

Expanding the Esper: Virtualised spaces of surveillance in sf film

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Abstract: This article traces how twenty-first-century digital technologies have changed the way we conceive of images, and suggests that virtualised mapping techniques create ‘spatial images’ that ultimately extend ideas embedded within the painting tool of perspective. It explores this first in relation to the production practices of virtual cinematography and 3D conversion, and then through various diegetic technologies within popular sf cinema that echo these practices, focusing in particular on the evocation of kaleidoscopic deep space in *Blade Runner*’s Esper machine and the visual nominalism and spatial mapping depicted in the recent *RoboCop* (2014). Interrogating the uses to which these technologies – whether fictional or non-fictional – are put, the article concludes that they currently take part in and extend the digital panoptic surveillance culture embedded within contemporary digital life.

Keywords: 3D conversion, *Blade Runner*, digital space, perspective, *RoboCop* (2014), spatial image, surveillance, virtual cinematography

In a striking scene from *Blade Runner* (Ridley Scott US/Hong Kong/UK 1982), replicant-hunter Rick Deckard (Harrison Ford) analyses a photograph for clues. He uses a futuristic (if now rather clunky) ‘Esper’ machine to scan the image and isolate details. Following his verbal instructions the console screen magnifies the scanned photo and roams through it, eventually panning across a convex mirror at the image’s centre. This action reveals depth disparities through motion parallax: different layers of space within the photographed room move and overlap one another at different speeds during the pan. The effect suggests the screen image is shifting its viewpoint around a physically existing deep space. More than just magnifying portions of the image, the Esper seems to penetrate and somehow reproduce the space that has been photographically captured, revealing in the process previously hidden parts of the represented room.

Scott Bukatman describes how this moment is a fantasy of photographic possibility:

This inert object, a mere trace of the past, becomes multidimensional and is suddenly possessed of the present-tense modality of cinema. [...] The screen, that frontier separating electronic and physical realities, becomes permeable; the space behind it, tangible. [...] The sequence, with its fantasied control over the projected image, is a most hypnotic meditation on the power of cinema. (Bukatman 46–7)

Our traditional understandings of photographic ontology are thus overturned. Traditional images can only be expanded to a certain degree before their status as artefacts – the existence of pixels or pigment or photographic emulsion, of *surface* – becomes present and subsumes that which is being represented. The Esper overcomes such limitations. A visual world is thus conjured which promises to be endlessly explorable. Bukatman intriguingly links this to cinema and its ‘present-tense modality’, even if for all their movement cinema images are like other images: they make promises of spatial depth that they, as planar surfaces, cannot fulfil. The Esper is not an isolated (fictional) technology, and in the years since *Blade Runner*’s release both real-world production practices and onscreen sf devices have continued to dream of images that are not really images at all, but fully reproduced volumetric environments. This article will explore manifestations of Esper-like image-penetration in recent sf cinema, showing how what are here termed ‘spatial images’ combine qualities associated previously with *either* images *or* spaces. It will link these fictional technologies to tools of contemporary cinematic production that similarly assert the navigability, spatiality and ‘present-tense modality’ of the onscreen diegesis, and it will argue that digital spatial images both real and imagined reproduce space for panoptic ends.

As a medium that captures and reworks reality, cinema has always translated life into its technologically produced double, but this becomes an ever more marked aspect of film in the digital age. In a range of twenty-first-century sf films the dream of visual media to mimetically represent a volumetric spatial world within the bounded frame seems to be realised. Diegetic technologies in films like *Enemy of the State* (Tony Scott US 1998), *Minority Report* (Steven Spielberg US 2002), *Déjà Vu* (Tony Scott US/UK 2006), *Star Trek Into Darkness* (J.J. Abrams US 2013), *The Dark Knight* (Christopher Nolan US/UK 2008) and *RoboCop* (José Padilha US 2014) all codify and reproduce space, and the way they do speaks to how space is being

managed and imagined today – as simultaneously a spectacle and a totalised map. The content these technologies produce is well summed up by Lucius Fox (Morgan Freeman) in *The Dark Knight* as ‘beautiful, unethical [and] dangerous’. The digital rendering of space becomes a vital first step in its rigorous and intense regulation through advanced surveillance techniques.

This article will propose that these represented sf technologies can be best understood through the contexts of both perspectival theories of image composition and contemporary production techniques that similarly assert the ability of technology to render images spatial (namely virtual cinematography and digital 3D conversion). These contextualisations are necessary in order to demonstrate how logics of mapping, control and the removal of ambiguity operate in relation to methods of visual spatial representation. Following this work, analysis of the diegeses of various sf films will show how these logics find full expression in a range of imaginative technologies, and also how these technologies speak to the intentions, consequences and allure of surveillance culture. If contemporary security apparatuses operate according to principles of ‘synoptic viewing’ and dream of an endlessly explorable archive of human actions (Chamayou 38–41), then these speculative technologies can offer us glimpses into our impending reality, cinematic sf spectacle tracing and also somehow making safe existing and developing methods of panoptic spatial monitoring in the twenty-first century.

From psychophysiological space to mathematical space

Developed in the fifteenth century by artist Filippo Brunelleschi and later codified by architect Leon Battista Alberti, the tool of perspective constructs the surface of an image as a window that opens onto a spatial continuum. The planar surface of the image remains, but geometric tools such as vanishing points and the careful calculation of relative object size are all employed to assert the realness – which is to say the coherently organised depth – of the scene presented. Perspective orders space using Cartesian methods of coordination; it conceives of space as a surface consisting of homogenous, mathematically plotted points. To appear within such a Euclidean space an object’s precise location, size and shape need to be known. Perspective generates depth through the orchestration of a spatial volume, but does so at the cost of other aspects of visual experience, in particular stereoscopic vision and spectator mobility. As a compositional tool, perspective seeks to make irrelevant the

ambiguities of planar images, ambiguities arising precisely from the absence of binocular disparity and our inability to gain new vantage points upon represented visual content through even the most minor movement – the tilt of a head, for instance. Perspective substitutes these traits of embodied vision with mathematical order and exact attributes of location.

In this way perspective not only tries to offer the permeable screen and tangible space beyond it that Bukatman identifies in *Blade Runner's* Esper, but also regimentally organises this space, doing so in a manner that, as shall be shown, evokes the strategies of a disciplinary society. As various art historians suggest, for all its claims to realism, perspective is less a method for evoking how we actually see the world than it is a method of cartography. In Rudolf Arnheim's apt description, perspective 'was not introduced to imitate optical projection as faithfully as possible, but to provide a continuously organized space in the depth dimension' (195). In Erwin Panofsky's seminal *Perspective as Symbolic Form* he shows how perspective may presume that 'the planar cross-section of the visual pyramid can pass for an adequate reproduction of our optical image' (29), but also that it nonetheless offers something radically different to our embodied perception of space, an embodied perception he terms 'psychophysiological space' (30). As a method for arranging the visual field, perspective makes space ordered and sensible; yet it simultaneously puts this space behind a metaphorical pane of glass, and so tames and controls it. Perspective may be so culturally ubiquitous as to seem 'equivalent to natural vision' (Jay 59), but this ubiquity effaces perspective's quantifying operations. Creating homogenous and boundless spaces that are 'foreign to the direct experience' of space, it 'transforms psychophysiological space into mathematical space' (Panofsky 30–1). Evoking the much-discussed link between perspective and capitalism, John Berger accordingly proposes that the model for perspectival art is not so much a window on the world as 'a safe let into the wall, a safe in which the visible world has been deposited' (109). Within this space, dimensions and actions can be rigorously plotted, recorded and reproduced.

As a method for making a surface into an illusionistic space, perspective has proved successful and enduring, and many consider photography and cinema to inherit it wholesale (Ivins 'New Reports' 219; Manovich 11; Damisch 28). Cinema may have the potential to unsettle the structuring presumptions of perspective and to depict space in an alternative manner (something often explored in avant-garde and

experimental work), yet in order to depict a coherent, legible onscreen environment mainstream film overwhelmingly appeals to perspectivalist codes of representation, even if it does so with the addition of movement and the multiple points of view provided by editing. This conceptualisation of the screen as a window is only strengthened by cinema's reproduction of material reality, the existence of which is asserted by photographic (which is to say, indexical) reproduction. The spectator is thus encouraged to imaginatively step through the window and into the represented scene.

The proliferation of digital screens in the twenty-first century seems to extend this logic. As Thomas Elsaesser suggests, images have today become things to be navigated through and endlessly explored, not only imaginatively but actively through touch screens and virtual reality displays (228). Yet even if we now live our lives within what he terms 'data-rich simulated environments' (221), these 'environments' nonetheless have at their core perspective's attention to measurement, coordination and virtual reproduction: they are manufactured according to planar dictates. For Elsaesser traditional images have not been superseded by spaces exactly, but rather by images that operate like spaces in their profusion and their function, and which produce 'not a particular view' but a 'particular kind of spectator' who is surrounded by screens and floats, glides or is suspended within virtual(ised) reality (238). It is equally the case that these data-rich simulated spaces operate like (perspectival) images, and, moreover, that this data-richness facilitates not only the simulation of space but also its monitoring and control. The more ubiquitous these technological spaces become, the more we seem to find ourselves deposited within Berger's wall-safe.

Making spaces from images – virtual cinematography and 3D conversion

Technologies like virtual cinematography and digital 3D post-conversion seek modes of address that overcome perspective's limitations of monoscopy and immobility and so remove the gap Bukatman describes above between physical space and electronic space. They posit the image as something deep, boundless and present. Monoscopy is overridden through stereoscopic exhibition, and the immobility of the image is frantically superseded in the roving, exploratory takes of virtual cinematography. Yet these forms of image presentation extend perspective's mathematic disavowal of psychophysiological space, and through them cinema's function becomes less to fix

‘a real image of reality across time’ (Mulvey 10) than to deliver visual representations of mathematically ordered and totalised spaces that are endlessly navigable.

The Matrix (Wachowski Siblings US/Australia 1999) is particularly demonstrative in this regard, and marks a crucial development in the imagistic representation of space through digital means. In order to produce the widely discussed ‘bullet-time’ effect – in which the camera seems to move at impossibly high speeds around an event shown in slow motion – the film’s production team produced a virtual three-dimensional space by amalgamating a collection of photographic source material (see Martin 70–2). While cinema in general creates the impression of movement from still images, bullet-time shows how imagistic source material can be digitally processed and re-presented in a manner that asserts, like the Esper machine, the boundless depths of the image, depths into which we may plunge given the appropriate technological aids. The existence of effects like this lead Sean Cubitt to suggest that since the 1990s Hollywood cinema has overwhelmingly privileged space as an organising principle and an aesthetic pleasure. He argues that the use of computer-generated imagery (CGI), steadicams, and even currently popular methods of editing, sound and production design all contribute to Hollywood’s ‘spatializing project’, space now taking over ‘from narrative the job of managing the film’s dynamics (223–4). The use of digital compositing to produce lengthy shots that relentlessly penetrate diegetic space promotes for Cubitt a kind of vectoral movement that is ‘totalized in the bounded world inside the spatial image’ (228); that is, although infiltrating space in a seemingly dynamic way, these camera movements can only show what has been planned, mapped, orchestrated and rendered, and so ultimately cannot really penetrate or ‘discover’ anything.

This kind of camera movement comes to the fore in the ‘virtual cinematography’ of *The Matrix Reloaded* (Wachowski Siblings US/Australia 2003), in which digital reproductions of space and performers allows for excessive and dynamic spatial penetration and navigation. At key moments in the film this all-digital form of image making is employed to demonstrate the physical skill and rapid movements of the superhuman protagonist Neo, simultaneously granting these attributes to the notional camera itself. Since in these shots the scene as a whole has been constructed within a computer, the positions the notional camera can take are infinite, and the speed, scale and manner of its movements all outpace that which would be possible with a physically-existing camera. Though the image remains a

monocular composition within an immobile frame, this frenzied movement works hard to stress an imagined capacity to access the space beyond the screen. This space has been virtualised as a digital environment rather than captured with practical cinematography precisely in order to assist in this excessive navigation.

As new media theorist Lev Manovich has shown, perspective is essential to these computerised representations of space. This is thanks to perspective's inherent visual nominalism, which Manovich defines as 'the use of vision to capture the identity of individual objects and spaces by recording distances and shapes' (2). This aspect of data recording and representation comes into its own with mechanisation and computerisation, which extend and automate the nominalism of perspective and themselves rely on perspectival mapping and the algorithmic rendering of exact measurements into visual data (10). In a similar vein to William Ivins's *On the Rationalization of Sight* (1973) and Paul Virilio's *War and Cinema* (1989), Manovich considers perspective, visual nominalism, and the automation of both through computer technology to be crucial aspects of economics and warfare. Exact mappings of depth and relative positions in space are necessary tools for a globalising culture, such that Ivins suggests that the 'mathematical development of perspective was absolutely prerequisite' to the mechanisation of life and industry in the nineteenth century (*Rationalization* 12).

For Cubitt, digital effects are an 'art of space', being designed and rendered in three-dimensions (249). Given their spatial mode of production and fundamental conceptualisation as holistic and navigable three-dimensional environments, it is not surprising that digital effects techniques like virtual cinematography show off their constructed spaces from as many angles as possible. (In this they resemble contemporary open world or free-roaming computer games, in which the endless and aimless navigation of a fully realised virtual environment is a key pleasure of the gaming experience.) In films like *The Matrix Reloaded* the movement of the notional camera is imperative, as it is this movement that demonstrates how the immobility normally applied to perspectival representations of space has seemingly been overcome. Nonetheless, this mode of production itself still relies upon logics of perspectival ordering: we seem to be given spaces rather than images, but these spaces are themselves constructed from perspectival images. The single perspective may be replaced by seemingly infinite perspectives, but perspectival logic remains

ingrained within the represented space. We thus experience a *perspectival volume*, a space built from images.

If virtual cinematography is a method by which digital technology works to supersede the immobility of perspectival space, then similarly 3D conversion works to remove its monoscopy. Stereoscopic 3D media appears to extend in front of and recede behind the screen plane, an effect achieved through the simultaneous projection of two sets of images, each set polarised so that, when viewed with the correct eyewear, the offset of the two images and the observer's own perceptual apparatus generate a stereoscopic impression. 3D projection potentially removes the ambiguities of planar imagery, and in its trumpeting of a more immersive cinematic experience it would seem to bring film closer to Panofsky's psychophysiological space than planar, perspective-based cinema. The spaces of 3D film after all seem to be volumetric rather than imagistic representations, to the extent that Miriam Ross proposes that the 'hyper-haptic 3D field screen' be understood quite differently to the planar screen (407). However, in the contemporary cinematic landscape digital 3D conversion (a common method for producing this form of exhibition in blockbuster cinema since at least 2010) also repeats the automation of visual nominalism that Manovich and Cubitt identify in digital effects production. In doing so 3D conversion further highlights how the digital virtualisation of space is increasingly important to film in the digital age.

Converting 2D content to 3D involves the production of two image streams from a monoscopic source. In contemporary cinema, this is accomplished through extensive digital mapping and animation. The exact placement in space of delineated objects and surfaces are calculated, as are their shapes and movements. This data can be gleaned from physically measuring sets, objects and even actors with literal laser-precision, or from collating the information provided by numerous views of a filmed space (the motion parallax of a tracking shot reveals depths by the relative movement of layers, for instance). These reverse-engineered perspectival coordinates are used to generate depth maps – either greyscale images (in which the darker the object is the further it is from the camera) or wireframe models of the geography of the contents of the shot – which then provide necessary spatial detail for the animation of a slightly offset second view, or for the generation of new image streams for both eye views. A detailed example of this conversion process can be found in Mike Seymour's article for *fxguide*, 'Art of Stereo Conversion: 2D to 3D – 2012'. Seymour describes how in

a shot from *John Carter* (Andrew Stanton US 2012) the movements of the camera and contents of the image are tracked, lens distortion is calculated, the spatial parameters of the filmed set and actors upon it are mapped, and additional CG props, figures and backgrounds are added. A second view is generated from all this information, into which missing details are introduced via animation (which can be automated or manually achieved). Visual features of the planar image such as film grain and lens flare are concurrently either removed completely, or heavily re-engineered in order to synchronise with the added impression of stereoscopic depth.

This description indicates how any ambiguity related to the planar constitution of the source image must be removed, replaced by a complete understanding of the geography, dimensions and proportions of that which is being represented. What was an image during the capture stage becomes a volumetric, calculated space. These spatial attributes are then communicated to viewers through stereoscopic exhibition. In this way, digital 3D conversion can be understood as a development of digital effects production generally, and moreover as a method by which the spatial data generated by the visual nominalism of digital effects can be retained in a fuller manner than is possible in monoscopic media.¹ That is, while virtual cinematography seeks to show diverse views of digitally manufactured objects and spaces in order to demonstrate their spatial fullness, 3D achieves much the same effect through the illusion of stereoscopic depth, an illusion produced through the simultaneous projection of twinned views that have each been carefully and comprehensively mapped. Stereoscopic 3D projection is thus a highly appropriate method of presenting digitally created spaces, since both technologies paradoxically deploy the tools of perspective even more extensively than planar analogue cinematography in their attempts to overcome what are perceived as deficiencies in the effective representation of space.

If the virtual spatial productions of virtual cinematography and digital 3D conversion are imagistic at their core thanks to their reliance on perspective and visual nominalism, then this is quite different to how images were interpreted by the futuristic technology of *Blade Runner*'s Esper. The Esper may provide access to the space of an image, but this space is ambiguous: motion parallax makes clear we are

¹ This is not to claim that 3D media does not produce content that is also ephemeral, contingent and subjective (see Jones).

witnessing the navigation of deep space, but the presence of a concave mirror in the analysed photograph leads to strange layering and a kaleidoscopic sensation of depth. By contrast, contemporary digital technologies turn images into spaces using perspectival systems of nominalism, exact cartography and the eradication of spatial ambiguity, and as a result operate according to logics that might be considered panoptic. In this way, Elsaesser's floating or gliding spectator surrounded by interactive screens gives way to a monitored and mapped spectator whose screens stare back at them and log their movements and online activities. Indeed, it is in sf's ever-increasing diegetic deployments of spatial imaging technologies we most powerfully see the association of these with networks of surveillance, control and detection.

Spaces of surveillance

Sf makes speculations about how technology will develop in the future and to what uses it will be put, extrapolating from present conditions in utopian, dystopian or ambivalent directions. Given the current pace of technological development, cinema can equally manifest in the guise of science fiction what is fast-becoming science fact. The production of what are here called 'spatial images' (deep spaces rendered from imagistic material) is undertaken by digital effects artists and stereoscopic converters in the present day. So while the *Esper* was a machine of radical futurity, speculating on possible alternative ontologies of the image in a digital future, the technologies in the films explored below instead offer re-conceptualisations of currently existing systems of spatial mapping and representation.

Of course, the *Esper* also functions as an expression of *Blade Runner*'s central themes of memory, identity and the precarious nature of the human in a world of cloned reproductions and implanted histories. Given the ocularcentrism of both Western culture and cinema itself, it is not surprising that these concerns find direct expression in the film in the control and modification of imagistic traces of the past. *Blade Runner*, as Bukatman argues, links memory with 'the recorded vision of photographs' (10). As a result, it constructs photographic material as more than a mere two-dimensional impression, and this construction takes place both in the diegesis and at the level of the film's own style. The aesthetic of the *Esper*'s revelations – with its overlapping layers of fractal detail that seem to recede forever – is a microcosm of the film itself, which is so detailed as to produce 'an inexhaustible

complexity, an infinity of surfaces to be encountered and explored' (8). This distinctive overall look, then, develops the film's argument that recorded images might be deeper and richer than mere planar surfaces. Even when Deckard looks at a photo of a mother and child on a porch without the aid of the Esper this picture still comes alive for a fraction of a second, a similarly kaleidoscopic and hallucinogenic moment illustrating the power of the image to record and capture not just planar patterns of light, colour and shade, but space (and time) itself.

In sf films since the late 1990s, the ability of digital technologies to turn images into spaces, or to capture spatial rather than visual data, is increasingly regulated, and is repeatedly harnessed in the service of state surveillance. Debates about memory and identity recede, replaced by the spectre of intense and totalised spatial monitoring. This coincides with the widespread adoption and commercialisation of Global Information Systems (GIS) and Global Positioning Systems (GPS) – modes of geographical knowledge derived from the precision targeting techniques of the US military (Kaplan 696) – and the expansion of state surveillance following the events of 9/11. The ubiquity of GPS sat-nav systems that record our location (unwittingly or not) at all times, head-mounted augmented reality tech like Google Glass, and the persistent but invisible governmental and commercial monitoring of online activity all inform the spatial images of a significant body of recent sf cinema. These films visualise the kinds of hyper-observed virtual spaces contemporary technology can create, and intriguingly trace the desired or expected uses and meanings of such spaces.

Released in 1998, *Enemy of the State* is not an sf film per se, but a paranoid exploration of all the ways in which civil liberties can be infringed by digital technologies of observation. It follows successful lawyer Robert Clayton Dean (Will Smith) and his attempts to survive being targeted by the National Security Administration (NSA), who believe he is in possession of a videotape of a political assassination. Dean is quickly bugged with monitoring devices and surveilled by orbiting satellites and CCTV cameras. To ascertain whether or not he actually has the incriminating tape NSA specialists observe surveillance footage from a lingerie store in which Dean accidentally met with the tape's producer, scrutinising Dean's shopping bag. Even though they only have access to a single camera feed, the NSA extrapolate from this a 3D model of the meeting. They then extract Dean's bags from the reconstruction, examining them within a Euclidean, gridded void. Rotating and

zooming in on this abstraction, they try to ascertain if the bag has changed shape (which would indicate that something has been dropped into it). Their investigations are inconclusive: as one of the NSA technical staff comments, the computer can only ‘hypothesise’ the shapes of objects from images, it cannot provide concrete truths.

Whether or not such technology was available to spy agencies in the late 1990s, the film shows at the very least how surveillance systems seek spaces rather than images, producing the former from the latter. They do this in order to harvest information concerning dimensions, volumes and distances which might be absent or ambiguous in static planar renderings. *Enemy of the State* shows how Esper-like technology might be used to provide less a window onto the past and more a digital, virtualised reproduction of an event compiled from all available visual data.

Intriguingly, the same logic defines the ‘image-scrubbing’ technology of *Minority Report*, in which three clairvoyants are plugged into a machine that feeds their prophetic visions of future events into an elegantly curved screen. Pre-crime officer John Anderton (Tom Cruise) then filters and modifies this jumbled content in order to find patterns and meaning, constructing a coherent timeline from visual chaos. During the second image-scrubbing scene, while changing the position and magnification of the images, Anderton seems to rotate the spatial dimensions of a particular image, moving fluidly around a central feature of interest (a man pointing a gun at another man). These shards of the future are here revealed, albeit briefly, to be not images exactly but something more spatial and totalised. Anderton’s image-scrubbing appears, like the Esper, to be able to see round corners. This moment flaunts Anderton’s mastery of these prophetic visions, and by extension his control over the future itself. This control is subsequently shown to be false when he discovers that he himself is predestined to murder an unarmed man, a revelation that throws his entire existence into crisis.

Such spatialised surveillance may only be glimpsed once in *Minority Report* but, as in *Enemy of the State*, its representation points to a broader shift in surveillance culture away from the simple recording of planar shards of a given event and towards the coordination of these image-shards into a spatial reproduction of that event. This shift is further made visible by the diegetic surveillance technology of *Déjà Vu*.

‘Snow White’ – a complex computer system able to screen past events – is initially introduced as a satellite observation and data-harvesting network, but is later revealed to be a time-machine providing a literal window into the world four days prior. As the

system and its operators take commands from the film's detective protagonist, they create penetrative montages on Snow White's screens that move from aerial urban views, side-on street perspectives, and then through closed doors and into private apartments. Past events are thus not only concurrent with the present but are represented as a single, ultra-navigable world. These visuals, created by Digital Air (an effects company whose work here and in commercials relies on a camera array familiar from *The Matrix*), are only briefly glimpsed, but they further argue that vast amounts of disparate information can be usefully centralised and coordinated in a dream of totalised rendering and omniscient access.² *Enemy of the State*'s desire to recreate a spatialised view of a historical event for national security purposes is here progressed and literalised. The power of this technology is vigorously proposed by the film's narrative – as a time-machine, Snow White can actually give the protagonist physical access to the surveilled events of the past, access he then uses to prevent a terrorist attack.

As Stephen Graham and David Wood argue, the digital age brings with it both quantitative and qualitative transformations in the methods and meanings of surveillance: quantitative, because much more data can be stored with greater ease and simplicity; and qualitative, in that social practice alters due to digital monitoring systems and their material consequences (229). Behaviour is observed and automatically policed by 'assemblages of digital technology and software' (233), assemblages that inevitably reinforce and extend the commodification of the urban environment. Spatial images are evidence of this move towards the digital monitoring of space, their use in *Enemy of the State*, *Minority Report* and *Déjà Vu* revealing how extrapolated visual mappings of space and time might be useful for law enforcement. While these examples sometimes hint at the inefficiencies and even the ethical dilemmas associated with such technology, as the shift from analogue to digital surveillance becomes more inclusive and wide-ranging any qualms about its inaccuracies or the correctness of its deployment seem to disappear. In 2006's *Déjà Vu*, after all, spatial images do not only allow the identification of a domestic terrorist, but even provide a way for our hero to stop a mass killing before it is perpetrated.

The extent to which spatial images are increasingly taken for granted is revealed by an offhand example from *Star Trek Into Darkness*. After a terrorist attack

² See the company's website: <http://www.digitalair.com>.

in London destroys a data archive, associated personnel assemble to discuss the attack and plan their response. At this meeting protagonist James Kirk (Chris Pine) inspects the surveillance imagery from London. On his personal screen we see him scroll through various still images of the explosion's aftermath, each image featuring the film's villain John Harrison (Benedict Cumberbatch). Probing one of these in more detail, Kirk zooms *into* the image: as with the Esper machine, the process of zooming gives him access to the spatial content of the represented scene, not just its photographic impression upon a planar surface. He plunges through the image, passing between fragments of debris (which help assert the three-dimensional movement involved) and rotating around Harrison's frozen form.

As in *Enemy of the State*, *Minority Report* and *Déjà Vu*, almost unfettered access to another time is granted through technology that allows the onscreen viewer to step through the surface of the image and into the volumetric space beyond, a procedure which renders that space perspectival and seemingly infinitely navigable. The information Kirk gleans from these spatial images is not terribly significant, nor does the addition of spatial data provide any further clues. Unlike the other films, *Star Trek Into Darkness* is not explicitly about surveillance. The use of this form of image penetration seems, then, to function as little more than an attractive piece of *sf mise en scène*, subtly working to assert the futurity of the setting. However, we may note once again the trappings of state-sanctioned observation in which the technique is embedded. Perhaps what Kirk is looking at has been produced from triangulated and extrapolated source images, or possibly CCTV in this fictional future operates in a different way than it does today, somehow capturing three-dimensional recordings of events as they happen. In either case, boundless (yet also totalised) images are once again posited as a natural extension of existing technologies of both representation and crime prevention.

The Dark Knight makes the same presumption in a sequence in which Batman (Christian Bale) hacks every cell-phone in Gotham city and turns each one into a microphone and 'high frequency generator-receiver', thus creating a real-time sonar map of the city. Although this greatly troubles his advisor Fox, Batman asserts that this kind of surveillance is necessary in order to capture insane terrorist the Joker (Heath Ledger), whom it promptly and unambiguously locates. Batman's assault on the Joker and his small army in a half-built skyscraper is then greatly assisted by this

sonar array's volumetric mapping.³ Though it relies upon audio information, the manner in which this is received is visual: white sound waves emanate and bounce off objects and people, in the process defining their positions in space, all of which is screened for Batman on a flip-down visor. During the action, we witness Batman's technologised gaze swooping around the building even though he remains stationary, this mobile view taking in police officers on the roof and hostages and criminals on various floors in shots that go on for many seconds and move through walls and other solid objects with fluid precision. (The mobility of these shots is unlike anything else in the film, which otherwise features mostly eye-level cameras in indexical locations, all edited together with fast, even abrupt cuts.) These are virtually cinematographed shots, but they do not aspire to verisimilitude and instead reveal their status as digital renderings and spatial abstractions. As in *The Matrix Reloaded*, this computerisation of space encourages its roving, relentless navigation and penetration, asserting our access to every relevant event in a given spatial volume.⁴

[Fig.1 here]

Caption: Screen grab from *The Dark Knight* (Warner Bros. Pictures 2008): Batman's panoptic spatial vision.

In *The Dark Knight* a technology of spatial totalisation is once again put to use detecting and preventing criminal actions. More than this, Batman's device acutely reveals the panoptic logic of such totalisations. In the Panopticon (as designed by Jeremy Bentham in the late eighteenth century) individual prisoner cells are arranged around a central monitoring tower; the cells are backlit, but the tower is dark, meaning the prisoners never know when they are being observed, and so effectively self-administer the discipline required of them. As Michel Foucault (200–9) influentially describes, this architectural arrangement is a fitting metaphor for the disciplinary procedures of urban life since the nineteenth century, the ever-present monitoring of individuals from an invisible seat of power emblematic of how

³ The screen set-up consulted in another part of Gotham by Fox is strongly reminiscent of Mark Hansen and Ben Rubin's *Listening Post*, a museum installation in which multiple screens show random text data taken from Internet chat rooms and forums; see http://www.sciencemuseum.org.uk/smap/collection_index/mark_hansen_ben_rubin_listening_post.aspx.

⁴ An aesthetically and functionally similar sonar map is employed by the blind superhero protagonist of *Daredevil* (Mark Steven Johnson US 2003; Drew Goddard Netflix 2015).

surveillance and regulation culturally function in modernised societies. More than most superheroes, the character of Batman functions like the Panopticon's central tower, a symbol of disciplinary potential perched atop the city, constantly visible (via the Bat-signal searchlight) and able to detect, solve and punish criminal actions almost instantaneously. *The Dark Knight* extends these characteristics: Batman's sonar map allows him to observe diverse spaces and actions from a distance. Offering him virtualised access to space, it makes his subsequent disciplinary actions all the more efficacious. Despite Fox's stated concerns, the film nonetheless celebrates what the map is capable of. In this the film applauds the ability of digital special effects to instrumentally reproduce the world and to provide unfettered access to this reproduction.

Volumetric virtuality

Spatial images are but one tool in the arsenal of these sf police forces. Their deployment reveals how the technology that produces cutting edge special effects like converted 3D and virtual cinematography works toward monitored, surveilled spaces, and reorders social space according to this lens. *RoboCop* offers perhaps the most sustained and up-to-date exploration of these processes of panoptic spatial reproduction, and also ambivalently traces their relationships to various systems of power. A remake of the violent 1987 action-satire of the same name (Paul Verhoeven US), the film concerns Detroit police officer Alex Murphy (Joel Kinnaman) who after nearly being killed by a car bomb is turned into a cyborg by enormous robotics company Omnicorp. Set in 2028, the film's principal narrative thrust concerns Murphy's humanity and the ways in which this is threatened not only by the software keeping him alive but also by the corporate entities wishing to profit from his new technological form. In its margins, however, *RoboCop* consistently demonstrates a keen attention to how the visual field can be increasingly embellished with additional data and even usefully subjected to automated processes of nominalist mapping.

Many scenes in the film evoke the 'data-rich simulated environments' Elsaesser has discussed, and assert that in the film's future world images are best considered windows into navigable volumetric environments. In the first shot we see the back of Pat Novak (Samuel L. Jackson), the host of a right-wing television news show. The camera tracks around him, gradually revealing the set upon which he stands, a set which is nothing but darkness until the show begins, at which point lights

strafe across it and various graphics – including a map of the mainland US and a wireframe representation of downtown Tehran – gracefully appear. In the shots that follow, these graphic elements are revealed to be something more than images: reverse angles of Novak shoot through the digital model of Tehran, which is thus shown to be a volumetric three-dimensional projection extending into the space of the set, its depth indicated by focal blur. In another news segment halfway through the film, Novak deftly manipulates surveillance footage of a crowd. Using hand gestures that evoke those used to operate tablet and smartphone screens he divides the imaged crowd into several rows then pulls these apart to give a layered, cardboard cut-out effect. Novak then strolls between the rows of this layered scene, pointing out details of interest: a felon, arrested by Murphy shortly after the image was taken, and two police officers nearby, oblivious to the felon’s presence. Elsewhere, schematics, screens and billowing, digitised US flags float around him in a powerful, if satirical, rhetoric of knowledge centralisation and Novak’s asserted command of all relevant information.

Novak’s blank news set – a void technologically transformed into a deep, layered environment of shifting information and digital spatial reproductions – is an appropriate place for this film to begin, prompting us to pay attention to the control, reproduction and instrumentalisation of space in the digital era. These scenes use dimensionalised images in ways that are familiar from television broadcasts today, but in both figuratively and literally expanded forms. Novak is not so much surrounded by screens as he is inserted within a virtual reality that includes screens amongst its many other elements. A screen, as the word itself suggests, offers a partition between viewer and viewed, and is contained within a bounded frame. By contrast, *RoboCop*’s virtual or augmented reality of spatial navigation surrounds and contains Novak and other characters. In a linked operation, the film for the most part eschews the regimental clarity of careful planar composition and instead consistently privileges Steadicam and tracking shots that drift in graceful arcs around characters, in the process asserting the volumetric nature of their surroundings. Even dreams take explicitly spatial form: when Murphy is first roused after the operation that has turned him into a cyborg one of these circling tracking shots shows the warm space of his hallucinated memories becoming the clinical coldness of his present laboratory milieu. The transition between the two spaces is of course made possible through digital effects and augmentations, an aesthetic expression of the film’s thematics of

the confusing intermingling of the real and the robotic. Another example of this occurs later, when during a combat test the film cuts between location shooting and a sweeping piece of virtual cinematography that moves through the rafters of a warehouse. The latter shot, achieved through extensive on-set photography and even LIDAR scanning (see Failes), reveals Murphy's targets in a manner akin to Batman's dynamic, sonar-enabled spatial survey in *The Dark Knight*, and further highlights the correlation between virtual cinematography and Murphy's own cyborg processes of digitised spatial mapping.

[Fig. 2 here]

Caption: Screen grab from *RoboCop* (MGM and Columbia Pictures 2014): RoboCop's mathematical spatial perception.

Indeed, when Murphy later engages in police work and gun battles these kinds of three-dimensional computerised renderings of space come heavily into play. Given frequent access to his point-of-view, we are shown how Murphy employs his digital connectivity and robotically extended perception to map his surroundings. Tracking a lead, he accesses CCTV databases across Detroit and applies facial recognition software to quickly locate his target in an alley. He then constructs a wireframe model of the alley in order to plan his attack. The model is shown being instantly assembled from the raw material in his visual field, wireframe outlines materialising upon the buildings in front of him. He then rotates this model to give him an elevated view. In such moments not only can Murphy literally see around corners, but – much as in virtual cinematography – the digital construct of the alley (and the disembodied movement of the notional camera through it) provides a wealth of spatial data that would seemingly remain ambiguous in a planar representation. Elsewhere, point-of-view shots show his software calculating the heights of obstacles and precise angles for leaping over them, and identifying passing individuals from their glimpsed fingerprints, in the process even assessing their biochemical and emotional condition.

[Fig. 3 here]

Caption: Screen grab from *RoboCop* (MGM and Columbia Pictures 2014): subject assessment and classification.

Murphy's computer-mediated vision situates him within a virtualised and augmented reality. It codifies, annotates and replicates real space in instrumental ways. When Murphy begins investigating his own attempted murder the film directly narrates how these technologies work. At the point the murder first occurs it is depicted in a sustained take: Murphy steps out of his front door and the camera tracks steadily back as he tries to turn off his car alarm. The car suddenly explodes, yet the camera surprisingly continues to pull back rather than cut to show Murphy's pain, or his wife's panic, or even to depict the explosion from a greater range of angles. This seeming omission is rectified later, as Murphy returns to the crime scene and uses his new computerised perception to search for clues. He begins by producing a virtual construction of the house – a wireframe model that exists within a black void. He then identifies four different CCTV cameras that have useful vantage points, and uses each of these to add further spatial data to his wireframe model. We are shown Murphy's point-of-view during this process, and see precisely how the virtual construction is assembled and honed as new information is gleaned from each camera feed, the triangulation of the four cameras providing Murphy with a three-dimensional schematic. He then renders the resulting wireframe into a lifelike reconstruction and puts it into motion, replaying the tragic event. As he does so, he steps inside it, looking around for clues and watching his wife cradle his own badly injured body.

[Fig. 4 here]

Caption: Screen grab from *RoboCop* (MGM and Columbia Pictures 2014): making a space from surveillance images.

This sequence puts to diegetic use the production tools of virtual cinematography and 3D conversion, generating volumetric spaces from a coordinated selection of images. Each CCTV stream alone is deemed insufficient to reveal the truth of the matter; only through their unification and the production from this of a virtual space can Murphy fully perceive what happened and act accordingly. Murphy's new perception of the crime, moreover, functions as an externalised prosthetic memory, visually and spatially showing him his own experience under new conditions of vision. He is here most decisively not *remembering* the attack on his life, but observing it through modified CCTV surveillance. Compare this to the original 1987 film, in which Murphy has flashbacks to his murder and revisits his family home to regain his lost

memories. Fragments of the past arrive through a haze of televisual static, and take the form of embodied point-of-view shots. This earlier incarnation of the character even picks up a discarded Polaroid of his family, and remembers the moment it was taken. Like the twenty-first-century RoboCop he steps inside images, but he does so in a very different way. We can suggest that the earlier scene offers psychophysiological spaces of memory (or at least cinematic representations of this), while the more recent film shows how, as in Panofsky's account of perspective, this embodied perception might be superseded by an empirical form of perspectival vision, a kind of vision here equated with digital technologies. Though the CCTV cameras themselves render space monoscopic and immobile, technologies of computerised cartography and extrapolation explicitly overcome these limitations, just as the many cameras in *The Matrix*'s bullet-time worked to generate a sensation of three-dimensionality over and above traditional cinematography. Arnheim's 'continuously organized space' of perspective is in the 2014 *RoboCop* extended and even more rigorously organised through Manovich's automated visual nominalism.⁵

Like other moments in which Murphy's robotic point-of-view is shown to map and annotate space (not to mention Novak's data-saturated news show), this reflexive sequence shows *RoboCop*'s attention to those technological trends Elsaesser proposes are reshaping our attitudes towards images, making them not so much looked at as lived in. In *RoboCop* television sets, memories, surveillance systems and even the content of diegetic screens are all markedly volumetric, not planar. This may remind us of the Esper machine and its capacity, described by Bukatman, to turn traces of the past into multidimensional, 'present-tense' environments. But unlike the kaleidoscopic spaces revealed by the Esper's image-penetration *RoboCop*'s digital aesthetic renders these boundless worlds Euclidean and unambiguous. It then layers them into real spaces in a manner that perceptually breaks down the barriers between the two, creating an augmented reality in which objects, people and spaces are sources of quantified information above all else. This information is in the process made available to the systems of 'intense registration and of documentary accumulation' that sustain panoptic space (Foucault 189). Moreover, the film shows how panoptic space is mathematical space. By introducing rectilinear grids and exact measurements

⁵ Appropriately enough, tools essentially similar to those that Murphy employs in this scene were used to digitally convert the film itself into 3D for its theatrical release in China and for its Blu-ray release.

into lived space, computerised mappings and reproductions generate a digitised form of ‘abstract space’ (Lefebvre 165): pre-planned and highly rational space that is conceptually manufactured by capitalism in the pursuit of predictability, homogeneity and social control. *RoboCop* 2014 is not as scathing towards such spaces as *RoboCop* 1987 – it removes a subplot about land clearance and social deprivation – and offers an ambivalent perspective on surveillance culture. The film may stress its political and satirical credentials with its clearly tongue-in-cheek last line – in which Novak claims the US ‘is now, and *always will be*, the greatest country on the face of the Earth’ – but even as it traces the profit-oriented commodification and corporate control of urban space the film simultaneously (and much like *The Dark Knight*) celebrates the spatial images that serve these ends. Useful and effective, digital mappings and panoptic data-recording allow our hero Murphy to be a highly effective law enforcement officer and combat machine.

Conclusion

Tracking the development of these diegetic technologies reveals a thirty-year transition from the hypothetical and impossible (the Esper) to the practical and the commonplace (*RoboCop*’s crime scene reconstruction). This transition coincides with the rise of digital surveillance methods in real life. *Sf mise en scène* barely manages to keep pace with the development of virtual reality systems that map space as a kind of perspectival volume. Contemporary space is increasingly open to a form of digital interpretation that imposes abstract logics upon our experience of it: GPS software makes the entire world into a trigonometric plane and augmented reality apps further nominalise and codify the world we see through our smartphones, tablets and even eyewear. Manifesting these trends and speculating on their place in social life, sf cinema reveals their close relationship with surveillance culture and the panoptic monitoring of twenty-first-century space.

More broadly, spatial images are a glimpse into a speculative urban environment of ultimate surveillance, control and real-time monitoring. In contemporary techno-culture psychophysiological space and the ambiguities of planar spatial representations are de-emphasised in favour of abstract and digitally augmented space. The Esper’s ambiguous representation of images, spaces and identities is replaced in the digital age by mathematical certainties and a powerful rhetoric of visual truth. The various sf films described above explore and assert such

new technological conditions. Furthermore, the underlying parallels between the navigable spatial images presented by these films and their own modes of virtually cinematographed and 3D post-converted production reveal broader ideas about what these technologies are for, and whom they serve. As witnessed in the narrative renditions of these tools, digital spatial mapping functions in a panoptic mode, working as it does to maintain a disciplinary society of disembodied participants constantly monitored via visual data capture. These films celebrate these technologies partly due to their crime-thriller narratives of detection and pursuit, but perhaps this tone arises more fundamentally from the fact that the films themselves rely on these technologies for much of their visual excitement, and so embed the digital tools of their own production into their diegeses in order to acknowledge and highlight their presence. Narratively, even if they operate in the service of corrupt or misguided police agencies, or are at times posited as potentially unethical and dangerous, such virtualised spaces of surveillance are nonetheless overwhelmingly shown to serve useful and virtuous ends. While spectacular, these representations therefore work to invisibly normalise the procedures of rigorous spatial control they exemplify.

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