With that said, it would be possible to consider Facebook's Open Graph and its Open Graph API from an object-oriented philosophical perspective where everything is an object connecting with other objects within objects. Such a broader account is beyond the remit of this project.

228. For a discussion of tagging as a motor of social relations, see Rubinstein (2010). For discussion of tagging and privacy from the point of view of technical design, see Besmer & Richter Lipford (2010) and on patterns in collaborative tagging, see Cattuto, Loreto & Pietronero (2007). For a semiotic discussion of tagging, see Huang & Chuang (2009).

A method comprising: receiving from a device of a first user information tagging an entity in association with an item of digital media, wherein the item of digital media is stored in a database; storing the association between the identified entity and the item of digital media; responsive to receiving the information tagging the entity in association with the item of digital media, sending a notification of the tagging to a device of a second user; and enabling the second user to reject the identification, wherein the identified entity is different from the first user (*ibid* col. 14 lines 49-61).

A similar connection between imaging and the Open Graph relationships on which Facebook's business is built appears in other patents under Mark Zuckerberg's name. In one concerning *Dynamically providing a news feed about a user of a social network*, the patent says:

The activities may include activities performed by the subject user e.g., add an affiliation to a group, terminate an affiliation with a group, add information to the profile, remove information from the profile, RSVP to an event, withdraw the RSVP, activate a mobile connection, add a note to the notes file, add a photo to own photo album, approve a relationship request, create an event, create a group, create a photo album, manually add a link, and the like (Zuckerberg *et al.*, 2010, col. 5 line 62-col. 6 line 2)

Here again, for Facebook, photos are more than images, they are objects whose object-connections in the form of the broader Open Graph are dynamic and integral to the business. In a patent for the new Timeline, photos and "relationships" are clearly connected. *Claim 5* states: "the social timeline further comprises photos of the members connected in relationship" (Sittig & Zuckerberg, 2010, col.11 line 41-43).

Photographs are talked about as being "utilized" as avatars but also as a way to "access specific timeframe data about the user relationship with the users in the photos" (*ibid* pp. col.8 lines 17-18). The broader mission of the Timeline, to "measure the roles and influences the users have on one

another" (*ibid* col.9 lines 17-18) is entwined with the user's photographic data and metadata on the site.²²⁹

Facebook, photography and governmentality

Photography on and through Facebook can be seen as a matter of governmentality. In a series of lectures in 1978 and 1979, Foucault opened up the question of "government" (2008; 2009).²³⁰ Here power is addressed as a matter of how government works as an activity or practice. While he is concerned with the forms of rationality and regimes of truth/power that offers answers to questions such as "who can govern", "what governing is", "what or who is governed" (Gordon, 1991, p. 3), it would be a mistake to read "governmentality" as a move away from his conception of biopower as a modulation of power different to that of discipline, one more focused on "care of self". In a lecture in 1982 Foucault says:

[I]f we take the question of power, of political power, situating it in the more general question of governmentality understood as a strategic field of power relations in the broadest and not merely political sense of the term, if we understand by governmentality a strategic field of power relations in their mobility, transformability, and reversibility, then I do not think that reflection on this notion of

229. A final proof that imaging is central to Facebook's strategy can be seen in the fact that other companies are seeking to challenge its legal position. In 2011, FotoMedia issued a writ against Facebook (as well as MySpace, Tagged and Memory Lane) arguing it held patents that allowed users to "upload, tag, and share digital media" (FotoMedia, 2011). Journalist Joe Mullin (2011) claims that FotoMedia is a "patent troll" a company that buys up or acquires patents and then exploits the US' confusing and arguably lax patent system (Blumberg & Sydel, 2011) by taking companies to court for infringement. Regardless of the status or legitimacy of FotoMedia or its claims, what is clear is that photos, photo management, photo tagging and photo sharing are central to broader IP and business battles and Facebook's position. Furthermore software, standards in the form of patents and protocols are at the heart of that. Similar proof comes in the shape of Facebook's pre-IPO purchase of Instagram.

230. It is beyond the scope of this work to address the debates around Foucault's work on government and indeed the subtle shifts in his conception of power. For the former see Keenan (1982); Burchell, Gordon & Miller (1991); Barry, Osborne & Rose (1996); Rose (1999); Lemke (2001; 2011); Bratich, Packer & McCarthy (2003); Jessop (2006); Gane (2008) and Dean (2009) and on the latter Nealon (2008). In terms of spatial rationality, see Rose-Redwood (2006); Crampton & Elden (2007) and Huxley (2006: 2007). For a critique of the concept as "top down" and marginalising struggle, see Kerr (1999). Government is also a theme picked up by Guins (2009) as discussed above. For a Foucauldian archaeology of photography, see Bate (2007). In terms of governmentality and film, see Grieveson (2009). For an early use of Foucault to discuss the Internet in terms of legal discourse, see Boyle (1997).

governmentality can avoid passing through, theoretically and practically, the element of a subject defined by the relationship of self to self (2005, p. 252).

A study of, or focus on governmental rationality is not simply a study of how government is organised, in our case how the state or Facebook governs or exercises power over us, but how that rationality, that focus on the “conduct of conduct” becomes part of our understanding of the state and Facebook but also ourselves - the relationship of self to self. It is here where the more interesting questions about Facebook and scopic power can be found and developed as a starting point for an account of JPEG’s position within those relations.

There is an increasing amount of work on the relations between social media space and practices such as Facebook and wider fields of identity, biopower and ultimately governmentality.²³¹ Lisa Nakamura has discussed what she calls “digital racial formation” (2008; Nakamura & Chow-White, 2011); E.J. Westlake draws on Foucault to address Facebook’s News Feed in terms of “performative surveillance” whereby Facebook users “perform themselves and offer themselves up for surveillance” (2008, p. 38), an issue, if not a conceptual framework, echoed by Anita L. Allen (2008) and Mark Andrejevic (2009). There has also been work that, while addressing Facebook practices via psychology, also addresses the notion of self and “conduct of conduct” that is at the heart of governmental rationality. Daniel Miller explores Facebook as a cultural practice (2011), Anabel Quan-Haase and Alyson L. Young have taken a uses and gratifications model to address how young people have used Facebook to organise themselves not just in a literal but also in a subjective or governmental sense (2010). The “social information” that they find as a key part of Facebook use is governmental. It is about organising one’s social position and network subjectivity as well as social events. Jane Lewis and Anne West’s study of Facebook users raises similar issues of how, what they see as young people’s “weak, low-

231. For an early use of Foucault to explore what became known as “social media”, in this case Usenet, see Aycock (1995). For more general explorations of governmentality software and identity, see Elmer (2002; 2004; 2008) and Cheney-Lippold (2011). For a discussion of databases, identity and power, see Aas (2004).

commitment ties” relate to wider social relations and ultimately notion of self and “conduct of conduct” (2009). The authors talk of “managing ‘friending’” with their respondents required “to manage the blurred boundaries between different sorts of friends, and between themselves and the unknown, wider audience in their networks” (*ibid* p. 13). Here again (governmental) management or organisation of the self is at heart of Facebook.²³² Studies that have focused on “narcissism” and self presentation within social networks such as that by Laura E. Buffardi and W. Keith Campbell (2008), Bernie Hogan (2010) or Andrew L Mendelson & Zizi Papacharissi (2010) can be seen as pointing inwards to a self-presentation but also outwards to a social-presentation and “social capital” (Ellison, Steinfield & Lampe, 2007) as can Rob Cover’s account of social networking sites as performative acts (2012). As Mendelson & Papacharissi say: “Facebook pictures are where college students visually play out their lives for each other, demonstrating their identity as college student” (*ibid* p. 32). My concern here is not to rehearse those arguments or even start from their position, but merely to note that the sense of Facebook as power-full and governmental in a wider sense than questions around privacy or surveillance, is widely considered.

Before I look at how JPEG is connected to these issues and how an object-oriented account of JPEG can help us address them, it is important to draw out more particularly, even technically the software instantiations of governmentality within Facebook. In order to do this I return to two Facebook patents and a technical paper from the company on photo storage and search.

Facebook and software governmentality

Facebook’s software does not act as a simple channel for governmental power. Following an object-oriented approach, the company’s patented software systems can be seen as objects within which other objects (including JPEG) connect. These objects are governmental. As they connect

232. Eli Pariser’ discussion of what he calls the “Filter Bubble” (2011) and Jonathan Zittrain and John Palfry’s work on internet filtering (2007) point to the material and technical underpinnings of these social and cultural practices of management of information and the self.

and enable to connect human and unhuman actants, structures, institutions, ideologies and subjectivities (the Latourian litany of objects), they set in motion power relations. Contra Latour, these do not define or exhaust the objects. They do not determine the objects' position through a field of relationality. But they are inevitably power-full.

Clearly as a legal document conferring rights and delimiting IP space within a competitive market, a patent is governmental. It is a part of a system of organising knowledge, information, even truth. But the technologies that it discusses - as well as the way it discusses them - are also issues of governing, of "conduct of conduct". Facebook's patent on *Managing information about relationships in a social network via a social timeline* (Sittig & Zuckerberg, 2010) and *Tagging digital media* (Zuckerberg, Sittig & Marlette, 2011) further suggest that the patent object can be seen as an object within which governmental objects (hardware, software, processes, practices, business strategies, human and unhuman objects) connect. The hardware/software mesh that these patents lay claim to - and that forms the basis for Facebook social practices and business - appears as governmental insofar as it is designed to trace and generate relationship objects through connecting and ordering objects. Furthermore those processes appear as dynamic, machinic, material and scopic. That mesh can be characterised, following Charles Babbage, as a "relationship engine". The patents point towards Facebook's development of (and proprietorial claim to) a system that enables and multiplies "social" relationships via a computational mesh. These relationships are positioned as themselves objects in a system that connects and orders them ultimately for data mining and advertising purposes. In the abstract to the Timeline patent, Facebook's engineers and lawyers agree on what they are building and laying claim to:

A system, method, and computer program for generating a social timeline is provided. A plurality of data items associated with at least one relationship between users associated with a social network is received, each data item having an associated time. The data items are ordered according to the at least one relationship. A social timeline

is generated according to the ordered data items (Sittig & Zuckerberg, 2010, col. 1 lines 42-48).

What is important about this phrasing is that “data items [are] associated with at least one relationship between users”. This is the core of Facebook’s business: forming a bridge between data and relationships, turning relationships into data (objects). The social timeline is “generated” from the data, and itself becomes a data object within the “relationship storage module” (*ibid* col. 3 lines 54-56). Furthermore, “a different social timeline can be generated for different communities associated with the user” (*ibid* col. 4 lines 4-6). Here relationships are dynamically created by user or by machinic action.

Any type of data can be utilized to generate the social timeline and to be displayed via the social timeline page. Further, some of the time identifiers may not have any names or events listed.

“The photos may be selected automatically, based on profiles associated with the users or any other data. The photos may be automatically updated when a user uploads or otherwise provides updated photos that the social network engine determines to be relevant to the social timeline (*ibid* col. 8 lines 21-30).

The human and machine actant-objects within the mesh generate relationships and connections and order data objects (including images) and those relationships. This ordering and connecting is governmental. It is governing and managing self, others and the self-others network as well as enabling self-government. The relationships managed, generated and governed by Facebook’s “relationship engine” are dynamic and productive. They suggest new timeline connections and thus relationships. They position images/subject positions by software action but also by encouraging and enabling us to do the discipline/governing ourselves - for ourselves or others.

Similar governmental practices of ordering and connecting (by machine, by self or by self and machine; by human or unhuman objects) are apparent in Facebook’s tagging patent (Zuckerberg, Sittig & Marlette, 2011). The patent, which uses the digital image as its core example, argues that the patented technology is necessary because of a desire for and to order.

Some social networking websites offer mechanisms that may allow the user to select particular photos or albums for immediate viewing. Typically, however, these photos are disparate and disorganized. In other words, the user must spend time visually searching through albums, photo by photo, for individuals or objects that are not presented in a coherent or consolidated manner. Often, many of the photos do not depict persons or objects of interest to the user. Just as often, the user remains unaware of the existence of some photos that were overlooked. What is needed is a method to organize digital media and automatically generate notifications to persons or entities interested in the digital media (*ibid* col. 1 lines 39-50).

This tagging, not just of the image as a whole but of sections of it, facilitates a form of ordering that the Foucault of *The Order of Things* (1989) would recognise.²³³ That tagging can again be human or machinic or a hybrid (where software offers “choices” to a human actant). While it facilitates an ordering of self, it also enables a governmental ordering of self and others. Tags connect users.

Clicking any of the previously used tags may associate the tag with the selected region. Clicking any of the entries in the friends list may associate the friend’s email address with the selected region (Zuckerberg, Sittig & Marlette, 2011, col. 8 line 66-col. 9 line 3).

The taxonomy (or folksonomy)²³⁴ of tags are part of the relationship engine’s work of generating the Open Graph. Tagging an image or part of an image can send a notification to another user of Facebook or someone outside, connecting or reconnecting what Google+ has called “circles” and what here are referred to as segmented communities (*ibid* col. 3 line 41). Images and tags become data elements or objects. What is more the connections themselves become data objects where “[t]he association between the digital image and the email address may be stored in the media

233. See also Geoffrey Bowker and Susan Leigh Star’s discussion of categories and standards (2000).

234. Folksonomy refers to a “bottom-up”, user or crowd-generated collection of tags or metadata. The term is usually credited to Thomas Vander Wal in 2004 (Vander Wal, 2007). For a discussion of the potential compatibility of folksonomies and formal ontologies, see Halpin, Robu & Shepherd (2007).

database" (*ibid* col. 5 lines 11-12). The governmentality here is more than simply labeling and positioning (or self-labeling and self-positioning) of population as data or information. It is the creation of a self-sustaining human-unhuman machine of governmentality. The relationship engine continually generates, or helps us generate, new orders, new connections, new relationships which are fed back into the engine as new data objects open to yet more orderings, connections and relationships. Ultimately of course this Open Graph becomes the engine for advertising and data-mining as well as surveillance.²³⁵

Images and imaging are a key part of that engine, as evidenced in both the timeline and tagging patents. They act as vehicles for ordering and connecting and relationships - self and self to self-management.

Facebook and machinic governmentality

What is important to note and is often missing from critical accounts of Facebook and power, is that this governmentality operates through a material, machinic (and I will argue) object-oriented apparatus. Here discipline, biopower and governmental rationality are enfolded in real material objects and technologies. The patents are necessary because the governmental engine being built is enfolded within the machinic. The timeline is generated by and through a "relationship storage module" (Sittig & Zuckerberg, 2010, col. 3 line 44); "social timeline module" (*ibid* col. 3 line 57) and a "display module" (*ibid* col. 4 line 9). These are not just modules in the sense of boxes on a patent flow chart but real material

235. Even leaving aside any potential state uses of the Social Graph, Facebook is happy to talk of "monitoring" as a core component of its technologies: "The monitoring module tracks one or more user's activities on the social network environment. For example, the monitoring module can track the user's interaction with one or more items of digital media, such as digital images, news stories, other users' profiles, email to other users, chat rooms provided via the social network provider, and so forth. Any type of user activity can be tracked or monitored via the monitoring module. The information, digital media (e.g., digital images), people, groups, stories, and so forth, with which the user interacts, may be represented by one or more objects, according to various embodiments. The monitoring module may determine an affinity of the user for subjects, other user's digital images, relationships, events, organizations, and the like, according to users' activities" (Zuckerberg, Sittig & Marlette, 2011, col. 4 lines 44-58). For discussions of monitoring and databases, see Andrejevic (2009) and Parry (2011). For a discussion of the US government's "Project Carnivore" surveillance programme (a project critiqued by Galloway and his Radical Software Group, <http://r-s-g.org/carnivore>) in terms of concepts of governmentality, see Ventura, Miller & Deflem (2005).

technologies, objects in a (computer as well as ontological) object-oriented sense. They are hardware and software meshes, built and housed in real locations, generating CO₂, protected by human and unhuman security. The “social network engine” (*ibid* col. 3 line 5) is not a metaphor. It is a real, material and machinic object.

Facebook’s IP lawyers make it clear:

The social network provider includes a profile database, a communications interface, a monitoring module, a media database, a display engine/GUI, an activity database, and an advertising module. Although the social network provider is described as being comprised of various components (the profile database, the communications interface, the monitoring module, the display engine/GUI, the media database, the activity database, and the advertising module), fewer or more components may comprise the social network provider and still fall within the scope of various embodiments (Zuckerberg, Sittig & Marlette, 2011, col.3 line 67-col.4 line 11).

These modules, engines, databases and evocatively titled “embodiments” are certainly business objects within Facebook’s strategy, legal objects within its IP portfolio and ideological objects within its brand, but they are also real and material. What is more they are nested. *Fig 3A* in the patent shows the “media engine” as consisting of an “album component”, a “digital media component”, a “digital image edit component” and a “tag component”. In turn *Fig 4* unpacks the black box of the “tag component” to show a “region selection component”, an “auto list component”, an “email component” and a “tag display component”. The governmental engine is revealed as a Latourian black box,²³⁶ as an object-oriented nested object - but a concrete, real one.

This is even more apparent when we consider Facebook’s solution to the real problems of storage, search and access that its self-perpetuating relationship engine generates.

236. Harman says: “While the term ‘black box’ is not of Latour’s own invention, he deserves much of the credit for importing it into philosophy. A black box is any actant so firmly established that we are able to take its interior for granted” (2009c, p. 33).

Facebook and scopic governmentality

Faced with the overwhelming quantity of image objects being added to, and generated by the site (Facebook software creates multiple versions of the images uploaded as well as storing copies in distinct locations (Beaver *et al.*, 2010)) as well as the data, metadata and arguably meta-metadata the relationship engine generated, the engineers at Facebook decided to redesign the image storage system, creating a system they called “Haystack”.

A key element in the commercial and governmental success of Facebook as a practice is that the ordering and connecting, the generating of new relationships happens as seamlessly, transparently and quickly as possible by “dramatically reducing the memory used for filesystem metadata, thereby making it practical to keep all this metadata in main memory” (*ibid* p. 4).²³⁷

The secret to effective photo storage and retrieval and so running of the “relationship engine” is metadata - creating, finding and serving scopic data points to enable new relationships.²³⁸ Leaving aside issues surrounding the company’s controversial exploration of face-recognition,²³⁹ what Facebook’s Timeline, tagging and other relationship services and practice do is deal with metadata. Users connect “images-taken-on-my-birthday”, “images-tagged-with-Charlie’s name”, “images-in-my-eBook-album”. This metadata can be organised, connected and governed, by me or by software. The key problem for Facebook and the most important aspect of Haystack, is managing or governing that metadata as a way not only of finding and serving images but also enabling relationships. The engineers identified that the existing system was slowing down because of the amount of (governmental) metadata

237. The engineers report that “in Haystack, each usable terabyte costs ~28% less and processes ~4x more reads per second than an equivalent terabyte on a NAS appliance” (Beaver *et al.*, 2010, n.p.). Here financial and user experience cost are seen as equivalent. It is interesting to note the governmental discourse of waste and efficiency that runs through Beaver *et al.*’s paper.

238. This separation of data and metadata can be approached from an object-oriented point of view with engineers as well as philosophers and media critics working with distinct, actual objects and their connections. Needless to say, however, that is beyond the scope of this project.

239. For discussion, see Pidd (2011). For a broader discussion of the legal implications of facial recognition technology, see McClurg (2007) and for a more technical discussion of the possibilities of finding images of people in crowd scene photographs through visual and contextual cues including time-stamps, see Garg *et al.* (2011).

associated with each image-object and the financial, storage and speed of access costs involved in having to access all that metadata each time an image was searched for or rendered. Their solution was to “keep[...] all metadata in main memory, which we make practical by dramatically reducing the per photo metadata necessary to find a photo on disk” (*ibid* p. 1). By making image objects in the system easier to find, resources could be saved for the social metadata that enables the relationship engine to function and new governmental relationships to be set in motion.

On a user’s domestic photo management system such as iPhoto, Aperture, Lightroom or Google’s Picassa, each photo-object is stored as a separate file - visually apparent in the PC’s directory structure or Finder. This results in a lot of metadata. Each image has its own location as well as any other metadata (time of creation, time of modification, owner etc). With a small-scale archive on a PC, this is not a huge problem. On a social archive, it is. Facebook needs to keep that metadata in memory to allow quick and easy access and connection. Haystack’s solution was to store multiple photos in a single file and therefore maintains very large files. The system then works with “needles” and “index records”. “Each needle represents a photo stored in Haystack” (*ibid* p. 6) complete with the metadata supplied at upload.²⁴⁰ Searches however are not on the metadata in the JPEG-encoded files or even the needles but on an index record.

There is a corresponding index record for each needle in the haystack store file [...] The index file provides the minimal metadata required to locate a particular needle in the haystack store file [...] The main purpose of the index is to allow quick loading of the needle metadata into memory without traversing the larger Haystack store file, since the index is usually less than 1% the size of the store file [...] Storing photos as needles in the haystack eliminates the metadata overhead by aggregating hundreds of thousands of images in a single haystack store file. This keeps the metadata overhead very small and allows us to store each

240. The authors continually elide between “photo” and “file” or “data”. Such language is clearly interesting in terms of the ontology of image/data objects and issues of discourses of representation. I use Facebook’s language here while recognising it as problematic.

needle's location in the store file in an in-memory index. This allows retrieval of an image's data in a minimal number of I/O operations, eliminating all unnecessary metadata overhead (Vajgel, 2009, n.p.).²⁴¹

It is "minimal". Space and computing power is used to connect those objects, set up governmental relations. In simple terms, each discrete photo is mapped to a needle which is in turn mapped to an index record. Each mapping makes the data smaller, more manageable and more connectable.²⁴²

It is important to emphasise that this "system" is materially located - a series of actual, material, connected objects. The Haystack architecture consists of the Haystack Store, the Haystack Cache, external CDNs (content delivery networks, often hosted by an external company) and the Haystack Directory. The Store, the persistent storage where "photos" are stored, consists of arrays of 10 terabyte web servers (materially present and real), which the system divides into 100 physical volumes each of 100 gigabytes. These physical volumes are grouped into "logical volumes" across different machines. This allows for protection against data loss due to hardware or software failure. A photo object uploaded to Facebook is resized into four different sized image-objects (via the JPEG protocol) and stored on a logical volume and written to all corresponding physical volumes. Haystack retains external CDNs but adds a Cache, an internal CDN "which shelters the Store from requests for the most popular photos and provides insulation if up-

241. Vajgel, one of the Haystack engineers, also says: "The main requirement for the new tier was to eliminate any unnecessary metadata overhead for photo read operations, so that each read I/O operation was only reading actual photo data (instead of filesystem metadata)" (2009, n.p.). Of course the system is not reading the JPEG-encoded "photo data" so much as data about that "photo". The metadata being left out is about the filesystem.

242. There is an interesting object-oriented parallel with the way JPEG compresses space and data through DCT and Huffman coding.

stream CDN nodes fail and need to refetch content" (*ibid* p. 4).²⁴³ The Cache includes copies of the most frequently requested files. The Directory (note again that this is materially located within a software/hardware mesh, it exists somewhere in Facebook's server farms) does not store "images" but rather keeps track of the logical to physical mapping, any free space available on the volumes and the metadata necessary for the browser to construct the URL for an image.

This architecture establishes particular scopic and necessarily governmental practices when a user uploads an image to become an object within, and generator of, governmental relations. Beaver *et al.* acknowledge this human object dimension when they turn from an account of their computer architecture to the user experience of that material mesh (*ibid* p. 4). They explain how a user uploads an image to Facebook and the Social Graph as well as how a "friend" accesses it and so sets a "relationship" in motion.

When I uploaded the "pages" of my eBook to my Facebook album, I sent the data to a web server where it was re-encoded through JPEG in different sizes. The server contacted the Directory for a write-enabled logical volume to store the files upon. It then assigned a unique id to the file and uploaded it to each of the physical volumes assigned to the logical volume. Here a "photo" becomes a data as well as metadata object for Facebook and for the user's "profile". It is ready to connect with that profile, the Timeline and whatever tags become associated with it. It is integrated into and set to generate relationships, organisations, connections and data trails. When my examiner seeks to read my eBook,²⁴⁴ his browser sends a request to the

243. JPEG-encoded files (or, as Beaver *et al.* refer to them, "photos") are cached after retrieval from the Store or CDN only if the request comes directly from a user and the photo is fetched from a write-enabled i.e. more current Store machine (As Directory and Store "machines" become full, they become read-only). The authors report that "photos are most heavily accessed soon after they are uploaded and filesystems for our workload generally perform better when doing either reads or writes but not both. Thus the write-enabled Store machines would see the most reads if it were not for the Cache. Given this characteristic, an optimization we plan to implement is to proactively push recently up-loaded photos into the Cache as we expect those photos to be read soon and often" (2010, p. 5).

244. And of course download a copy to his or her browser cache,

Facebook server (for a page including an image). That server, contacts the Directory which creates a URL for the JPEG-encoded image file held in the Store and/or the Cache and/or the CDN.²⁴⁵ The URL that is used to locate the file destined to be Liked on the user's page takes the form:

*http://(CDN)/(Cache)/(Machine id)/(Logical volume,
Photo)*

It is designed to enable Haystack to “find” and render the file (via the JPEG decoder built into the browser).

The first part of the URL specifies from which CDN to request the photo. The CDN can lookup the photo internally using only the last part of the URL: the logical volume and the photo id. If the CDN cannot locate the photo then it strips the CDN address from the URL and contacts the Cache. The Cache does a similar lookup to find the photo and, on a miss, strips the Cache address from the URL and requests the photo from the specified Store machine. Photo requests that go directly to the Cache have a similar workflow except that the URL is missing the CDN specific information (*ibid* p. 4).

The URL can be seen as governmental. It is an object created by Haystack (a material hardware/software mesh) that does things in the world. It orders data for the users and the system. It facilitates scopic and governmental encounters and relationships. As an address that can be used elsewhere on the Web or posted, mailed, tweeted etc. it generates new (governmental) data, data trails and data relationships.

In terms of issues of governmental rationality, the Haystack system underpins the “relationship engine” in terms of ensuring that images and image data seamlessly and efficiently allows the organisation, management and government of self and social relations. Without Haystack's technical infrastructure, its concrete material instantiation in server architecture, standards of encoding and metadata, hard drives and light-as-data image

245. The aim of Haystack is to make sure that images are held, and available for connection, in whichever space is most beneficial to the user and the relationship engine.

file-objects written in/on it,²⁴⁶ profiles, timelines, “friendships” and the panoply of Facebook’s Open Graph would not be possible. Haystack provides the techno-scopical underpinning for the relationship engine, the Open Graph and its governmental rationality.

Reading the relationship engine in terms of objects

An object-oriented account of this governmental relationship engine allows a technically located, materialist conception of how that engine is built and operates but also allows those material objects to be seen in relation to other human, unhuman, abstract, even virtual objects.

As has been noted the engineers think in object terms. The lawyers’ discourse too is object-oriented. The “modules”, “machines”, “databases”, “fields”, “needles”, “files”, “data” and “metadata” as well as the tagging, ordering and connecting associations detailed by both are objects on the pages but also on material servers. Where Harman’s framework adds value is firstly in opening up the scope of the objects that make up the engine and secondly in explaining how they connect as a matter of objects not some wider field. In short it enable us to see Facebook’s governmentality as a matter of objects not as the outcome or result of an external governmental rationality.

From Harman’s perspective what we see in Haystack, the Timeline and the Open Graph is objects connecting within objects. The objects discussed above and familiar to the engineers and lawyers are joined by the Facebook user-object, the photographer-object, the Facebook brand-object, the “friend”-object, the “Like” object (Gerlitz & Helmond, 2011) - a whole collection of objects within and without Facebook. All have a real dimension that withdraws. We can never access the totality of the “relationship storage module”, the “needle” or the “identifier”. We encounter its sensual dimension as we (human user, software algorithm, image data etc.) expand energy on it. But those objects have real dimensions outside of our relation to them. The Haystack has a reality “beneath” the

246. My language here is deliberately tentative and perhaps confusing because following Matthew Kirschenbaum (2008), I seek to draw attention to the very real, material and yet subtle physical operation of read/write media.

shifting accidents as we walk around it or encounter its particular instantiations. But those wider objects in play have that dual character too. The Facebook brand, the Open Graph are not just ideologies floating in the abstract. We encounter their sensual dimension as they are realised in the world but they have a reality, an *eidos* that I can intellectually approach (see above) and an essence (fundamental characteristics that make them what they are). They also connect as objects within other objects: the state's surveillance, an IPO or a company's marketing programme. When we come on to look at how objects connect, we realise that engineers actually have a lead on philosophers. For the developers of Haystack or the creators of Timeline, objects connect within objects. The "network" is nothing more than nested objects: components connect within engines, metadata objects connect within indexes within servers within... For them this is a matter of engineering reality. Harman would see the same thing. Objects connect within objects. There is nothing outside objects. User-objects and governmental "self"-objects connect within profile-objects, connect within timeline-objects, connect within Open Graph-objects, connect within...

What Harman would add is that those object never *fully* connect. Real can never connect with real, sensual with sensual. Objects connect through mediating objects. There are "real" Facebook users and there are real Facebook "users". From an object-oriented point of view, both the flesh and blood human and the social media "user" have a reality. As objects they have a real dimension that withdraws and can never be grasped in its totality. The relationship engine (and Facebook's business depends on connecting them. One has real money to spend, one a data position to be sold and managed). These real objects connect within an object. They are mediated by a sensual object, one that *can* be accessed. In this case they connect (or are connected) within the Open Graph and Timeline (sensual) objects. These objects, while also having real dimensions that cannot be fully accessed also have a sensual dimension that is available for access as long as energy is expended on it - literally in terms of the user being logged in and also ontologically in terms of objects relating to it.

Similarly that real Timeline, the unfathomable software/hardware object that has more to it than we can access (governmental powers, real qualities that define its essence etc.) mediates the connection between the sensual dimensions of Facebook objects. The particular profile (another ontological-computational language parallel) of me as a user, that instantiation as “Close Friend”, “Family Member” or whatever I or Facebook’s database define it,²⁴⁷ connects with another user’s sensual profile or the particular instantiation of a marketing company’s demographic target, is mediated through that real Open Graph. It is not just human objects that Facebook connects.

Facebook as relationship engine, as an issue of governmental rationality, surveillance, sousveillance (Dodge & Kitchin, 2007; Bakir, 2010; Ganascia, 2010), power, psycho-cultural practice or any other framework by which it is explored, is a matter of objects not of some meta-field of becoming, processuality or determinacy.

The question then become how does the JPEG object fit into this mesh. My aim is not to argue that JPEG is the only protocological object in play within Facebook, its business and IP struggles or their governmental or disciplinary effects. Facebook connects with other standards objects. Users can upload GIF, PNG and TIF-formatted files. But JPEG does have a privileged position. In order to explore that, I turned to my practice.

Facebook, photography and protocol

When I uploaded any of my images (whether originally JPEG-encoded or not) to Facebook, they were re-encoded through JPEG as four-different size image files within Haystack. JPEG as an object connected with the uploaded data if it was in a format Facebook’s upload software could read. JPEG was not the only protocol object in play. PNG, the format of my screenshots, could connect with Facebook’s software (including JPEG) but WebP and RAW could not. When I “published” one of my eBooks on/in Facebook, the encoded image files of the pages (including the photos) were added to my

247. Facebook “encourages” users to tag their Friends according to a taxonomy of relations. These may parallel how I define myself or not. From an OOP perspective both are sensual profiles, particular subjective instantiations. The interesting thing of course is that Facebook’s taxonomy also has a real dimension as data points are created and used on the Social Graph.

Facebook profile, my Timeline.²⁴⁸ As discussed above, I tried to upload RAW and WebP-encoded versions of the pages, and failed.²⁴⁹ In the dialog box that opened, I could see the files on my computer. JPEG-encoded and PNG-encoded files were visible. Their names were black. I could select them, add them to the waiting list and upload them to my account/Timeline/profile, tag them and make them part of the government of (my)self on the Open Graph. The RAW-encoded and WebP-encoded objects however are “greyed out” - a symbolic lesser status. They fade into the background. Inaccessible. Invisible. They are locked out, unavailable for networking, tagging, recognising, data-mining, integrating into and exploiting (or being exploited by) the power of the Open Graph. My imaging was about encoding and then sharing and connecting light-as-data through standards. When I built that apparatus with JPEG, it worked fine. Light became social data. When I didn’t... it didn’t. Light became unsocial data.²⁵⁰

It is not that Facebook’s upload software-object fails to connect with RAW. Rather it connects in terms of failure, rendering a greyed-out name that creates a new object: a “cannot upload object”, a “blank photo album object”. RAW and Facebook’s algorithms are part of the same object-mesh. They connect in the heart of a new object, a non-searchable, non-taggable, non-networkable, “failed upload”-object which is still real and powerful - it is part of this PhD for instance. This is not semantics. It is important within OOP that we do not narrow down the range of objects in play or their connections. Just because the RAW-Facebook connection is not the same “successful” connection as the JPEG-Facebook one does not make it any less real or important. If one were to build a Facebook marketing strategy around images of products encoded by the RAW protocol, that “failed-upload”-object would be very important. Similarly if one were looking to image

248. I use the term “my” advisedly.

249. For a discussion of “failed” image searches, see Pu (2008).

250. I use the term “unsocial” in the same way I use the term “invisible” (see n. 183) to draw attention to the sense in which the data is somehow “outside” a particular social mesh. It could be “social” within a different mesh.

outside the social web, data-mining and Facebook's hegemony, "failure" would be an important mark of a successful mesh.

JPEG is enfolded in Facebook's Open Graph, Timeline and its governmental work. Its sensual dimension connects with the sensual (accessible) dimension of other software (the upload algorithm) and hardware (the Haystack, Timeline and tagging modules and servers) within a real, withdrawn, governmental Open Graph object. Its real dimension connects with the withdrawn dimensions of Facebook as a business object, the inaccessible dimensions of the "user", within a particular sensual instantiation of the Timeline. Similarly RAW is enfolded with the same objects in terms of its technical failure to connect. The sensual dimension to RAW connects with the the sensual (accessible) dimension of the upload algorithm, within the real Open Graph. If it did not, it could not have returned a failure warning. Similarly its real dimension connects with the real Facebook business object again as a "failure warning", an exclusion from the social imag(in)ing system Facebook has set up, that it can manage and can exploit. Its exclusion is just a different form of connection. The important thing is that RAW *does* connect ontologically if not technically. The fact it is rejected is as relevant as the fact JPEG is accepted. Both connections are enfolded in the mesh that is Facebook's social imag(in)ing systems and its government of the self.²⁵¹

Conclusion

JPEG, not just JPEG-encoded files, is enfolded with Facebook, its technologies, material infrastructures, IP, datamining, advertising and business practices. As such, as it connects with the panoply of objects in play in the relationship engine's Open Graph, it has governmental implications. So much is clear from from an analytical and a practice-research point of view. To see that with OOP eyes is not to position JPEG as

251. One could of course discuss the connection between JPEG and/or RAW-encoded image files and Facebook's software but the JPEG and RAW standards also connect or "fail" to connect within the (social) digital imaging pipeline and so the imag(in)ing mesh. An example is those photo library applications that enable direct uploads to Facebook. Here JPEG's presence as an encoder within the software connects with Facebook's upload software.

a determinant, to overmine or undermine its position with relation to governmental rationality. Rather it is to ascribe it a position alongside that panoply of human, unhuman, structural, infrastructural and superstructural (to use the old-fashioned terms) objects, all of which connect and re-connect within objects through the tensions of their sensual and real poles.

To say that “JPEG is governmental” is a power-full statement and, I would hold, accurate. But it is only as accurate as to say that “the Timeline is governmental”, “the inode is governmental” or “the Facebook Like is governmental”. What OOP offers us is a perspective that refuses to leave any object outside of power.

Conclusion: by way of an Exploit

This project began with Barthes staring at a photograph, unable to clearly position it as text or practice, unable or at least unwilling to account for its power through his existing conceptual apparatus. *Camera Lucida* famously continues as a meditation refracted through another (unseen) image-object, a photo of the author's dead mother. My project began with a similar gaze. Looking at JPEG I too was as at a loss for a vocabulary appropriate to something that, while clearly powerful, remained elusive. Again like Barthes I have sought to meditate on JPEG, in my case refracted through practice. This is a practice-research project. Practice is not an illustration of my thought, nor theory and analysis of my practice. Rather I have sought to bring my object-oriented photography and object-oriented philosophy together in object-oriented practice-research. By doing so I have looked to explore the character and workings of JPEG within my own practice but more widely within social digital imaging and archiving. The OOPh eBooks, the commentaries on photographers scattered throughout this thesis, the JPEG-encoded images and RAW-encoded "non-images", the mash-ups as well as the written chapters are all objects connecting within the heart of that practice-research object.

In a paper I published early in this research, before I fully developed an object-oriented account of JPEG, I argued:

In his great unfinished *Arcades Project* (2002) [Walter] Benjamin collected fragments of material about the nineteenth-century Paris Arcades. He brought together (mashed up one might say) traditional historical information with what he called the 'rags 'n refuse' of the everyday. He built an analog database of file cards with quotations, aphorisms and historical details perhaps with the aim of producing a traditional linear book but also, as with his earlier *One Way Street* (1997), of writing history in a new way.

The Arcades Project can be seen as a form of data mash-up, an exploit opening up the process of writing history. In Benjamin's hands the 'rags 'n refuse' - the advert, the window display, the fashions - are 'black boxes' that unfold

to tell the story of a particular moment in the history of capitalism. The fragment is his protocol. It gives his work its particular form in the same way that JPEG generates the form of Flickr-space.

One could argue that Benjamin's collection offers a fragmentary view of history where structural processes of capitalist development are hidden by a kaleidoscope of signs which are made the centre of attention by his method. Likewise, mash-ups of 2012 imaginings could be seen as distracting critical attention from the workings of globalisation. I would argue that the two mash-ups tell the story (as Latour might express it) of the Paris Arcades or 2012 in a way that avoids determinism and pays attention to the specificities of the actor-networks at work in those complex historical moments and processes. Furthermore, in terms of critical intervention, Benjamin would argue, colliding fragments in his database of file cards or a mash-up app, creates a Brechtian-style montage that shocks the viewer and sends meanings and significations spinning.

The protocols (the 'fragment' or JPEG/XML) hold within their black boxes the potential to 'hide' history but also to open it up, as an exploit. The same protocols that can underpin ideologies of consumerism and capitalist development, legacy and participation can set in motion mash-up/ dialectical image montages that destabilise that hegemony (Caplan, 2010, p. 35).²⁵²

This project moved beyond the creation of imaging mash-ups (what became one of my apparatuses) to take that idea of fragment/object-oriented philosophy and practice across the project as a whole. I would assert, as I did in 2010 that this offers critical potential in terms of developing an account of JPEG but also launching an exploit within photographic practice and within the PhD thesis object. Approaching JPEG as an object has allowed me to not only understand its withdrawn and yet deeply networked character as well as its presence within governmental spaces and objects such as Facebook's Open Graph, it has also enabled me to develop a

252. It should be noted that this paper, with its more Bryant-like embracing of protocol "hold[ing] within their black boxes" a potential for exploit, was written before I explored the critique of potentiality outlined above. As my practice moved on, so did my thinking. I would now argue that the position of exploit is not dependent on hidden potential but rather can be accounted for in terms of actuality and object connections.

particular form of object-oriented imaging. I would assert that OOPh can be seen as acting as an Exploit within digital imaging.

My OOPh practice problematises the traditional ontological hierarchies and discourses of representation and relationality that dominate photographic practice - even in new digital art practices where the network field of relationality and becoming, the imaging process and the potential image are key themes. My practice widens the cast of actants to include myself as breathing, shaking object; Facebook and its patented Timeline; light photons with no respect for security fences and of course JPEG. All are in play. All are equally real, present and fourfold. OOPh is unwilling to privilege the technology, the artist, the medium or the Subject. Such a flat ontology takes the logic of “the democratic art” (whether in terms of the rhetoric of William Eggleston or the hype around social imaging and “citizen media”) and turns it back on itself. The OOPh Exploit, like Galloway and Thacker’s virus remains within the mesh, pushing its logic into a liminal space where the Subject, the image, the photographer lose whatever privilege they claimed or was granted to them by structural actants such as Apple, Tate Modern or a practice-research PhD.

Similarly I would argue that the object-oriented focus of this project (in terms of theory, practice and methodology) has, like Benjamin’s mosaic, through connecting and reconnecting object-fragments, problematised the writing of media. As I discuss in my *JPEG Object in Practice* chapter, practice-research claims to explore new ways of writing (and judging) media. Amerika’s remix the book project and Bogost’s software works have challenged the dominant (and lately powerfully governmental) discourse of what counts as research. By working with and through objects, by allowing a panoply of actants a place in my work and submitting a fragmentary mosaic of objects, I look to follow their lead but also follow Benjamin in making the form of my work as important as the content.²⁵³ Like Benjamin I look to my

253. For discussions of the relationship between Benjamin’s method and imaging/visuality, see Buck-Morss (1989). Also see Gunning (2003) on Möbius strip-like topographical views; Dubow (2004) on a particular Judaic conception of vision, and in terms of Benjamin’s archive, see Leslie & Marx (2007). On montage as a method in *The Arcades Project*, see Doherty (2006).

palimpsest to act as Exploit, to work within my discipline but allow the writing to undermine by overwhelming. Benjamin's mosaic of fragments: character objects like gamblers, whores, mirrors, dust, wax figures and mechanical dolls; trace-objects like quotations and textual ephemeral; the interwar equivalent of tweets and anything else he collected, like Barthes' fractured analysis in *Camera Lucida* were not just merely a response to complexity but the development of a form appropriate to that object-mesh.

Perhaps the reason that *The Arcades Project* and *Camera Lucida* have such a pull for academics is because they act from within the academic mesh to overwhelm them by their own logic. Like Galloway and Thacker's Exploit it is not a gesture but a "swarm, the flood" (2007, p. 98). There is too much in *The Arcades Project* and *Camera Lucida*. There are too many objects.

Benjamin's form and Barthes' tone while remaining within their respective meshes overwhelm not just the reader but the mesh itself. Like a virus they set off new connections, configure new objects, replicate and reconfigure "history" and "photography". Similarly I look to my photos, mash-ups, eBooks, interludes and chapters to collide and connect within other objects, to disturb as "dialectical images". My aim is to analyse objects, work with objects and use objects as a way of doing practice-research. By approaching those objects as having a fourfold character, as withdrawing from access but at the same time real, connected and present; by writing through and with a flat mosaic of objects, I look to open up a space for those connections and dialectics, question the scale of analysis and the scope of praxis and so create an Exploit.

Epilogue

As part of my experiments with JPEG, I looked for an imaging practice that was “beyond JPEG” not just in the sense of being analogue, but in terms of being outside the governmental meshes I identified. I used a 1950s stereo camera, the Belplasca and the last remaining rolls of Kodachrome 64 slide film (the film and processing were discontinued in November 2010) to take OOPh images.

The resultant “stereo” slides were one-offs. Of course they could be copied but as with all analogue media, the “quality” would degrade. Furthermore as Kodachromes they were “unique” and irreplaceable. What is more they could only be viewed through a stereo viewer, one image, one viewer at a time. They were not viewable or shareable online. Even if they were scanned and output as JPEGs or, through software (such as Fuji’s MPO “3D image” format - essentially a pair of JPEG-encoded files) as a “3D” image, they were not the image or scopic experience I intended.

The scopic object and experience was particular and unique, it could not connect with JPEG.

I include a unique stereo Kodachrome slide with each copy of this thesis.

Appendix: the memory card

The practice at the heart of my research and discussed in this report consisted of my OOPh experiments with a digital pinhole camera, mash-up and eBook imag(in)ing apparatuses. It was in the practice of creating and using these apparatuses that JPEG's quadruple form became apparent. I could have chosen to just present the report on those experiments. Instead, I have chosen to include the eBooks (and therefore the mash-ups and images) with this document. Although, as I have noted above, OOPh and my practice research are not about the final (sic) products - images or eBooks, I include these "works" as philosophical objects, as ongoing theoretical works, that open up JPEG's quadruple form and weird workings for any reader who "reads" them. As such the image files, eBook files etc. could be the subject of an OOP analysis, exploring their quadruple forms and the way they connect. As discussed, my intention has not been to explore those objects but the JPEG standard with which they connect.

I include the eBooks as objects that, like all objects, must be addressed in their specificity and actuality. As objects they have a reality that exceeds their relations within my work. The objects on the "memory card" continue as experiments. Following Bogost's idea of "carpentry" they are also theoretical works themselves - not illustrations of my theory nor just source material for it, nor even a record of my own practice. As with the images and imaging apparatuses, they were and remain the vehicles of the theory. I "crafted" a range of eBooks as objects where JPEG and RAW/WebP standards in authoring and viewing software, servers and hardware meshes connect or fail to connect with other objects. It was that practice that opened up the black box of JPEG for me to explore (and on which I report). The book objects attached here continue to do the same philosophical work for objects encountering them, connecting with them or even using them as imag(in)ing apparatuses.

the eBooks

I chose to use the OOPh sections of this work as the material for my eBooks. This obviously included the images, mash-ups and remixes I crafted

within my practice-research but also the text that forms the “interludes”. In order to remain focused on images and imag(in)ing I chose to render/encode that text as image files.²⁵⁴

The objects I chose to use to “craft” my eBooks were:

- 60 digital pinhole imag(in)ing objects encoded with the JPEG standard
- 60 digital pinhole imag(in)ing objects encoded with the RAW standard
- 60 digital pinhole imag(in)ing objects encoded with the WebP standard
- 2 mash-ups generated via JavaScript and server-side software²⁵⁵
- 4 “text-as-image” imag(in)ing objects (each of the “interlude chapters”)

encoded with the JPEG, DNG and WebP standards.

During this project I created and worked with other images and mash-ups such as the geolocation and augmented reality screengrabs I discuss in my report. These do not form part of the eBooks although as images I have added to Facebook’s Haystack, Flickr and my Blog, they may end up as parts of the image-search mash-up.²⁵⁶

As discussed in *The JPEG object in practice* chapter, I chose to publish my project in five formats (an Apple iBook, a Kindle book, an Evernote “notebook”, a Facebook album “book” and an HTML Webpage “book”) to investigate how each connected with or failed to connect with the different data objects.

The eBooks are included on an imag(in)ing apparatus “memory” card.

The eBook document (iBook and Kindle)

There is currently a format war in the rapidly expanding ePublishing industry as the open standard ePub, Amazon’s proprietary Kindle format, Apple’s iBooks format and newer HTML5 formats battle for market share and

254. There is an interesting parallel with the way vector-software Adobe Illustrator can trace text and make it a vector “object”.

255. The JavaScript for the mash-ups was made available at <http://tutorialzine.com/2010/02/photo-shoot-css-jquery> and <http://www.zurb.com/playground/rapid-prototyping-with-flickrbomb> as well as <http://jquery.com>

256. They can be seen on my Flickr photostream <http://www.flickr.com/photos/content2bdifferent/>

acceptability. Where of course an ANT framework would see these struggles as proof of the importance of the number and extent of relations in determining an actant's power, an OOP perspective addresses the objects in play and their connections within hardware and software objects as well as cultural-practice and business/brand-objects, as the important issue. By encoding my work in the various frameworks, I looked to investigate how JPEG connects with those meshes.

Technically in terms of the Kindle (*.mobi*) and the iBooks (*.ibooks*) files, both formats are variations on the standard *epub* format. Issues surrounding these formats, standards and protocols are beyond the scope of this project which is around how JPEG connects or fails to connect with these meshes. My experience of creating *quadJPEG.mobi* and *quadJPEG.ibooks* is however instructive.

Kindle (quadJPEG.mobi)

In order to create an eBook for the Kindle (using the *.mobi* format²⁵⁷) I created a simple HTML page with HTML `` links to the three sets of differently encoded image files. The Kindle eReader available in the UK (not the Kindle Fire tablet which is unavailable in the UK) cannot read (or connect with, as an OOP approach would have it) JavaScript files so if I wanted my HTML file to compile as a *.mobi* format eBook, I could not include the HTML code necessary to make my mash-ups visible. Although the Kindle could have connected with the JPEG-encoded objects brought into the mash-up, the "failed" connection with the JavaScript meant the Flickr, Google, Bing, Yahoo image searches and the Artviper server-objects were inaccessible.

Having created the HTML file (and the two XML files necessary to encode the eBook) I attempted to connect those objects with Amazon's *kindlegen* software. When the software "reached" the first RAW-encoded file and attempted to connect with the non-JPEG objects, it "failed". In order to

257. The Kindle uses files encoded using the *.mobi* and *.azw* standards, both proprietary to Amazon and each of which allows DRM "protection" for books sold through Amazon's store. It has also developed a *.kfb* standard for its new Kindle Fire.

encode the eBook I needed to remove the non-standard objects and the links to them. When I did I could encode the eBook.

I then tried using the Open Source *calibre* software to convert the HTML package. This eBook software object could connect with the HTML file and while it too “failed” to decode the RAW/WebP-encoded objects, it did not fail to create a viewable eBook. That eBook - the object that my Kindle object connected with - includes the JPEG-encoded but not the RAW and WebP-encoded objects. It is not that the Kindle device could not connect with them. It did not even get the chance as other software intermediary objects failed to connect and so did not include them. It is this *calibre*-encoded Kindle file that I sideloaded²⁵⁸ onto my Kindle and include on the memory card. As a further experiment to see how JPEG-encoded, RAW-encoded and WebP-encoded objects connect or fail to connect with the Kindle-object, I sideloaded the complete set of images into a folder called *quadJPEG* within a *pictures* folder on the device. In a little-known feature of the Kindle, this creates a picture viewer. By pressing Alt-z, this *quadJPEG* is added as a book on the home screen. When this is opened, the device-object, operating system-object, screen-object connect with the JPEG-encoded files, decoding and rendering them visible, but fails to connect with the other digital objects.

iPad (quadJPEG.ibooks)

The iBooks format is an Apple-adapted version of the *epub* standard (Glazman, 2012) and the iPad can read *epub* books. I could have re-encoded my HTML, CSS and JavaScript “package” as an *epub* file. I chose however to use Apple’s new *iBooks Author* WYSIWYG software to create an eBook. By using this software (positioned as Apple’s attempt to popularise, and arguably dominate, the creation as well as the consumption of eBooks)²⁵⁹ I could explore how the JPEG object connected with an authoring programme object as well as the browser and server software

258. To sideload means to transfer files directly onto a device as a mounted disc or volume rather than using the App/Kindle store etc. These issues of “official” and “unofficial” channels could of course be explored as a matter of objects but again, they are beyond the scope of this project.

259. See notes 195 and 225 above.

objects in the other eBook experiments. As I used the software, I found that I could add RAW-encoded *.orf* files to the page. When I disassembled the *quadJPEG.ibooks* file (essentially a zipped *epub* archive), I found that the software had stripped the JPEG preview embedded in the Olympus *.orf* file and used that as the image file. It could not do this with the WebP or DNG-encoded files as there was no JPEG-encoded preview.²⁶⁰ Again, in terms of my practice-research, it was the JPEG protocol object that was facilitating connections, visibilities and the wider proprietorial and governmental connections within which iBooks as brand, business and strategy are enfolded.

The Facebook Timeline “book”

In order to explore the governmental nature of Facebook’s Timeline and Haystack, I uploaded a series of JPEG-encoded images (as well as attempted - and failed - to upload RAW and WebP-encoded images) of the eBook to Facebook.²⁶¹ These JPEG-encoded images were loaded onto the Timeline to form a sort of eBook which was searchable and taggable by, within and through Facebook.

The database “book”

Although more usually thought of as the basis for a publication (via CMS for instance), a database can itself be seen as a publication. In a nod in the direction of Walter Benjamin’s own Arcades database, I published the thesis as a database using www.evernote.com.²⁶² Evernote works in a way Benjamin would recognise. Each database entry is a note in a notebook. All notes can be titled, tagged, dated and even geolocated. All are searchable. I added each image fragment to a note. This rendered the “book” as a series of “dialectical images”, searchable and capable of being organised by tags and searches. In addition I used Evernote’s OCR capabilities (where the text in images is recognised (by software objects) and made searchable) to make the text in the JPEG-encoded images searchable.

260. One can choose to embed a JPEG-encoded preview when saving a *.dng* file. I chose not to.

261. <https://www.facebook.com/pages/Jpeg-the-quadruple-object/227885703990297#>

262. <https://www.evernote.com/pub/theinternationale/jpegthequadrupleobject>

The HTML webpage “book”

I chose to create a version of the eBook in an as open as possible a standard - HTML, CSS and JavaScript. While there are issues around the forms of “openness” involved in these technologies, which OOP could unpick, they remain standards which work/connect with a wide variety of apparatuses - including non-Apple mobiles, TVs and games consoles. The webpage “book” uses basic HTML, CSS and JavaScript to create a website with 192 pages - one for each encoded image and one for each encoded “interlude” plus two pages for the two mash-ups. Rather than host this webpage “book” online, I included it along with the other eBooks on the card as a directory of files which would render the “book” differently depending on whether it was online to connect with the mash-up data (as well as the Google-hosted JavaScript) objects. As with the Apple *iBooks Author* experience, I found that Apple’s Safari browser could “render” the pages of the book with RAW-encoded *.orf* files. It appears that as with *iBooks Author*, Apple’s browser could “read” the JPEG preview in the file. It could not do so with the *.webp* or *.dng* files.

A word about design

This project is about protocol, imag(in)ing standards and encoding. It is not about web design. I deliberately did not “design” the pages or the layouts of the eBooks, nor post-process the digital pinhole images. I want the emphasis to be on the images as data objects, encoded by protocol objects.

A word about photography

As noted above, this project is about standards. I use my (OOPh) photographic practice as a way to explore that issue. My eBooks include photographs but they are not the “point” of the exercise. As I have discussed, their absence or more correctly their failure to appear/connect is as important as their presence. I ask my reader to approach my books as protocol rather than photographic works. If the images are pleasing, challenging or interesting themselves, so much the better but it is the protocol works I ask my reader to address.

Reading the eBooks

This thesis comes with a memory card. When a reader connects that object to his or her computer²⁶³ the eBook-file-objects will connect or fail to connect with the computer's software - the operating system, browser and any other software. The reader can then load (or in object-oriented terms, "connect") those eBook objects with a Kindle and iPad object - or fail to connect them with other hardware objects. As I discuss in my report it is these "successful" and "failed" connections that can be addressed via OOP as opening up the form and workings of JPEG.

Of course it is impossible to set out every way in which the digital objects I have "crafted" will be used and connected. A reader may read them on a Mac or a PC; on Linux or Android; unpack them and recompile them for different devices or simply never connect them with any other device. I will however outline what a human-Apple-Amazon object (a reader with a Mac, an iPad and a Kindle) might experience:

1. When the disc is plugged in, a folder appears on the desktop which contains 3 files and 2 directory/folders: *quadJPEG_web*; *quadJPEG.mobi*; *quadJPEG.ibooks* and the folders *quadJPEG_web_files* and *pictures*.
2. If the user clicks on the *quadJPEG_web* file, the webpage book opens. This consists of a series of HTML pages, JavaScript files and image files all held in the *quadJPEG_web_files* folder.
3. Depending on the browser the reader uses, she will see some image files and not others. In OOP terms some object connections will "work" others will "fail" depending on whether the various protocols involved in the digital imag(in)ing pipeline of which the eBook is now a part, have "worked" or "failed".²⁶⁴

263. Of course the card could also be loaded into/connected with a camera. The software in the camera would then display some of the encoded image files. Depending on the model of the camera and the standards it uses, these could include the RAW-encoded files as well as the JPEG-encoded files.

264. The terms "worked" and "failed" are, as discussed above, used advisedly see pp. 173-175 above.

4. The menu in the *quadJPEG_web* book also includes links to the Facebook and Evernote eBooks which are available if the user's device is online (again a matter of objects, protocols and standards). As discussed above the Facebook eBook only contains the JPEG-encoded images. Haystack would not allow any other files to be uploaded. Evernote includes all three sets of files but only the JPEG-encoded ones have previews, even when using Google's own browser which, while capable of connecting with the WebP encoded files, could not connect with the Evernote page/server which displays the WebP-encoded data. Within the Evernote eBook it is possible to search for text within the four interlude images - or at least the JPEG-encoded versions.

5. If the reader has access to an iPad, she can sideload the *quadJPEG.ibooks* file via iTunes into iBooks. The book can then be read (in landscape format) again as a series of chapters some of which "work" and some of which "fail". As noted above, the RAW chapter displays not the RAW data files but the embedded JPEG previews stripped during authoring. Again if the iPad is protocologically connected to the Internet, the mash-ups will work by using JPEG to render live image search objects.

6. If the reader has access to an Amazon Kindle, she can sideload the *quadJPEG.mobi* file. When this book is opened on the Kindle devices available in the UK (i.e. not the full colour Kindle fire), the book and its JPEG-encoded images will appear in 16 shades of grey. The reader can also sideload the *pictures* folder (containing all three sets of images) onto the device, press alt-z and then open the *quadJPEGslideshow* "eBook".²⁶⁵

These various scopic and imag(in)ing experiences (if the reader chooses to use the apparatuses to screengrab 2012 imagin(in)ings and upload them to

265. The reader can also zoom in on the images: q = zoom in; w = zoom out; e = reset zoom; c = actual size; f = full-screen; r = rotate; nav controller = pan and page forward and back = cycle through images. The Kindle does include a WebKit based browser and so could access, if not fully decode and render, an online version of the eBooks, but my concern is with the Kindle as an eBook reader/imag(in)ing apparatus. Once again there are interesting issues about elnk display objects and screen refresh technologies which OOP could approach but are beyond the scope of this project.

the social web to appear in the mash-ups for instance²⁶⁶) of “success” and “failure”, visibility and invisibility, sociality and unsociality are the work of quadruple objects connecting. JPEG is one of the objects in play here as it was in my original OOPh. These eBooks are philosophical carpentry insofar as they “do philosophy” every time they are read - or refuse to be read. My practice in crafting them and yours in reading them are moments of object-oriented practice-research.

266. To screengrab on an iPad click the Power and Home buttons simultaneously. The *png*-encoded file will be added to the Photo stream. To screengrab on a Kindle, press alt + shift + G. The *gif*-encoded file will be added to the *documents* folder. These can then be uploaded from the iPad or via a PC/Mac to the social web.

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