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## *Mad Max: Fury Road* and the toxic storm: the transcalar possibilities of digital images

The toxic storm is one of the main visual effects of *Mad Max: Fury Road* (George Miller, 2015). Its impressive scale is introduced by a shot showing a long vehicle and accompanying escort off in the distance. As these race left to right, they move toward billowing clouds of dust encroaching onto the desert floor. A chasing pack of vehicles looks increasingly small as the framing reconfigures to take in the massive wall of debris swirl ominously filling two thirds of the screen. When looking at the toxic storm, what do we see? Which frames of reference might we use to give it meaning? At face value, it is a portent-laden depiction of an immense storm signalling a character has crossed the line, provoking more turbulence to come. Taking interpretations deeper, we can pay attention to its range of visual references and address the digital technologies used by the creative team crafting the storm. Kristen Whissel, for instance, discusses the visual motif of the emblem in relation to a range of digital technologies, including MASSIVE and Morphplus.<sup>1</sup> As she shows, these are not mutually exclusive forms of analysis. Appraisals of the efficacy of digital technologies are frequently tied into visual frames such as photorealism, and whether digital processes can recreate our shared cinematic expectations of physical reality or add innovative aesthetics. Steven Prince has written extensively about digital imagery and realism.<sup>2</sup> Lisa Purse argues for the importance of paying attention to digital elements and what they add to our range interpretive possibilities when thinking about film.<sup>3</sup> As we already see, there is more than one way of thinking about digital images. In this paper I propose another way forward by looking at digital images for what they tell us about digital objects. By digital objects I mean software and its algorithms, the technologies behind the production of digital images. Through this shift from digital images to objects, on-screen digital entities are reconfigured in ways that help us reflect on and interrogate our experiences of a digitally mediated world.

Although now very much a part of our everyday world, explanations of digital objects such as software and algorithms have so far tended to remain focussed on how they are used or how they operate. We are very familiar, for instance, with explanations about the many and varied on-screen digital images created by teams of VFX artists using a range of software. Often drawn from publicity materials, these provide insight into how effects were achieved. Such explanations, I argue, have the potential to also tell us about software as

digital objects. Software consist of numerous algorithms, and a growing impetus to interrogate algorithms is visible across a range of disciplines, including anthropology, philosophy of technology, software, technology and cultural studies. Since moving images are increasingly digital, whether as digital cinematography, visual effects embedded in live-action films, computer-generated animations or games, they are a source of visual prompts through which many kinds of digital objects can be investigated, described and understood. They are a means through which scholars in screen studies can enter into and participate in the growing debate.

In the following I put forward a conceptual framing for thinking about digital objects. Even though it focusses on *Mad Max: Fury Road* and its associated production materials, the framework has wider applicability for deepening our analyses of digitally generated imagery. The conceptual framework builds on Johanna Drucker's writing on digital materiality as well as scholarship from software and technology studies, including the work of Paul Dourish, Ed Finn, and Yuk Hui. Drawing from across this range of literature, I work with the digital image of the toxic storm in order to explore the 'object-ness' of digital objects, by which I mean their materiality and how we come to understand them through the relations they have with people, systems and culture. Before addressing the toxic storm, I first illustrate the idea of object-ness by looking at physical stunts in *Mad Max: Fury Road*. Claims about the realness of stunt action at first seem to rely on a simple assertion of physical presence. Introducing the idea that bodies have object-ness, I argue that the apparent realness of stunts emerges from relations between people (actors and stunt actors), the systems of stunt conventions and the cultural influences of genre as well as gender. Having illustrated what I mean by object-ness I turn to digital objects, where my particular focus is on automation, the interplay of agency between artists and software, and also the veracity of simulations. Insights into these concerns are gained through an analysis of readily available paratextual materials of the kind released in conjunction with many films. The toxic storm in *Mad Max: Fury Road* is a particularly interesting starting point for this exploration of digital objects as it allows me to introduce the idea of a transcalar object. That is, a visual effect with the potential to pivot our perspective from narrative elements to digital objects. On such a turn, we can shift the toxic storm from its status as a fantastical phenomenon to that of a visual prompt from which to see digital objects for what they are and do in the world.

## Introducing Digital Objects

In the publicity for *Mad Max: Fury Road* much attention is paid to George Miller's stated desire to keep the film's spectacular stunts real. Part of a strategy whose primary aim is enticing an audience into cinemas, such statements can be treated with scepticism. Even so, these publicity materials have value since they shed light on the blurriness often surrounding the material status or the object-ness of digital images. Claims that stunts are real as opposed to digital chimes with a wider tendency to by-pass digital reality, by which I mean digital objects and their relations with humans, systems and culture. When digital images are pushed into the background, often through a series of confluences such as those illustrated here, the matter of digital objects also easily slips out of sight. Consider Miller's remarks for an interview published in *Fresh Air*, which draws attention to his view that digital images lack authenticity:

It's a film in which we don't defy the laws of physics. It's real people in a real desert; there's no men in capes flying around or space vehicles and so on, so it wouldn't make a lot of sense to shoot it all digitally, or a large part of it, because it would lose a lot of authenticity. ... Despite the amazing advances in 15 to 20 years of the digital world in filmmaking, it's still very difficult to make something feel really authentic.<sup>4</sup>

These comments layout out two key principles used by the filmmaking team in their construction of the many dangerous stunts and 140 vehicle chases of *Mad Max: Fury Road*: adhering to the laws of physics and maintaining authenticity. Implicit in Miller's observations is a suggestion that digital images lack the qualities he associates with authenticity. Guy Norris, the film's stunt co-ordinator, both re-iterates Miller's position and goes further when he underlines claims about the realness of live-action: 'We wanted to make it *real*,' he says. 'Real vehicles, real locations, real movement and real stunts (emphasis in original).'<sup>5</sup> Comments like these feed into a wider and on-going disenchantment with the alleged excesses of digital visual effects. At times, this enchantment has taken form as a criticism of simplistic plots and the absence of depth in characters; in its current phase, it homes in on celebrating the authenticity and realness of practical as opposed to digital effects. Brian

Curtis, for instance, noted in *The New Yorker* in early 2016: ‘You could hear boasting about “real” sets and practical effects in the hype around nearly every one of last year’s non-Marvel blockbusters.’<sup>6</sup>

Beginning my discussion of digital objects with George Miller and Guy Norris’ claims about realness comes with a danger since it seems to presuppose we know what is meant by real. The idea I develop is that any notion of realness is not already given but emergent, dependent on material and cultural influences and associations. As a starting point, explanations of the production decisions made when making *Mad Max: Fury Road* often illustrate how perceptions of and presumptions about realness tend to straightforwardly rely on the evidence of physical presence. This in turn reveals a conflation wherein physical equates to real and digital to unreal. Tom Boellstorff, reflecting on a similar problem in discussions of digital reality in anthropology, argues:

...conflations of physical with real and digital with unreal, even in rhetorical passing, have devastating consequences for addressing the reality of the digital. Much more than slips of the conceptual tongue, these conflations reflect deep-seated assumptions about value, legitimacy, and consequence. The ubiquity of analyses based on a presumptive gap “between the virtual and the real” [...] rather than between the virtual and the physical—forecloses comprehensively examining world makings and social constructions of reality in a digital age.<sup>7</sup>

Though disclosures in *Mad Max: Fury Road* do not explicitly make the claim that digital objects are unreal, designations of realness are often contoured around physical reality. With realness characterized using parameters better suited to tracing out objects in a physical environment, there emerges a presumptive gap between digital and real. To counteract this gap, I examine the world makings and social constructions of digital objects, their relations with humans, systems and culture.

With further excavation, the same publicity materials that endorse the reality of physical objects have much to say about digital ones too. There is, however, a problem: how is it possible to have ‘sight’ of a digital object? The toxic storm as a digital image, a depiction, is easy enough to see. Visible (and audible) on-screen, it has a logical reason for its existence via the plot of *Mad Max: Fury Road*. To see the toxic storm as a visual prompt for thinking

about digital objects and their object-ness some further clarifications become necessary. As objects, digital things are conceptually and literally hard to grasp. They are a step-beyond the physicality of humans, since we have no capacity to directly see or touch them. Instead, they require the mediation of an interface to make an appearance.

How, then, do we think about or explain our experience of digital things when we have no direct access to them? Within screen studies, significant attention has been given to how digital elements are perceived as part of our experience of digital visual effects in live-action cinema. Much has been said about on-screen digital images and the ways they look increasingly realistic (or photoreal),<sup>8</sup> and the transformative possibilities of digital techniques on image aesthetics and their interpretations. Prince's *Digital Visual Effects* (2012) draws too on production culture, and he utilises this material to argue that visual effects expand the expressive possibilities of all kinds of cinema, fantastical and realist alike.<sup>9</sup> As this study does, Prince uses a diverse range of production disclosures as the basis of his argument. The different route my argument takes is to critically interrogate these materials for what they reveal about discourse surrounding software and algorithms. Kristen Whissel's *Spectacular Visual Effects* (2014) focusses on key moments in films, which she argues are effect patterns or emblems contributing to our understandings of the wider themes of a film.<sup>10</sup> Like Whissel, I pick up on a key visual effect in *Mad Max: Fury Road*. However, rather than link the toxic storm to the wider narrative themes of the film, I take it as a transcalar object, a visual prompt for exploring digital objects. As Lisa Purse suggests: 'In the process of analysis and interpretation the digital demands attention in the way it mimics earlier cinematic technologies, because of its malleable and generative nature, and because of the ideas about the digital and the pre-digital it evokes.'<sup>11</sup> Adding to our critical approaches through analysis and interpretation, Purse illuminates how digital image interventions contribute to the production of meaning within cinematic texts. My focus on digital objects offers another perspective. Digital images created using visual effects not only produce meaning in relation to the narratives of cinematic texts, they are hooks that can draw us toward a deeper understanding of digital object-ness, allowing us to conceptually grasp not only what digital images depict, but also the complex reality of digital objects when understood through what they do in the world.

As my starting point for thinking about what digital objects do in the world, I use design theory and its approaches to digital materiality because they focus on both objects

and their relationality. That is, the associations and connections through which an object can make a difference – influence, facilitate or constrain actions as part of an assemblage of people, systems and culture. Any film production, including that of *Mad Max: Fury Road* forms such an assemblage of personnel, production technologies and industry systems, and software influences, facilitates and constrains actions within a production assemblage. Paul M. Leonardi argues that the materiality of digital artefacts or objects can be understood through the ways they make a difference to activities in the world: ‘when... researchers describe digital artefacts as having “material” properties, aspects, or features, we might safely say that what makes them “material” is that they provide capabilities that afford or constrain action.’<sup>12</sup> Leonardi’s insight offers a way forward when considering the materialities of software and its algorithms as they afford or constrain action in a production assemblage. For instance, in describing the ‘deep remixability of previously separate media language,’<sup>13</sup> Lev Manovich has written extensively about the new aesthetic opportunities afforded by software, and in doing so touched on software’s materiality. He suggests: ‘from the point of view of media and aesthetic theory, file formats constitute the “materiality” of computational media.’<sup>14</sup> But, thinking about materiality need not stop with file formats since, as Leonardi’s position begins to suggest, software materiality can be further conceived in terms of its affordances and constraints, much in the same way as objects in physical reality generate limits and possibilities within a situation. Furthermore, a software’s materiality is not only given by its affordances and constraints but also through its place as part of a complex assemblage. This perspective is central to Johanna Drucker’s concept of performative digital materiality. As Drucker explains: ‘Performative materiality suggests that what something *is* has to be understood in terms of what it *does*, how it works within machinic, systemic, and cultural domains (emphases in original).’<sup>15</sup> In proposing the term performative materiality, Drucker expands on Matthew Kirschenbaum’s explanations of forensic and formal materiality.<sup>16</sup> Her relational position is similar to that of Yuk Hui who, in an article entitled ‘What is a Digital Object?’, recounts the varying ways they might be described:

Digital objects appear to human users as colourful and visible beings. At the level of programming they are text files; further down the operating system they are binary codes; finally, at the level of circuit boards they are nothing but signals generated by

the values of voltage and the operation of logic gates. How, then, can we think about the voltage differences as being the substance of a digital object? Searching downward we may end up with the mediation of silicon and metal. And finally we could go into particles and fields. But this kind of reductionism doesn't tell us much about the world.<sup>17</sup>

Hui acknowledges here that digital objects are both diverse and difficult to pin down. Defining them in terms of their programming text, as binary code, voltage changes, or file formats, is certainly possible. While such definitional markers suggest parameters for a digital materiality, as Hui notes, they tell us little about object-ness since they do not bring insight into a digital object's relations with other objects in the world. In a similar way to Hui, Drucker intercedes in overliteral descriptions of digital materiality which she perceives to be based on assigning only intrinsic or inherent values. Instead, she proposes a materialist move by placing objects in relation to their associations:

For example, identifying a typeface or font and the date, place, or producer of origin does not automatically reveal a "meaning" of a font. A font does not have a meaning, it has a set of associations and relative values. Description of material properties puts in play a series of interpretative events in which the performative dimensions of these properties are actualized in complex inter-relations, dependencies, contingencies, and circumstances.<sup>18</sup>

Taken together, Leonardi, Drucker, and Hui's conceptualization of the materiality and relationality of digital entities provide a useful way to approach them as objects. Rather than slipping out of sight behind the images they create, digital objects do things, make a difference to a possible set of outcomes, exist across domains (computational, cultural, political), and make an appearance in the complex interrelations their actions put into play.

Take algorithms for instance. When functionally defined, an algorithm is typically described as a sequence of instructions or a set of rules followed to complete a task. To be sure, such a definition tells us what an algorithm is, but little about how they appear via the interrelations their actions put into play. It is clear that film production and visual effects creation involve all kinds of interrelations. They are assemblages which include teams of



people, different hardware and software, combine live-action and digital production processes, and occur in situations where the demands of a narrative need to be met, one often associated with a particular set of social, cultural and political agendas. Images are themselves often crafted from different elements, some of these are live-action, without or without digital manipulations, and some are wholly digital, created using a range of software. Looking at algorithms in terms of the images they produce, the range of things depicted through digital images, is only a beginning. Starting with digital images and the software used in their production, we can also explore them for what they tell us about digital objects and their object-ness. The material I use to support my analysis is both familiar and widely available, primarily the marketing and making of materials for *Mad Max: Fury Road*. These materials provide the details from which the object-ness of stunt bodies and digital objects emerge. As Serenella Iovino and Serpil Opperman comment: 'In all the fields of life, the materiality of beings and substances that support their existence is deeply related to the ways this materiality is conceptualized and discursively formulated.'<sup>19</sup> The same is true of digital practices. Amongst other things, paratexts illustrate the ways techniques, both physical and digital, are discursively formulated. As I show below, these formulations illuminate the plural dimensions through which digital objects gain meanings, revealing their object-ness as associations and connections running between and through human, technological, and cultural domains. As other scholars have argued, production disclosures are far from neutral, they are narratives with all kinds of agendas in play, whether the self-promotion of a studio or director, claims aimed at enticing an audience into viewing a film, or a display of the specialist skills of stunt actors, visual effects artists or software programmers. Equally, they are narratives revealing, for instance, how algorithms are conceptualized and discursively formulated. At points in my discussions, these formulations will be challenged, at others I make connections between the specific context of a visual effect production and wider debates about algorithmic culture.

How does a conceptual framework about objects and their object-ness become productive for an analysis of visual effects in *Mad Max: Fury Road*, or equivalent digital objects seen in many other films? The toxic storm was created by visual effects artists working with the procedural software SideFX Houdini to generate the many millions of particles making up the image. Like all software, Houdini includes numerous kinds of algorithms, and as digital objects algorithms have performative dimensions. Drucker argues

that: 'materiality provokes the performance...in accord with other processes and decisions.'<sup>20</sup> Accordingly, the performative dimensions of an algorithm are enacted when their design provides capabilities that afford or constrain actions: Houdini affords the generation of particles. At the same time, the performative dimensions of an algorithm are enacted beyond any specific instance of a computation. It is not simply that Houdini generates particles, but that it co-exists with a number of different elements within a system, and these influence together. In line with Ian Bogost's statement that 'any computational system is never merely algorithmic,'<sup>21</sup> these performative capabilities are located in and understood across the different domains with which an algorithm has associations. They provide a way into thinking about the interrelations between human, technological, cultural and political influences. When articulated using this framework, the digital image which looks like a toxic storm becomes a digital object through which we can understand the ways algorithms participate and enact within a series of interrelations.

#### Taking Realness for Granted: the case of stunt bodies

Working with the framework outlined above, I begin interrogating the relationship between digital and unrealness by looking at the expectations surrounding the release of *Mad Max: Fury Road*. The focus of my discussion in this section will primarily be on the bodies of stunt actors whose presence confers a stunt with its status as real. While perhaps seeming a surprising place to start, this digression into stunt bodies allows me to rehearse my argument using familiar and visible objects. Furthermore, it offers a microcosmic version of a wider perspective that gifts physical objects such as stunt actor bodies a taken for granted realness. What appears straightforwardly real about stunts turns out, I argue, to be based in the interrelations through which stunt bodies are conceptualized and then formulated around a combination of ideas of physical presence, genre and gender. When thought of in this way, we can see stunt bodies as objects too, emergent through the processes of their formulation.

On its release in 2016, *Mad Max: Fury Road* came with an expectation of physicality and action that feeds into notions of real stunts. The film broadly inhabits the same ecologically stripped, post-disaster world established by the earlier *Mad Max* trilogy, now some thirty years old. The trilogy (*Max Max* (1979), *Mad Max 2: The Road Warrior* (1981)

and *Mad Max Beyond the Thunderdome* (1985), all directed by George Miller) are action-based films set in a post-apocalyptic world, where small groups of survivors fight with each other for the remaining scarce resources. Set an uncertain number of years after the end of civilisation, the latest *Mad Max* iteration starts in the same way as the trilogy, where ‘the world is a little worse than we know.’<sup>22</sup> Focussing once more on the precarious situation of survivors, the central power struggle of *Mad Max: Fury Road* is between the character Imperator Furiosa (Charlize Theron) aided by Max (Tom Hardy), as she defies the ruler of the Citadel, Immortan Joe (Hugh Keays-Byrne).

Anticipation surrounding *Mad Max: Fury Road* was built on the popularity of the trilogy, especially the first two films, which set a new and globally influential paradigm for road movies and post-apocalyptic aesthetics. For film critic Adrian Martin, George Miller staged an intervention in Australian film-making with *Mad Max* because it ‘bypassed the niceties of middlebrow literary and theatrical genres ...and headed straight for the Badlands of action, horror and grisly black humour.’<sup>23</sup> The trilogy generated significant attention within film studies scholarship too, examined for what it said about Australian identity, masculinity and queerness, postmodernism, colonialism and post-colonialism through conflict with the land.<sup>24</sup> Ross Gibson, for instance, remarks that the films can be read ‘as a chronicle of the collective faith in the drive to conquer the environment.’<sup>25</sup> Delia Falconer offered a different perspective, arguing that Australian audiences recognised them ‘as “Australian” in an historically original way.’<sup>26</sup> For Falconer, the country’s changing politics across the 1970s and 1980s were negotiated through the *Mad Max* films, with *Beyond the Thunderdome* exploring an association between entrepreneurship, citizenship and a ‘touristed’ landscape. On the release of the new addition to the series, Adrian Martin suggests that since *Mad Max: Fury Road* is set nowhere for a globalized culture, it loosens associations with a specifically Australian context:

*Fury Road* eschews any reflective dialogue or contemplative symbolism (of the kind that marred *Thunderdome*), and channels everything into its thrilling journey away from, then back to, the Citadel...It achieves what Miller has long dreamed of: to make a film set nowhere, only in the cinema-land of our dreams, for circulation in the world’s globalised “hyperculture”. (And how many “event films” these days so successfully launch themselves in so many countries – plus Cannes – on virtually the

same day everywhere?) Even Miller's homeland of Australia seems a distant memory along this *Fury Road*.<sup>27</sup>

The channelled thrill ride Martin describes comes from its heightened focus on vehicular chases and extravagant stunt action, all set in a world further intensified by its saturated and graphic colour palette.

As action-based films, stunts have always been central to the trilogy, and *Mad Max: Fury Road* is no different. What has changed is the scale of the stunts, which necessitated intense periods of training, detailed choreography involving stunt actors, numerous and varied vehicles.<sup>28</sup> Within the existing Mad Max fan base, expectations about the scale of the car-based action sequences in *Mad Max: Fury Road* ran high, and further stoked when director Miller stated his intention to make a bigger, faster than ever car chase, a position reiterated by previews of explosion filled action at the 2014 Comic Con.<sup>29</sup> Although not the focus of this paper, changes to the hardware of digital cinematography, audio recording devices, camera cranes, as well as post-production editing and colour grading techniques, facilitated Miller's decision to make *Mad Max: Fury Road* on the grand scale he envisaged. As well as the particular history of stunts associated with the *Mad Max* films, the production and release of *Mad Max: Fury Road* coincided with aforementioned expressions of dissatisfaction with digital visual effects, often because they lacked the presence and danger associated with a live-action performance. With this wider perspective evident amongst filmmakers, film goers and critics alike, it is not surprising that one of the marketing strategies of *Mad Max: Fury Road* was to proclaim the realness of its stunts. In addition, the evident panache of the stunts involving actors and vehicles gives an impression of validity to the assertions that 'real' stunts are better.

Against this backdrop of expectations around physical stunts, digital elements become less valued. To be sure, digital processes are involved in making these stunt sequences work too, such as the removal of visible wires or any cameras and cranes, the manipulations of foreground or background details (the creation of the citadel, for instance) or additional work on Furiosa's damaged arm and prosthesis, not to mention the digital colour grade. These, however, remain in the background, part of the battery of technologies brought into play to ensure the construction of a seamless digital image. While digital techniques secure the credibility of an action sequence, for claims about realness in a stunt

what matters is the presence of a human body (or indeed cars, trucks and motorbikes), with digital versions of bodies or vehicles taken as an inferior substitution. Unpacking why this is so reveals that the somewhat taken for granted term *real* actually rests on interrelations between the presence of physical bodies in front of a camera and a series of interpretive frames, including genre and gender.

Physical bodies always matter in stunts: there *is* danger involved for the stunt actors and they are highly trained to meet a stunt's physical challenges. An audience's knowledge about the presence of a human body matters too. Jacob Smith, writing about the history of stunt actors, notes how DVD extras draw attention to the ways digital techniques lessen the hazards of stunt performances.<sup>30</sup> Lisa Purse further describes how the body of the hero is central to a viewer's engagement with action stunts:

If action movies are often described as "action packed rides", then they are exhilarating and pleasurable precisely because there are bodies "on board" that ride; the body of the hero—agile, enduring, empowered, limbs extended, muscles tensed and stretched, pulling beyond normal physical limits—and the spectator's body, identifying sensorially with the exertions on screen, experiencing an exhilarated response to these fantasies of physical endurance, control, and mastery.<sup>31</sup>

Purse goes on to argue that the different qualities of digital stunt action can reduce a spectator's investment in a film's narrative and representational frameworks. Effectively designing digital doubles means giving an impression of the same materiality as human bodies, which, as Purse says: 'involves replicating the precise and multiple correspondences that the human eye expects: mastering complex muscle and tendon structures, simulating physical forces of weight and counter-weight, mass, momentum, resistance, torque, impact and so on.'<sup>32</sup> For many visual effects artists, the work they undertake strives to replicate the various correspondences and cues that a human eye expects, and as software and computational capacity continue to develop, this work is increasingly done to great effect. But, for an audience whose expectation of action sequence thrill is based on also celebrating the risky physicality of a stunt, excellent visual effects work seems to not be enough. The matter of real bodies and what stunt bodies do, then, might seem straightforward. If at risk and highly skilled human bodies are absent, stunts become less enthralling. In this kind of

discourse, the idea of realness condenses and simplifies, solely equated to physical presence.

Such an equation, however, does not wholly settle the matter, as stunt bodies connect in other ways too. For instance, since stunts are built on sleight of hand, there is always a paradox in watching stunt action: whose real body is present in the extremity of action? We see a human body perform, and this body represents a character. At the same time, a stunt is a moment when the figure on the screen has often been exchanged, and so we do not necessarily know who we are looking at. The issue of realness becomes less straightforward with this observation as the 'real' figure on the screen is articulated in relations running between the identities of actors and their stunt doubles. Charlize Theron's main stunt double was Danya Porter, and Tom Hardy's was Jacob Tomuri. In an interview involving both Tom Hardy and Jacob Tomuri in *Trailer Addict*, Hardy describes how the different elements of the film are carefully threaded together: 'Both Jacob and I had a harmonious relationship to create a fully dimensional Max, so you couldn't as an audience member, see who was who, when and where.'<sup>33</sup> Hardy's comments point to the ways the actor and stunt actor interrelate, crafting a singular Max from their combined performances, each indistinguishable from the other. In a recent study of stuntwomen, Miranda Banks and Lauren Steiner comment on how a stunt actor's ability to carry out stunts is central to giving an action film actor's performance its anticipated dynamic qualities.<sup>34</sup> For instance, in *Mad Max: Fury Road*, camera placements, and seamless transitions in editing enable stunt actor Danya Porter to enhance the dynamism of Theron's performance. Porter's actions in, say, the scene where Furiosa shimmies along the drive shaft hanging beneath the speeding War Rig, is essential to how compellingly the character of Furiosa is brought to life. As Banks and Steiner note: 'Thus, while the star plays the primary character, she does not commonly contribute to the most physically demanding elements of body-spectacle that cement that character's status as an 'action' heroine.'<sup>35</sup> Through the interplay between actor and stunt actor, the emphasis on what is meant by realness shifts away from the simple and singular presence of an actor's body to a set of relations running between the star actor, their persona, the quality of their acting, the stunt actor, and the authenticity and physicality invested in them. Such a shift, raises in turn another question: what is authentic in a highly choreographed and carefully designed stunt?

Comments made more widely about stunt action start to answer the question about authenticity. As these indicate, expectations around real stunt action reside not only with a particular film but also with wider trends in film culture. In an article written for the *Guardian* newspaper in 2008 Steve Rose, noting the impact of the actors Matt Damon and Daniel Craig in their respective roles in the Bourne and Bond franchises, called their performances 'method action'.<sup>36</sup> Noting good old-fashioned danger had been missing, Rose suggested real stunts were coming back, creating an expectation that actors could be action heroes for real. A version of Rose's comments plays out in *Mad Max: Fury Road* commentaries noting the prominence of action and physical danger with actors asked to do 'heavy lifting' on camera:

Fury Road, roaring into theatres Friday, is one of the most stunt-heavy films of the decade. As with his three Mad Max movies before it, director George Miller avoided the use of digital effects whenever possible, preferring to film real cars crashing and real stunt performers being hurled about. Thanks to Miller's impeccably trained stunt directors, drivers and performers, no one was seriously hurt, particularly among the film's principal cast. But Miller's thirst for realism meant his actors were occasionally called in to do some heavy lifting on camera.<sup>37</sup>

Since the mid 2000s, then, an emphasis on the physicality of the actors in action film roles has been increasing. Not only through the longer standing expectation of bulked muscular bodies, buffed to show an actor's muscles delineated and defined on screen since the 1980s<sup>38</sup>, but also because actors are increasingly doing some of their own stunts. From these comments, authenticity in our current era (late 2010s) starts to emerge as a particular kind of muscular physicality, a greater involvement of stars in the stunt action, which comes associated with risk.

Authenticity, then, relies not only on method action, but equally on the thrill of an effective illusion of a present danger for the figure on the screen. Such an expectation of thrills is embedded in the history of stunt work in films. As Jacob Smith argues in his account of stunts in the cinema in the 1920s and early 1930s, stunt actors are: 'specialised in dangerous activities whose vehicle was the body and whose acts had a visceral affect on audiences.'<sup>39</sup> In addition, male stunt actors in the early twentieth century presented a

particular kind of masculinity to audiences. The question of dangerous activities and authenticity pertains not simply to the fragility of bodies but is caught up with prevailing discourse on gender. Smith elaborates:

...The thrill makers' displays of white masculinity were ... entangled with discourses about class, race, and femininity. Ironically, though the acts of the thrill makers were frequently understood to be the province of an exclusively male prowess, these same supposedly male performance forms became a resource for female performers who intervened in them and so called into question conventional definitions of gender.<sup>40</sup>

Even though, as Smith suggests, female stunt performers can call into question conventional definitions of gender, Banks and Steiner's study offer further insights into how a stunt performer's contributions vary for men and women. Female stunt actors frequently face a higher potential for physical damage because they have less space in their often tighter or skimpier costumes for hidden padding. It is interesting to compare the costuming of Theron and Hardy in the light of this study. As *Furiosa*, Theron is bare armed, no padding on one of her shoulders and her neck is exposed. Hardy, especially once his character Max retrieves his iconic leather jacket, has covered arms, shoulder pads and a heavy neck scarf. Given these disparities, the two stunt doubles are open to the potential of physical damage to differing extents. In addition, stuntwomen face a dissimilar set of expectations in terms of body shape, which has consequences for the robustness of their bodies. Keeping in shape requires a tricky balance between slimness and muscularity: 'While the actors strive to stay thin, stuntwomen must be both slim (to match the stars) and muscular (in order to perform the feats required for the stunt) – a body type that is extremely difficult to maintain.'<sup>41</sup>

Peeling back what is meant by realness in the stunts of *Mad Max: Fury Road* gives insight into the simple and complex interrelations between the material bodies of the stars and stunt performers, relations between authenticity and danger, which spin out to incorporate gender too. The actuality of weight, gravity, friction, and velocity in an environment where people are leaping, hanging, swinging and fighting at speed, conjures the physicality of human bodies endangered by their performances. That actors and stunt actors in a literal sense enact a risky performance is clear. But, as per my description above, enactment also occurs in a more complex way. Stunt bodies are sites in which a series of



associations and interrelations work through, and realness is no longer simply attributed to the material presence of a human body. Bodies can be exchanged, muscularity can be re-defined through social and cultural convention, while choreographed and heightened actions are designated as real.

The contingencies of stunt bodies combine material (physical presence and the dynamics of human bodies) and a range of cultural influences, and it is through these influences that the object-ness of stunt bodies becomes apparent. Having explored object-ness in relation to stunt bodies, I turn now to digital objects and their conceptualization and formulation in production disclosures. I begin this exploration by first looking at a digital image, the toxic storm, and explain why I call it a transcalar object, one that pivots our attention from human to digital scale. With that idea in place, I move onto consider what the image of the toxic storm tells us about algorithms as digital objects.

### Digital Images as Transcalar Objects

The toxic storm is a complex visual effect embedded in the predominantly photorealistic paradigm of popular cinema. Unpacking explanations of the visual effects involved in its making allows us to explore the storm as a transcalar object. The team who created the toxic storm in *Mad Max: Fury Road* received a Visual Effects Society (VES) award for Outstanding Effects Simulations in a Photoreal Feature. The category of award signals two key points. Visually crafted to be embedded in a photoreal feature, it is a simulation too and so a digital image combining cinematic and digital standpoints. Closing the film's first act, the storm is necessarily impressive. Director George Miller, determined that the stunts and chase for *Mad Max: Fury Road* be bigger and better than anything before, wanted the same for the visual effects sequence. He asked for it to be designed with the dimensions of a supercell storm (a multi-centre storm with a rotating updraft) in mind. As well as being crafted to have visual impact, the toxic storm is a storytelling device. When Furiosa drives off road she crosses a line, a particularly volatile and dangerous line in the desert. The towering funnels of multiple twisters, churning clouds of sand, and flashes of lighting converge into a massive storm under which Furiosa drives, pursued by Immortan Joe's War Boys, including the character Nux who has Max in tow, tethered through a blood transfusion line.

The storm is cued to the audience when several characters (Max, Nux, Furiosa, and then the War Boys) are edited into a sequence of shots where, with the briefest of pauses, they stare ahead and upwards. The leaden clouds, already inserted as background in the ongoing battle to stop Furiosa as she drives the War Rig, coalesce through their uneasy eyes into an imminent threat. When the camera shifts perspective into a wide establishing shot looking downwards across desert terrain, the gargantuan scale of the storm has a spectacular moment. Roiling clouds of sand encroach along the desert floor even as their upward flow curls over into a daunting sky of dust. Against the horizontal spread of vehicles, to use Kristen Whissel's terminology, the verticality of the storm demonstrates the hierarchy for this sequence: there will be limited human survival against this phenomenon.<sup>42</sup> Much of the storm sequence, though, is presented as a rapidly cut action sequence, which includes exploding fiery vehicles and flailing bodies caught up in the rotation of the storm. Its action focusses primarily on the battle between Max and Nux, the former hanging on for his life while the latter aims to die in blazing glory as he chases down Furiosa in his Chevrolet Coupe. Around the two men and the speeding car, sand and dust swirl, with music and sound providing continuity: we hear the noise of revving engines, the stress and grind of metal on metal, shattering glass, desperate fighting, and, reverberating booms of wind and clattering grit as it blasts against the car. At points, the engulfing swirl clears just enough to reveal bolts of lightning and columns of multiple smaller scale tornadoes just ahead. Until the black screen and silence which signals the storm's end, a hectic energy is maintained via a graphic colour palette in which heightened oranges and reds are interspersed with black and white on the beats of the edit.

The toxic storm sequence is constructed around stunts, special and visual effects, as well as sound design, colour grading and editing. Paratextual disclosures often draw attention to the seamless integration of these visual effect elements, which mimic real world climatic events extended to spectacular proportions. As Prince suggests: 'Digital tools give filmmakers an unprecedented ability to replicate and emphasize... cues as a means for anchoring the scene in a perceptual reality that the viewer will find credible because it follows the same observable laws of physics as the world s/he inhabits.'<sup>43</sup> Portrayed in this way, we see a digital image primarily associated with its capacity to enact a visual depiction that contributes to the story-world of the film. For instance, discursive formulations locate the digitally enhanced and computer-generated imagery under the broad umbrella of

cinematic realism appropriate to an action film on the scale of *Mad Max: Fury Road*. As described in an *Indiewire* article by visual effects producer Tom Wood:

“The ground was often replaced to give greater speed and an un-driven, clean look. Onto this we added layer upon layer of individual dust simulations. Ground dust that looked like arctic ice racing close to the surface, rivers of dense dust up to window height, large, dense clouds of roiling dust the vehicles swept through and a huge volume that gives a modulation to visibility into the distance,” he [Wood] said: “On top of these, we added CG and practical element grit and light variation to immerse the camera into the experience. Lightning strikes were added as light sources, casting shadows onto and lighting through the dust layers. These had a whole series of choreography passes reviewed by George to accent the action, building to the final crash-endo.”<sup>44</sup>

From these comments, we gain insight into the interrelations that associate a digital entity with the combination of practical and digital elements used in constructing the dust clouds. They describe particulate matter of varying granularity (dust, sand, grit), and the complicated scale of the toxic storm constructed from layers of practical and CG dust, overlapping motion, an impression of density and a lighting set up that allows shadows to be cast by lightning in a dust cloud. Taken at face value, the reference points in these descriptions remain a version of actuality, or a cinematic version of what such a storm might feasibly look like. Though visually vast, it is presented on a human and cinematic scale, and so the digital-ness of the toxic storm as a transcalar object remains opaque.

Bringing digital objects and their realities back into the conversation requires a switch in codes, achieved by introducing a set of associations and interrelations that go beyond the depictive qualities of an image to make connections instead with the wider framework of a digital environment. Switching codes reframes the toxic storm as a transcalar object and so pivots attention between human and digital scales. To explain what I mean by codes a little more. Looking back to the disclosures around stunt bodies, physical presence is a code, which at first seemed to map fully onto realness. But, as I argued, taking a wider view reveals how physical presence is a code amongst several others such as genre and gender. What is taken to be realness emerges not simply from the code of physical presence,

but out of a combination of the more fluid parameters of genre and gender. Two further codes I have been using are human and cinematic scales. Stunt action occurs according to the limits and possibilities of human physique, taking place on the same audio-visual and spatial-temporal scale usually experienced by human beings, what Prince means by the same observable laws of physics. Stunts are shown on a cinematic scale, they are choreographed, compositionally framed and edited to fit in with an audience's expectations based on their knowledge of action films. Interpretations of the toxic storm I have so far discussed map onto human and cinematic scales—they are aligned with the imagined physical reality of such a storm, and enmeshed with cinematic conventions of composition, editing, and storytelling. To switch codes from a human to digital register and see the toxic storm as a transcalar object, I re-interpret it through an examination of ideas about algorithms and automation.

Algorithms have recently gained currency and, having moved out of their programming context into wider culture, are now an increasingly familiar digital object. The focus of academic debates in many disciplines such as anthropology, philosophy of technology, software, technology and cultural studies, algorithms are often featured too in journalistic articles. A recent article entitled 'Franken-Algorithms' conveys, for instance, a concern with the unpredictability of code.<sup>45</sup> One of the problems easily run into when talking about algorithms is their opacity and, despite emerging wide-spread scrutiny, they remain to some degree obscured.<sup>46</sup> To get around this Malte Ziewitz, when asking what sustains the image of an algorithm as a powerful and yet inscrutable entity, suggests: 'one key to understanding the politics of algorithms might be not so much to look for essences with consequences but to attend to how the figure of the algorithm is employed and comes to matter in specific situations.'<sup>47</sup> For instance, algorithmic culture is understood as: 'the enfolding of human thought, conduct, organization and expression into the logic of big data and large-scale computation, a move that alters how the category culture has long been practiced, experienced and understood.'<sup>48</sup> Algorithms here alter what culture is, what it does and what people do in and with it. As digital objects, they make a difference, transforming relations between people and things. Adding to such an understanding of algorithmic culture, Ed Finn argues that algorithms are entities deploying: 'concepts from the idealized space of computation in messy reality, implementing them in what I call "culture machines": complex assemblages of abstractions, processes, and people.'<sup>49</sup> In the

process of altering culture, algorithms bring the abstraction of computation into the processes of human decision making. Ian Bogost's comments on algorithms and abstraction provide more insight: 'Like metaphors, algorithms are simplifications, or distortions. They are caricatures. They take a complex system from the world and abstract it into processes that capture some of that system's logic and discard others.'<sup>50</sup> Bringing these views together, algorithms perform a process of computational abstraction, which sets up further relations with a multiplicity of other participants in a system. As Yuk Hui puts it: 'Relationality is the point where algorithms act, and at which data are related to each other.'<sup>51</sup> And this algorithmic relationality is a site for the diffusion of control, which can bring both positive and negative experiences and consequences in the world. Just as genre and gender introduced more complex interrelations around definitions of the realness of stunt bodies, algorithms are also sites where cultural and political control come to bear on computation and vice versa. From this perspective, algorithms as digital objects operate in a reality that is far from unreal. As the following analysis describes, they do work in the world, make a difference by influencing the decisions of other elements in a network, including people.

Having already mapped the comments by visual effects producers Tom Wood and Andrew Jackson, quoted above, onto human and cinematic scales, below I begin to switch codes by remapping them onto digital ones. As quoted in *Cinefex*, Tom Wood notes the scale of the digital constructions in the toxic storm:

"We built huge assemblies of dust blasting by the cars in three-dimensional volumes, and mini twisters that swirled up to the top of the truck. Larger twisters were volumetric renders with particle animation skirts that joined them to the ground and to the clouds. It was a huge chaotic volume, with grit and dust bouncing everywhere."<sup>52</sup>

SideFX Houdini, used on *Mad Max: Fury Road*, is a procedural animation software, and its particle system was used in animating the twisters described by Wood. Talking about the storm and its elements for an interview with *Indiewire*, he reveals more details on the digital features used in its making:

We sourced a huge amount of real twister footage to find visceral effects we liked and thought would work well for this sequence. The main, large core of the twisters were 3D volumes, almost entirely shader-based, allowing internal lighting. These were then wrapped in multiple, dense particle simulations that connected to the ground and sky. The sky was a 3D, animated matte painting created as numerous layers in Photoshop and assembled in Nuke. As the plates were shot in full sun, the vehicles were tracked and partially re-lit in CG to sit in the dark environment.<sup>53</sup>

In the shot, the toxic storm is depicted as a phenomenon of post-apocalyptic proportions, conjured in a palette running from pale grey in the distance, through various tones and shades of orange to deep grey and black on the right foreground edges of the screen. Switching codes, using Wood's two sets of comments we can map the storm onto its component digital parts, including 3D volumes, shaders, particle simulations, as well as naming some of the software used in conjunction with Houdini: Nuke and Photoshop. Going deeper, Dan Bethell, CG sequence supervisor at visual effects studio Iloura, outlines the process in more technical detail by describing how a software called Mincer generated the particles of the storm:

A twisting velocity field provided the base motion of a vortex with layers of turbulence and collisions adding details. "A particle system emitting from the ground was advected through the velocity grids and more layers of noise and turbulence were applied," Bethell explained. "The particles were then rendered through PRMan using particle instancing to increase the numbers, sometimes up to half a billion particles."<sup>54</sup>

Bethell is explaining a process whereby particles were computationally generated to emerge as a flow at the base of a vortex, and then be drawn upwards through velocity grids (a field of parameters influencing velocity, direction, and force). That the system manages up to half a billion particles makes the computational capacity of the software pipeline evident. Remarks like those of Bethell show how the proportions of the particle cloud created in the simulation of the toxic storm go beyond human scale. Human labour on such a project is intensive too, combining the work of programmers and visual effects artists, but the

production of so large a number of particles relies on automation by simulation algorithms. As Wood and Bethell's comments demonstrate, the algorithms making up Houdini and Mincer do the computational work necessary to generate the particle cloud, and so make a difference within production practices at Iloura. Their comments also show why the toxic storm can be called a transcalar object: it shifts perceptions from human to digital scales.

Just as stunt bodies do more than perform a part of the story in *Mad Max: Fury Road*, the algorithms of Houdini and Mincer also perform across more than the dimension of production practices so far described. They enact on a computational scale requiring automation, and this in turn poses questions about where control lies. In an interview with *Animation World Network (AWN)*, Tom Wood talks about the work load required in a small company to produce the toxic storm for *Mad Max: Fury Road*:

The storm was a huge thing to do as a start-up company. We really had to break it down into component parts, try and minimize the load on us and maximize the final visual result, so that we had very, very reusable parts. We had three R&D guys who wrote a thing called Mincer, which is a particle iteration software, and that meant we could run fairly complex particle simulations through Houdini. Then through Mincer we would render out something that was intensely full of particles. Just a crazy, crazy number of particles that were still guided by the artist. That gave us a huge advantage. That was the hardest thing, because it was working on a unique film, doing the effects that were required upfront like the toxic cloud and getting a company on its feet.<sup>55</sup>

In these details about Mincer, Wood's comments give scope for seeing the extent to which our understanding of algorithms occurs through their location within a complex set of interrelations combining creative innovation, technological and artistic expertise. Algorithms are neither entirely operational nor computational, as their digital materiality emerge through a convergence with a range of influences. There is also scope, though beyond the focus of this essay, to extend the associations and connections around software to the larger framework within which this kind of work takes place. This larger framework can incorporate the environmental impact of server farms, outsourcing and sub-contracting of digital labour, the global spread of the visual effects industry as companies have subsidiaries in multiple

countries, and patterns of work that can lead to exploitative practices. These things too are part of the web of contingencies from which software materiality emerges.

My focus here remains on Wood's observation that software is guided by artists, as it introduces the question of where agency lies in the interrelations running between software and its users. Because algorithms alter the ways humans engage with many kinds of objects in the world, the two areas of automation and agency are important to unpack. Even though algorithms are linked to a plurality of interrelations, one of their strongest cultural associations remains with their potential to remove decisions from the humans who use them. Algorithms are still often perceived as running hand in hand with a restrictive automation, to the extent they sometimes become a shorthand for overdetermining technological control. That algorithms abstract processes and relate data to each other, comes with the potential to be experienced as a reduction of choice and agency for human users. For instance, when visual effects depicting either a multiplicity of images (particles in a storm, or crowd simulations created using Massive for the *Lord of the Rings* (Jackson, 2001-2003) and *Hobbit* (Peter Jackson, 2012-2014) films and *Dawn of the Planet of the Apes* (Matt Reeves, 2014), a vastly scaled image such as *Inside Out's* (Pete Docter, 2015) row upon row of memory orbs in Riley's bank of memories or the ever receding datascape of *Tron: Legacy* (Joseph Kosinski, 2010), software's capacity for automation is very apparent. Hand drawn animation is unable to show the repeating detail of smaller and smaller units, legibly continuing into the distance. Perspective converging on a vanishing point can be hand drawn, but not the receding precision of detail increasingly miniaturized to converge at a single point. Taking a critical view of such automated practice in the visual effects industry has often meant arguing against conditions of labour associated with a de-skilled, poorly paid and exploited workforce. In this context, automation is associated with a system displacing human agency, invoking digital reality as a negative experience, with algorithms enacting a disempowering mode of relationality.<sup>56</sup>

While it is important to expose the exploitative tendencies of digital economies and workplace practices, automation, algorithms and control are often collapsed together. When this happens concerns about algorithms often stand in for critiques of large scale systems associated with control and management. In such a claim, algorithms are taken to not simply be part of a problem, but *the* problem as they overdetermine the relations running between individuals and systems. Paul Dourish suggests the fit be loosened:



If we want to be able to speak of algorithms analytically in order to identify their significance as specific technical and discursive formulations then we need to be able to better identify how they operate as part of, but not as all of the larger framework.<sup>57</sup>

Only paying attention to the overlap between algorithms and over-controlling systems obscures the complex relations which can be enacted between algorithms and human users. An example of the alternative perspective to which Dourish gestures is Blake Hallinan and Ted Striphas's study of the Netflix recommendation algorithm. The study explored not just what the algorithm did, but also how users deployed it, and aimed to add depth and dimension to 'the conceptual and semantic work required to render algorithmic information processing systems legible as forms of cultural decision making.'<sup>58</sup> They conclude that people and algorithms are not simply controlled through automated processes, but are entangled in cultural production through their interrelations. Hallinan and Striphas agree with Tarleton Gillespie who says: 'It is important that we conceive of this entanglement not as a one-directional influence, but as a recursive loop between the calculations of the algorithm and the "calculations" of people.'<sup>59</sup> As these insights suggest, interactions between users, context and what the algorithm does are complex. They also take us back to agency and the ways in which it is spread between user and algorithm. Gillespie's recursive loop between algorithm and users is a perspective that draws from across a wide range of debates, especially those informed by Actor-Network-Theory, where understandings of agency have moved beyond intentional or meaningful actions attributable wholly to human actors in the world. As Bruno Latour puts it:

...any thing that does modify a state of affairs by making a difference is an actor—or, if it has no figuration yet, an actant. Thus, the questions to ask about any agent are simply the following: Does it make a difference in the course of some other agent's action or not?<sup>60</sup>

Such shared agency is visible in the transcalar interrelations which open up around a discussion of the toxic storm. Just as he stated in an interview with *Animation World Network* (cited above), in a round table discussion for *FXGuide* about the visual effects on

*Mad Max: Fury Road*, Tom Wood again comments on Mincer, the particle iteration software and notes how it is guided by the artist:

Yes, our R&D team wrote this tool. It's a particle iteration software which allowed us to run complex particle simulations through Houdini. Using Mincer we could render up to half a billion particles, *still guided by the artist* which gave us a huge advantage. Base smoke simulations were used for close-up shots of the twisters with layers of turbulence and collisions adding detail. Wider shots were modeled and animated by hand then converted to density volumes and level-set surface representations rendered in PRman using multi-layered procedural noise and displacement.<sup>61</sup> (my emphasis)

Wood's language in these comments combines interaction and automation: the iteration software Mincer generates the particles and visual effects artists guide the simulation's shape and density. Mincer makes a difference to the production environment for *Mad Max: Fury Road* because it has the capacity to produce such a large number of particles. While some elements of Mincer are fully automated, others rely on interaction with artists. The actions of both, the software and the artist fold together. Such a combination of interaction and automation is where shared agency occurs.

At the centre of my discussion about *Mad Max: Fury Road* is the procedural animation package SideFX Houdini and Mincer, the in-house software created at the production company Iloura. Along with many other visual elements, these software were used to craft the particle simulation key to the shape and scale of the toxic storm. By taking a transcalar approach, our understanding of the simulation is not contained by what it depicts. Despite the details that exist around many simulations, such as those evident in the paratexts surrounding *Mad Max: Fury Road*, simulations are often received as entirely computational, programmed using step-by-step methods that explore the approximate behaviour of real world or imaginary events. Based on numerical models, they depict how objects move, collide and break up. One consequence of seeing simulations as entirely computational is that the algorithms behind simulations remain opaque, like the larger systems and complex assemblages about which Paul Dourish writes. If understood in this way, there is a risk in seeing simulations as the product of algorithms which exclude human

agency because they are automated mathematical models. Ed Finn goes further, he suggests there is a prospect of becoming so overly familiar with computational models of the world that such models come to stand in and reshape reality. As he says: ‘...when algorithms cross the threshold from prediction to determination, from modelling to building cultural structures, we find ourselves revising reality to accommodate their discrepancies.’<sup>62</sup> Though Finn is referring to the algorithms behind Google and Netflix, his point is appropriate to this argument too. Keeping sight of the associations and connections around digital objects prisms an opening into this closing loop, it enables us to keep hold of the idea that simulations, the images created by digital objects, have discrepancies. Like the realness of stunts, the material and cultural reality of digital objects is emergent, and models purporting to stand in for actuality are equally emergent.

## Conclusion

Bryan Curtis remarks: ‘It’s as if directors—especially the reboot generation—have finally become self-conscious about C.G.I.; 2015 was the year they got embarrassed by the digital miracles of the movies.’<sup>63</sup> George Miller’s self-consciousness about digital visual effects has the side-effect of making *Mad Max: Fury Road* and its paratexts a rich resource for drawing out the object-ness of physical and digital objects. Interrogating the stunts of *Mad Max: Fury Road*, I have argued that realness is far from a simple fact of physical presence, it emerges in the interrelations between the material bodies of the stars and stunt performers, relations between authenticity and danger, which incorporate questions about gender too. Giving an account of how the particle animation software Houdini and Iloura’s algorithm Mincer contributed to making the toxic storm of *Mad Max: Fury Road* I have introduced it as a transcalar object, an analytic device pivoting attention to algorithms and the ways these generate associations and interrelations across human, technological and cultural domains. Pivoting from digital images as depictions to seeing them instead as digital objects offers a scope for analyses beyond my particular concern with *Mad Max: Fury Road*. Many kinds of associations and interrelations surround digital images, some of which I have alluded to only briefly. They are created within a wide-reaching framework, which takes in the changing dynamics of labour in studio pipelines, a global spread of software-based industries, the environmental costs of high computational loads for simulations and render farms, the

development, design and implementation of software, the agencies of digital objects, as well as the narrative possibilities of digital images. There is more to be said too about the convergent materialities of digital and physical interventions, as occurs, for instance, with LIDAR scanning. All of these offer rich areas of research through which screen studies can deepen our understanding of digital objects.

To go back to my opening question: when we look at the toxic storm, what do we see? We can see such imagery as double-coded, simultaneously embedded in a story-world *and* a transcalar object with the capacity to pivot viewers towards thinking about the digital. Information about digital practices and their impact is there to analyse, it circulates alongside cinema, animation and games in the media-intensive world we inhabit as audiences, screen studies students and scholars alike. Expanding how we speak and think about digital objects, recognising how they give us space to reflect on our experience of a digitally-based world, is vital. That world is around us, it is where agency, politics, social and cultural power accumulate and disperse, in both positive and negative ways. Digital objects make a profound difference in a myriad of ways within our world, and it's time to recognise the object-ness of the digital images on our screens.

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<sup>1</sup> See Kristen Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema* (New Haven: Duke University Press, 2014).

<sup>2</sup> See Stephen Prince, *Digital Visual effects in Cinema: The Seduction of Reality* (New Brunswick: Rutgers University Press, 2012).

<sup>3</sup> See Lisa Purse, *Digital Imaging in Popular Cinema* (Edinburgh: Edinburgh University Press, 2013).

<sup>4</sup> George Miller, 'Mad Max Director George Miller: The Audience Tells You What Your Film Is', *National Public Radio*, 8 February 2016,

<http://www.npr.org/2016/02/08/465989808/mad-max-director-george-miller-the-audience-tells-you-what-your-film-is> accessed 25 January 2018.

<sup>5</sup> Mark Yarm, 'Mad Max: Fury Road: The Story Behind It's Most Insane Stunts', *Rolling Stone*, 18 May 2015, <http://www.rollingstone.com/movies/features/mad-max-fury-road-the-story-behind-its-most-insane-stunts-20150518> accessed 25 January 2018.

<sup>6</sup> Curtis, 'Hollywood's Turn Against Digital Effects'.

<sup>7</sup> Tom Boellstorff, 'For Whom the Ontology Turns: Theorising the Digital Real', *Current Anthropology* vol. 57, no. 4 (2016), pp. 387–407: 387.

<sup>8</sup> Stephen Prince, 'True Lies: Perceptual Realism, Digital Images and Film Theory', *Film Quarterly* vol. 49, no. 3 (1996), pp. 27-37.

<sup>9</sup> Prince, *Digital Visual effects in Cinema: The Seduction of Reality*.

<sup>10</sup> Whissel, *Spectacular Digital Effects: CGI and Contemporary Cinema*.

<sup>11</sup> Purse, *Digital Imaging in Popular Cinema*, p. 8.

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- <sup>12</sup> Paul M. Leonardi, 'Digital Materiality? How Artefacts without Matter, Matter', *First Monday* vol. 15, no. 6 (2010), <http://journals.uic.edu/ojs/index.php/fm/article/view/3036/2567> accessed 25 January 2018.
- <sup>13</sup> Lev Manovich, *Software Takes Command* (London: Bloomsbury, 2013), p. 324.
- <sup>14</sup> Ibid, p. 215.
- <sup>15</sup> Johanna Drucker, 'Performative Materiality and Theoretical Approaches to the Interface', *Digital Humanities Quarterly* vol. 7, no. 1 (2013) <http://www.digitalhumanities.org/dhq/vol/7/1/000143/000143.html> accessed 25 January 2018.
- <sup>16</sup> Matthew Kirschenbaum, *Mechanisms: New Media and the Forensic Imagination* (Cambridge, MA: The MIT Press, 2008).
- <sup>17</sup> Yuk Hui, 'What is a Digital Object?' *Metaphilosophy* vol. 43, no. 4 (2012), pp. 380-395: 387.
- <sup>18</sup> Drucker, 'Performative Materiality and Theoretical Approaches to the Interface.'
- <sup>19</sup> Serenella Iovino and Serpil Opperman, *Material Ecocriticism* (Indianapolis: Indiana University Press, 2014), p. 10.
- <sup>20</sup> Ibid.
- <sup>21</sup> Ian Bogost, 'The Cathedral of Computation', *The Atlantic*, 15 January 2015, <https://www.theatlantic.com/technology/archive/2015/01/the-cathedral-of-computation/384300/> accessed 25 January 2018.
- <sup>22</sup> Meaghan Morris, *Identity Anecdotes: Translation and Media Culture* (London: Sage Publications, 2006), p. 83.
- <sup>23</sup> Adrian Martin, *The Mad Max Movies* (Sydney: Currency Press, 2003), p. 5.
- <sup>24</sup> See for instance, Rebecca Johnke, 'Manifestations of Masculinities: Mad Max and the Lure of the Forbidden Zone', *Journal of Australian Studies* vol. 25 (2001), pp. 118-125; Christopher Sharrett, 'Hero as Pastiche,' *Journal of Popular Film and Television* vol. 13, no. 2 (1985), pp. 80-91; and Roslyn Weaver, *Apocalypse in Australian Fiction and Film* (Jefferson, N. Carolina: McFarland, 2011), pp. 83-107.
- <sup>25</sup> Ross Gibson, *South of the West: Postcolonialism and Narrative Construction of Australia* (Bloomington and Indianapolis: Indiana University Press, 1992), p. 174.
- <sup>26</sup> Delia Falconer, 'We Don't Need to Know the Way Home', in Steve Cohan and Ina Rae Hark (eds), *The Road Movie Book* (London and New York: Routledge, 1997), pp. 249-270: 251.
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- <sup>28</sup> Joe Fordham, 'Mad Max: Fury Road Dust, Grime, Sweat and Blood', *Cinefex* 142 (2015), pp. 1-28.
- <sup>29</sup> At the 2014 Comic Con, Miller described Mad Max: Fury Road as a 105 minute chase. <http://www.reuters.com/article/film-comiccon-madmax-idUSL2N0Q10ND20140726> accessed 25 January 2018.
- <sup>30</sup> Jacob Smith, 'Seeing Double: Stunt Performance and Masculinity', *Journal of Film and Video* vol. 56, no. 3 (2004), pp. 35-53: 50.
- <sup>31</sup> Lisa Purse, 'Digital Heroes in Contemporary Hollywood: Exertion, Identification, and the Virtual Action Body', *Film Criticism* vol. 32, no. 1 (2007), pp. 5-25: 8.
- <sup>32</sup> Ibid, p.11.
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