**DIGITAL WARFIGHTING TEMPORALITIES AND DRONE DISCOURSE**

**Abstract**

As drones have emerged as icons of contemporary warfare so too have drone operators become symbols of contemporary warfighting. While drone scholarship to date has predominantly centred upon exploring the drone’s “functioning” and “implications”, including interrogating the ‘in-theatre’ experiences of operators, this article responds to calls for further attentiveness to the “making of” the drone (Klauser and Pedrozo in Geogr Helv 70:285-293, [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62)). In empirically examining the ‘making of’ the drone operator, it turns to their training, and in particular the use of simulators therein. This focus, it argues, offers an alternative accounting of the drone operator, one that both revisits and complicates existing and enduring narratives of drone operation and/as videogaming, and one that offers an alternative temporality and ‘site’ through which to explore how drones come to ‘function’.

**Keywords:** Drones · Unmanned aerial vehicles · Digital warfare · Simulation · Training

**Introduction**

Unmanned aerial vehicles (UAVs), or drones as they are more popularly known, have emerged as a central and “tactically indispensable” tool of military arsenals (Chappelle et al. [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR27): 357). Recent estimates demonstrate a sharp rise in adoption and development, with reports that 95 countries have drones in “active inventory” (Gettinger [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR39): viii). While cognisant that drones range considerably in size, capability, and purposing—and can thus be understood as an ecosystem (Jackman [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR59))—their growing popularity and pervasiveness are nonetheless indicative of their increasingly cemented status as “contemporary icons” of air power (Wall [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR96): 33; Gregory [2011a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR44)). Further, as drones have emerged as icons of surveillance and strike operations, so too have their operators—with digital warfighters increasingly under global spotlights (Bentley [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR20)). The growing deployment and development of military drones has thus been accompanied by a flurry of cross-disciplinary critical scholarship. This has ranged in scope and focus, but broadly examines the emergence and implications of drones through the tracing of both platform histories (Hall Kindervater [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR53), [2017](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR54); Gregory [2011a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR44); Shaw [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR84), [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR85)) and contemporary deployment configurations, scales, and geographies (Gregory [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR51), [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR52), [2011b](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR45), [c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR46); Adey et al. [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR4); Pugliese [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR75); Shaw [2017](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR86)), as well as operator practices and experiences (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8); Clark [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR28); Holmqvist [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR56); Williams [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR102); Weber [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR99); Wilcox [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR101); Macdonald and Schneider [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR63)) and ethical, (geo)political, and legal implications (Allinson [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR5); Shaw and Akhter [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR87); Chamayou [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR25); Baggiarini [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR14); Boyle [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR21); Schwarz [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR82); Wall and Monahan [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR97)).

While incredibly vibrant, collectively such scholarship has predominantly centred upon examining both the “functioning” of drones, that is drones ‘in-theatre’ as they undertake surveillance and strike operations, and their “implications” (Klauser and Pedrozo [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62)). While of course a central and important point for critical analyses, such investigations also arguably invite (empirically) approaching the drone (operator) at alternative temporal and operational points. In this vein, as demonstrated, there have been important contributions examining what can be labelled as the “making of” drones (Klauser and Pedrozo [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62)), those which have taken the form of tracing the lengthier histories of particular drone programmes (as above). Following Klauser and Pedrozo’s ([2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62): 290) call for explorations of the ‘making’ of the drone (operator) attentive to how drones become active and how action is enabled - namely “by whom, and for what reasons” - this article adopts an alternative focus. Rather than pursuing a deep history, it instead seeks to explore*processual temporalities* (see Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8)), approaching the operator at the alternative temporal point of their training. The training period, it asserts, acts as both a lens through which to empirically approach the drone operator, and an important and constitutive temporality through which the drone comes to function.

To this end, this article draws upon fieldwork of both attending military conferences focused on the manning of military drones, and the completion of industry-authored and hosted drone training courses covering manning and human factors issues. (1) Approaching the drone as such, I argue, affords an attentiveness to military knowledges and practices as they variously circulate and “touch down” (see Jackman [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR58); Rech [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR77)), at alternative and constitutive temporal points that underpin the “functioning” drone programme. Further, such an approach offers windows into a technology and an environment deemed variously “inaccessible to scholarly enquiry” (McNeal [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR64): 687). In developing its argumentation around the necessity to attend to the multiple temporalities of drones, their operators, and digital warfighting more broadly, the article focuses in on the training period specifically. In so doing, it turns to interrogate the role of simulator technologies therein, demonstrating their usage as both an ongoing area of debate within the military, a key site through which the drone operator is “readied” for war, and as a temporality variously informing subsequent ‘in-theatre’ operations. The article thus proceeds as follows. In contextualising the analysis that follows, it first introduces key discourses through which drone operators, as contemporary digital warfighters, have been narrated. Here, it highlights the sustained focus on the “functioning” or ‘in-theatre’ drone and the actions, responses to, and politics of its operation. In seeking to re-approach the drone operator at an alternative operational point, it turns then to the operator’s training, and in particular the role of simulators therein. In so doing, it demonstrates that a focus on simulators, brought into conversation with geographical scholarship on video games, enables the revisiting and complication of enduring discourses surrounding the drone warfighter “as gamer”.

**Approaching digital warfighters**

As the drone has emerged as the “signature device of the present moment” (Noys [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR69)), the drone operator, (2) a contemporary digital warfighter, has too become “an object of intense public fascination” (Stahl [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR89): 670). Spanning “confessions” and “stories of”, and “exposes” and “reflections” on both drone operators and the platforms, infrastructures, and institutions underpinning and enabling them, a range of reportage and critical commentary has emerged and enveloped the drone (Bentley [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR20)). When focused on their operators, both scholarship and wider commentary has tended to follow a “range of discourses” (Williams [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR102): 383), those which can broadly be divided into two, somewhat paradoxical, framings: namely those presenting the drone operator as “distant and detached”, and those conversely stressing an “intimate proximity” to and with those below the drone. In what follows, a brief reflection on each position is offered. This acts to contextualise the article’s subsequent “re-orientation”, that is re-approaching of the drone operator at an alternative operational temporality, that of their training via simulators. In so doing, the article argues that alternative discourses of drone operation are highlighted and revealed, those which it demonstrates variously inform both in-theatre operations and the wider discourses that surround them.

**The “distanced and detached” operator**

*The first thing they said was my job would be to kill people and break things (Former sensor operator in ECCHR Berlin*[*2014*](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR37)*: n.p)*

The first of two tropes commonly surrounding the drone operator centre around the operational configuration underpinning the drone, that of Remote Split Operations (Congressional Budget Office [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR31)). Here, the networked infrastructure featuring both ground and aerial bases/craft that enables action at a distance, for example of 8000 miles between the US Air Force’s Creech Air Base in Nevada and a “target” location (BBC News [2017](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR17)), is foregrounded. In citing distance, accounts tend to focus upon both the “telesthesia” (perception at a distance) or “telepresence” necessitated in and through the drone’s operation, and the ways in which the operator might experience this “virtual space”, one “connected to reality, but mediated” (Rothstein [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR80): 128; Gregory [2011c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR46); Merrin [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR65)), and the implications of this. Here, the claim of the US Air Force that drones, through their configuration, enable “projecting power without projecting vulnerability” is significant. This sentiment has been critically considered in relation to wider claims around the efficacy and “precision” of drone warfare, those which draw upon “biological-medical” metaphors in the wider legitimation of the drone (see Gregory [2013a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR47); Schwarz [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR82); Suchman [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR90)).

Critical reflections on discussions of this “clinical” arrangement have focused upon whether physical distance equates to an “emotional distance” (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8): 200) or “pathologic emotional detachment” (Chappelle et al. [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR27): 363). Turning to the testimony of former airmen discussing, for example, the derogatory designation of children as “fun-sized terrorists” and those below the drone more widely as “black blobs on a screen” (The Guardian [2015a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR92), [b](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR93): n.p), an operator’s “emotional distance” is then interpreted and interrogated as an “ethical detachment”, or “moral” and “psychological dissociation” from their actions (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8): 200, Robins and Levidow in Wall and Monahan [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR97): 246). The sentiment that those below the drone become “psychologically invisible” to operators (Robins and Levidow in Wall and Monahan [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR97): 246; see also Chamayou in Gregory [2013b](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR48)) is also further developed in discussion of the asymmetrical relations between those involved (Walsh and Schulzke [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR98)). The comparative lack of risk, or “non-reciprocity” (Chamayou [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR25)), faced by the operator is recurrently tied to a lack of operational compunction, or even an “impersonal cruelty” towards those below (Neocleous [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR68): 588). Such interpretations collectively thus tie physical distance to emotion and ethics, positing that remote operations can equate to and breed forms of detachment.

While met with a resounding refrain from operational forces that “regardless of where they’re sat…operators act under the laws of armed conflict and do not take lightly the act of taking a human life” (Royal Air Force operator in Business Insider [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR23)), narratives of a distanced indifference persist, taking a range of forms. One particularly enduring trope is that of the “video game mentality”, in which drone operation is equated to the “playing [of] a video game” (Cole et al. [2010](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR29); Rothstein [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR80): 127). Such accounts cite both the drone’s comparative architecture, such as the “screens and joysticks” (Shaw [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR83): 651) or “nature of the interfaces” (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8): 200), and statements of former operators citing that in entering the drone programme they thought they’d “get to play a videogame all day” (former US Air Force airman in Schei [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR81): n.p, Merrin [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR65)). This video-game-centred trope is further formed and exacerbated through the actions and statements of military forces, with military personnel remarking upon the “similarity” and shared “skill set…between flying drones and playing video games” (Lieutenant Barnes in Shaw and Akhter [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR87): 1493). Further, military forces have also sought drone operator recruitment in gaming-locations (Schei [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR81); The Guardian [2015b](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR93)), used video games as recruitment tools in “civil spaces” (Rech [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR76), Crogan [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR32); Merrin [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR65); Power [2007](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR73); Stahl [2006](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR88)), hosted video game drone simulators for civilians to play online (e.g. US Air Force game, see Download [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR35)), (3) and even re-fitted military drone simulators to “keep up with the technologies… familiar to the Xbox and Playstation generation” (Ministry of Defence in Rech et al. [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR78): 52; Crogan [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR32)). The multi-faceted trope of the “video game” and/or “armchair” or “cubicle” warrior has, as the wider military community have noted, thus become both enduring and “difficult…to counter” (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105), Unmanned Experts CCI). Drone operation, then, continues to be associated with both external and internal forms of stigma (Government Accountability Office [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR40)).

While when likening drone operations to the playing of a video game such analyses tend to focus critique upon “targeted killing” operations, it remains that a majority of drone operations in fact centre upon the conducting of Intelligence, Surveillance and Reconnaissance (ISR) missions (Unmanned Experts IC1). Such ‘non-kinetic’ surveillance missions purportedly involve “repetitive monitoring tasks” (Unmanned Experts CCI) over lengthy periods of time. Alongside assertions of bored operators spending 92% of their on-duty time “twiddling thumbs” (Barnard [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR15): 20; GQ [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR42); Rolling Stone [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR79)), this situation has attracted a further discourse of the “detached” operator as “voyeur”. Here, the testimony of former operators reflecting upon their their “persistent watching” as that of the “ultimate voyeur, the ultimate peeping Tom” (in Schei [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR81): n.p) is cited. This discussion of the “detached watching” of target populations is further critically developed through the citation of some (former) operators who have reportedly derogatively designated the drone’s “targets” as “squirters”, “prey”, or “beautiful” (Pugliese [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR74); Allinson [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR5)). In interrogation of such denigrations, scholars have been quick to note their orientalist roots, and the “drawing of a caesura, [namely] a mental and political cordon around those whose actions inherently render them part of the population it is acceptable to put to death” (Allinson [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR5): 119–120). Collectively, then, in understanding and representing the drone operator as “distanced and detached”, a range of constituting discourses are recurrently cited and performed. This narrative, then, is not singular, but rather multiply comprised. Nonetheless, as I will go on to demonstrate shortly, this presentation of the drone operator is both complicated, contested, and countered with the second key discourse surrounding their role and experience as instead “intimate and proximate”.

**The “intimately proximate” operator**

*The smoke clears… there’s this guy…the blood is squirting out of his leg, and it’s hitting the ground, and it’s hot. The blood is hot… it starts to cool off…It took him a long time to die. I just watched him…become the same color as the ground he was lying on (Former sensor operator in GQ*[*2013*](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR42)*: n.p)*

The characterisation of the drone operator as distanced and detached is countered by accounts which instead consider the operator as “intimately proximate” to and with those below the drone. Writing of the same technologies, such accounts instead portray the drone as a remote platform presenting operators with a continuous, (near) real-time, and detailed view of that below. Here, discussions of physical distance between bases and targets are commonly renarrated to those instead between the operator’s “eye and the screen”, namely around “eighteen inches” (Gregory [2011c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR46): 197). This spatial arrangement, then, is attributed with fostering “a peculiarly new form of intimacy” or connection (Gregory [2011c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR46): 206). This is then further associated with a revised discussion of risk whereby discussions of a lack of physical risk are instead replaced with those of risks to mental health associated with the screen-mediated warfare at a distance (Williams [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR102); Pinchevski [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR72)). Here, both the testimony of former operators-turned-whistleblowers “speaking out” against the unanticipated and lasting psychological effects of their role, and a growing number of studies (predominantly conducted by researchers in the US Air Force School of Aerospace Medicine and US Air Force Research Laboratory), are cited.

Within discourses of drone operators as ‘intimately proximate’ there remains a focus on the effects of exposure to violent combat footage (Chappelle et al. [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR26), [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR27); Ouma et al. [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR71); Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8); Pinchevski [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR72)). In reflecting upon the “intimate nature of the video surveillance” conducted (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8): 205), that evoked in the quotation opening this section, particular interest has been taken in testimony describing the effects of witnessing bodies “twisting and contorting and glowing from the heat of the blast” (operator in Breaking Defense [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR22): n.p, see also The Guardian [2015a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR92); GQ [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR42); Rolling Stone [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR79); Schei [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR81)). Here, the detailed view that the drone offers has been attributed with a “sobering reality rarely shared by other pilots or artillerymen” (Defence Committee [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR33): 39). Descriptions of the drone operator as “executioner” have thus been revisited and amended to note their potential susceptibility to becoming a “psychological victim of [their] duty” (Gregory [2013c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR49): n.p). Here, discussions of the vulnerability of drone operators to post-traumatic stress disorder (PTSD) continue, centring around operators witnessing “death in high definition” (Unmanned Experts CC1; Gregory [2013b](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR48)), leading to so-called invisible wounds (Dreazen [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR36): n.p, see also Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8); Gregory [2011c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR46)). Such issues have however been subject to wider critical debate (Chamayou in Gregory [2013c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR49)), regarding for example a potential fetishisation of the role in relation to other combat positions, such as soldiers on the front lines (Pinchevski [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR72); Morris [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR67)).

While differently approached, presented and interpreted, discourses around the drone operator as “intimately proximate” are arguably further developed in papers authored by US Air Force research personnel. Here, surveying active personnel, an otherwise largely inaccessible community, Air Force reportage has examined what it terms as “stressors”, those including “combat stressors” (namely exposure to combat footage) (Ouma et al. [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR71): 6). Here, researchers have determined that “there may be elements of the [drone] environment that engender clinically significant emotional reactions” and “psychological distress” (Chappelle et al. [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR27): 357). It should, however, be noted that such research did also more widely assert that a notable issue operators experienced was that of “burnout” (Chappelle et al. [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR26); Ouma et al. [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR71); Otto and Webber [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR70)). Here, researchers shift focus from combat exposure and instead to issues of “occupational stress” (including workload, hours, shift patterns, and career progression) as a key contributing factor to operational strain (see Chappelle et al. [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR26); Ouma et al. [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR71); Otto and Webber [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR70)). This sentiment is echoed in scholarly reflections on the ‘disjointed routine’ accompanying ‘deployment on station’ necessaitated for those in the core operational team (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8)). Here, operators describing their journeys from the roles and experiences of the Ground Control Station “back into the rest of life in America” are drawn upon—with their working patterns, that akin to “flipping a switch—you’re in war, you’re out of war” (Graham [2007](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR43): 130), foregrounded. It is these conditions, it is asserted, that further exacerbate and amplify both the complexities of the role and challenges around operator morale (Government Accountability Office [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR40)). Such reflections are echoed in academic literature and commentary more widely. For example, in discussion of the ‘disjointed routine’ drone operators experience as part of their deployment-on-station—scholars point to the “psychological complexity of moving back and forth, on a daily basis, between remote combat operations… and domestic…life” (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8): 205; Government Accountability Office [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR41)). Here, identified are a series of challenges in ‘combat compartmentalization’ (Center for the study of the drone [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR24): n.p), prompted by the “bizarre lifestyle” in which “mundane activities” are “interspersed with stints at the base” (Stahl [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR89): 670). Narrated as ‘intimately-proximate’, drone operation is understood and presented then as subject to a range of different forms of challenges and strains - spanning visibility, witnessing, and workload.

Collectively, in this and the previous section, then, we see an at once divided, contested, complex and even contradictory portrayal of the drone operator emerge, one that Adey et al. ([2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR4): 180) describe as occupying a “problematic…comfort-conflict disjuncture”. While encouraging further critical reflection of the utility of dichotomous representations, this overview of the narratives that recurrently envelop the drone operator—a key contemporary digital warfighter—seeks primarily to contextualise what follows. As is evident, much of the discussion on the drone operator’s role tends to focus upon the drone operator ‘in-theatre’, namely as they undertake surveillance and strike missions—performing and living with their actions, rather than learning them (though see Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8)). While of course a pertinent point or moment for critical analysis, such investigations also arguably invite (empirically) approaching the drone operator at alternative operational temporal points. In what follows then, drawing upon fieldwork both at military conferences (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105) and UAS [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR106)) and through the completion of industry-afforded online training hosted and kindly gifted by drone consultants “Unmanned Experts” (Unmanned Experts ICI, CCI), I seek to re-approach the drone operator at an alternative temporal point. Here, I focus on the training of drone operators through the employment of simulator technologies, demonstrating their usage as both an issue marking a key and ongoing debate within the military, an alternative empiric window, and, importantly, as a stage or act—a temporality—variously informing the subsequent ‘in-theatre’ operations of drone operators.

**Temporally re-approaching the drone warfighter**

This section re-approaches the drone operator, a contemporary digital warfighter, through the lens of training, and more specifically, explores the use of simulator technologies therein. In so doing, it seeks to both re-approach the drone operator at an alternative temporal point, namely prior to ‘in-theatre’ operatoins (which remain the focus of much critical commentary), and to more widely respond and contribute to Klauser and Pedrozo’s ([2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62)) call for further attentiveness to the “making of” the drone. Here, in seeking further attentiveness to how the drone comes to function, the scholars call for an exploration of the “domains of expertise…, expectations and beliefs that interact, fuse, emerge and crystallise around particular systems” (Klauser and Pedrozo [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62): 290). In so issuing this call, the authors arguably evoke existing literatures exploring both the (training of) the aerial subject, and the intersections between preparation and security more widely. For example, in describing “air-targeting” via drone, Adey et al. ([2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR4): 176–177) note that the practice remains “not merely a product of developments within the technologies of vision, but also developments within the epistemologies of…knowledge production” (see also Hall Kindervater [2017](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR54)). As such, they assert that a “crucial component of these violent epistemologies” is “the cultivation, training and discipline of an aerial eye”, one that is “able to interpret and target” (Adey et al. [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR4): 177). Here, work more widely examining the ways and means through which bodies (of “aerial subjects”) may be trained and prepared for action, is also evoked. For example, in discussion of the British Air Scouts, Peter Adey ([2010](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR1): 53) examines a range of exercises, games, and drills (e.g. how to fly, plan a battle, save someone from a crash), as methods seeking to produce a “particular kind of body: a body readied for performance, prepared for war…ready to step into action” (see also Adey and Anderson [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR2)). Following such interests in examining the training of the (war)fighting body, in what follows I turn to examine one key temporality and practice—that of training via simulation—as a window into more richly understanding the emergence and “making” of the drone operator, an endeavour, I argue, acting as a provocation for the temporally multiple study of the “digital warfighter” more widely.

This section is thus structured as follows. It first introduces and interrogates how operators are trained, through the use of simulators, to both manoeuvre and “identify” potential targets. Here, such analysis seeks to revisit and temporally extend existing analysis reflecting on the drone’s “scopic regime” and the “techno-cultural mediation” in and of drone vision (Gregory [2011c](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR46): 190, [2013d](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR50)). Given that, as Eyal Weizman ([2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR100): 372) argues, the “very purpose” of drone vision is to identify and target individual bodies, this section turns to simulation—an “important issue in the contemporary technoscientific milieu” (Kinsley [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR61): 1559; Woodward [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR104); Suchman [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR91))—in order to reflect upon *how* the drone operator *comes* to see. In so doing, it critically unpacks the role of the simulator as crucial device acting to prepare the contemporary digital warfighter. Second, it goes on to explore the ways in which such training represents a form of conditioning or “attunement” (Ash [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9)), one that itself furthers and complicates existing narratives of drone operation and video games. For example, as formerly discussed, there remains an enduring trope of drone operation as “like a video game”, with some operators themselves noting that “it can get a little bloodthirsty. But it’s fucking cool” (in Merrin [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR65): 163; see also Suchman [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR91)). In seeking to re-approach and revisit this trope, in this section I turn instead to geographical scholarship attentive to the digital which has critically examined video game production and play. In so doing, I argue that an opportunity emerges to re-script this trope, focusing instead on the ways in which simulators act to ‘attune’, that is to ready, their users (Ash [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9))—that which can be understood as an important preparatory stage underpinning the ‘live’ operations that follow. Collectively then, this section demonstrates that the training temporality, and practice and experience of simulation therein, both renders visible alternative scriptings of drone operators and operation, and contributes to emergent debates around the “making of” the drone (warfighter) more widely.

**Training the drone warfighter: simulator roles, hours, and mediation**

*The goal of simulation is a suspension of disbelief, it needs to be as much like a real operational environment as possible, you want to see a student start to sweat (speaker, UAS Training and Simulation*[*2014*](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)*)*

The recruitment of a drone operator, after successful screening, is followed by the scheduling of their training (Hardison et al. [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR55)). Over the course of several months (depending on entry route), drone operator candidates undertake a training pathway broadly comprised of: flight screening in which pilots learn to fly a small aircraft, instrument qualification in which simulators are used in learning how instruments function, a “fundamentals” course teaching key academics of flying (involving several labs or missions), formal training units in which pilots learn to fly particular platforms on base, and finally ongoing continuation training and checks (4) (Government Accountability Office [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR41); Center for the Study of the drone [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR24); UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105); Hardison et al. [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR55)). Parts of this process are shared in the training of sensor operators, who undertake a programme comprised of: an aircrew fundamentals course (covering aircrew culture); a basic sensor operator course (training operators on full-motion video, sensor basics, and analytics); and lastly (in conjunction with drone pilots) participation in formal training units (Center for the Study of the drone [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR24); UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)). Following the completion of these stages of training, drone pilots and sensor operators receive their ‘wings’ (UAS [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR106)).

As noted, the use of simulators forms a key part of the training process. By way of context, simulators seek to “model the real” with the aim of assisting in the “training or understanding” of particular environments (Hughes [2007](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR57): 982). Simulation can take a number of forms, broadly divided into “live”, “virtual”, and “constructive” forms (5). Training for so-called Medium Altitude Long Endurance (MALE) platforms such as the MQ-9 Reaper (US Air Force [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR106)) takes the form of “virtual simulation”, that which involves participants virtually “playing through” an imitated scenario in and via a “computer-controlled setting” (University of central Florida [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR95): n.p). This is undertaken on T-6 simulators (Hardison et al. [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR55): 11). While comprising an important segment in the wider drone training pathway, the use of simulators as training tools nevertheless remains the subject of considerable and ongoing debates at military conferences focused on the “manning” of drone systems more widely. Therein, the use of simulators is praised on a number of fronts. For example, in the UK, the regulatory conditions limiting the live flying of military drones have been said to necessitate the need for the use of simulation technology (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)). More widely, simulators have been lauded as reducing both “the environmental impact of military flying”, the cost of training (Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8)), and the number of platforms purchased solely for training purposes (Developments, Concepts and Doctrine Centre [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR34): 2–10). Simulators also provide the capacity to train operators around the clock, overcoming limitations of available training flight “slots” or the limitations posed by inclement weather (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)). Lastly, simulators are attributed with improving the “quality of training”, both by individually tailoring that offered, and increasing the breadth of what’s offered through “simulating [a range of] warfighting conditions”, thus providing operators the opportunity to train in synthetic “fifth generation” environments (Developments, Concepts and Doctrine Centre [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR34): 2–10).

Nonetheless, while receiving high praise by some, others in the military (and wider communities) have expressed concerns regarding the limitations of simulator technology as a training resource. Questions have been raised, for example, regarding the “comprehensiveness” of simulation packages, referring to the “mission sets” for which training can be offered (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)). In addition, commentators have repeatedly stated the importance of simulator “fidelity” in offering a “realistic” imitation or the drone’s visual capabilities, in particular of its sensor payloads (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105), UAS [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR106)). This statement is then met with the assertion that with “fidelity” comes great cost (ibid). This sentiment is echoed in Crogan’s ([2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR32): 45) critical exploration of simulator technology, in which he describes the key “stakes” of simulation as “realism”. In so doing, and drawing upon the work of Paul Virilio, Crogan ([2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR32): 45) suggests that the simulator’s “virtual space is dromoscopic”, thereby meaning that as more complex scenes are rendered (e.g. those containing more detail about “terrain, fixed structures, and objects moving in the scene”), more complex calculations are required: those which are accompanied by considerable cost. This observation was echoed at the military conferences attended, with delegates raising concerns about both the initial infrastructural costs of simulators, and the additional cost requirement to keep the systems updated (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)). Particular concerns were levied here regarding the ability of the simulator to meet the requirement for “future-proofing”, whereby technology can be updated with the aim of “keeping up” with the pace of wider technological developments (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105); UAS [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR106)).

Debates around the use of simulation technologies have further come to a head regarding the issue of the appropriate allocation of simulator time or hours during drone operator training. Therein, some commentators have proposed that given the aforementioned benefits that simulators are said to encompass, that while some forms of “collective training” remain necessary, “the live flying requirement for training could, potentially, be reduced considerably” (Ministry of Defence [2011a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR66): 6–11; see Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8)). This statement has been echoed in proposals for training for operators of Medium Altitude Long Endurance (MALE) platforms such as the British Army’s Watchkeeper to involve a “50–50 division” between simulator training and live flight training (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)). This sentiment has also notably been taken further by a number of military practitioners and proponents who have expressed aspirations regarding “zero hours” or “zero flight time” training, in which simulators would be used in an “end to end” training process in lieu of live flying (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)). This discussion is thus one that continues to unfold. Given this contextual situation, in what follows, in re-approaching the drone operator at this pre-operational training point, I seek instead to analyse the significance of the training temporality—as encompassing and mediated by the simulator. In so doing, I turn to digital geographical scholarship interrogating the production and playing of video games. Here, I argue that in approaching the drone operator through simulation—itself a form of video game, namely “playing through” a simulated environment (Rech et al. [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR78))—in conjunction with critical video games literatures, revealed are alternative scriptings of the drone warfighting—not as “Nintendo or videogame warrior”, but instead as undertaking and experiencing a form of attunement (see Ash [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9)).

**Alternative drone-video game scriptings: anticipatory attunements**

In training drone operators to “read” a scene, that is to discern and interpret potential “threats”, the use of simulators can be understood as the deployment of a tool or technique seeking to foster ‘anticipatory action’ (see Suchman [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR91)). Here, in using the term ‘anticipatory action’ geographer Ben Anderson refers to that which seeks to “preempt, prepare for, or prevent threats” through the “rehearsal” of particular scenarios and responsive techniques (Anderson [2010](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR7): 777; Adey and Anderson [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR2)). In discussion of a particular US Homeland Security programme, Louise Amoore ([2007](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR6)) concentrates this sentiment on the fostering of what she describes as “vigilant or watchful visuality”—namely seeing—and preparatory learning to look—in particular ways, those which “categorise and classify people into particular images and imaginaries” (Amoore [2007](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR6): 215, 218; see also Rech et al. 2015). In this vein, in approaching simulator technology as a form of “future-oriented production”, Patrick Crogan ([2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR32)) traces the development of SIMNET, a “networked military simulation training system” fielded in 1987 by the US Department of Defense (DoD). Reflecting upon the propensity of simulation technology to ask the question “what if?”, Crogan ([2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR32): 30) charts the “anticipatory” impulses governing the development and deployment of this technology. Interested in the simulator as indicative of the desire for “permanent preparation” (Crogan [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR32): xix), such an approach echoes wider discussions of “preparedness”, particularly in geographical scholarship, which explores the “practices and technologies that constitute” particular security apparatuses and assemblages (Adey and Anderson [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR2): 99). For example, in exploring the UK Civil Contingencies, a form of preparatory emergency planning, Adey and Anderson ([2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR2): 99) seek to forefront “the life of the security assemblage”, namely the “human experiences”, animations, performances, and modes of participation in scenarios and exercises that seek to “anticipate” particular events or occurrences, and thus mitigate against them through different forms of preparation. Following such discussions, and those which understand the (drone operator’s) body as a “site of performance” (Dowler and Sharp in Williams [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR102): 384), in what follows I argue that scholarship attentive to preparedness can be valuably considered alongside geographical work approaching videogames as “a (techno)cultural practice” (Ash and Gallacher [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR13): 351), and more specifically exploring the “bodily attunement” of gamers (Ash [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9)) (6).

In discussion of the video gamer, attunement, as James Ash ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9): 28) presents it, refers to the process of managing the “affective and emotional state of being of the user” via the development and employment of “various bodily capacities for action”. Users develop these capacities for action, Ash ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9): 34) argues, in seeking to anticipate “what others [in the game] will do”. Ash ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9): 34, 39) demonstrates this form of bodily attunement through the examples of players firing weapons, that which involves them being able to both “move the crosshair to an exact point on the screen”, and to determine lines of sight in the game (see also Bos [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR19)). Ash ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9): 34) describes such skills as both somatic and analytic attunements, as they involve the development of “hand–eye coordination”, and the use of “intuition derived from past experience” in progressing through the game. Building upon this sentiment, Ash ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9): 28) identifies these processes of attunement as “central to the production of captivated bodies” in the gaming landscape. Captivation of the user’s body, Ash ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR9): 28) argues constitutes a “key part of the genre’s appeal and commercial success”. It is here that we can return to the drone simulator. As a device predicated upon “captivating its user” by “immersing them in a realistic scene” (UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105)), the simulator can, I argue, be considered as similarly seeking to facilitate its user’s bodily attunement to particular dexterities and scenarios. While simulators are differently purposed and predicated, their operators nonetheless arguably undergo a similar, if distinctly guided, process of bodily attunement, in response to their repeated completion of a series of mediated tasks and scenarios. For example, in the process of releasing a missile from the drone, there is a lag or latency period of around 8 seconds between the period of arming the drone, releasing its weapon, and its impact (Unmanned Experts ICI). Operators are thus trained in order to anticipate this aspect of functioning in what is termed “near real time” (Unmanned Experts IC1). In training operators to anticipate and navigate this “temporal rift” (Pugliese [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR74): 938), they learn how to aim the missile based on both the (projected) movements of the targets, the missile latency, and the effect that the missile’s “sonic boom” may have on this movement. Akin to the somatic and analytic attunements of the gamer, through this form of mediated simulator training, the operator too becomes attuned to particular forms of analytic interpretation of a screenic scene, and anticipatory somatic dexterities. In the case of the simulator this is, of course, designed with a particular purpose—namely to prepare the drone operator with particular “reading and assessment” skills (Graham in Woodward [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR104): 49), those which are then mobilised ‘in-theatre’, as a crucial form of skilled pratice through which ‘targeted killing’ takes place (McNeal [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR64)).

This form of preparation, that is the “making of” the drone operator through particular forms of training, directly informs subsequent in-theatre drone operations. This relationality is pertinently evidenced in drone operator testimony. Responding to the interview question “what goes through your mind when you’re trying to eliminate a target?”, an operator states, for example, “you’re not thinking about taking a life—you’re thinking about getting the sums right—getting your commands right—focusing on the target, what you think the weapon will do to the target” (in BBC Radio 4 [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR18): n.p). In reflecting on the “making of” the drone through the process of learning to drone via simulator-led training, this section then has both responded to and further promoted an attentiveness to alternative temporal points comprising and composing drone operations. In so doing, it has demonstrated an opportunity to revisit and complicate the entrenched video game trope that surrounds the drone operator. By consulting nuanced and empirically informed videogame scholarship, it has demonstrated the utility of reflecting more widely upon different means and techniques through which drone operators both learn and come to drone, actions which themselves importantly underpin its subsequent and ongoing functioning.

**Conclusions: temporal and methodological provocations**

In re-approaching the drone operator, this article has turned to examine their training, and in particular the roles of simulator technology therein. Through what can be understood as a temporal re-examination, this article has sought to build upon and complicate existing and entrenched narratives which surround the contemporary digital drone warfighter, as either “distanced–detached” or “intimately proximate” from and to “target communities” below them. While extant drone scholarship largely (though not exclusively) focuses upon the drone as it "functions" (i.e. is ‘live’ or ‘in-theatre’), this article responds to calls further attentiveness to the drone’s “making”, that is the actors, actions, practices, processes, and knowledges enabling the drone to come to function (Klauser and Pedrozo [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62)). In so doing, it brings together fieldwork at military knowledge sites where simulators as tools for training drone operators were explored, with geographical scholarship examining video gaming, with with the collective aim of revisiting and critically complicating entrenched narratives likening the operation of drones to that of ‘video-gaming’. While here approached through the example of a specific aspect of the training period, this article ultimately calls for further reflection on the lenses through which we do and can empirically approach the drone operator, and maintaining an attentiveness to the multiple temporalities (that exceed the deep historical) that importantly act to constitute and comprise the subsequently functioning drone.

In this vein, this conclusion seeks to offer less of a restating of the article’s key arguments, and rather sees space for provocation for the study of digital war—that both temporal and methodological in nature. In terms of temporal provocation, the drone and its operator, one such digital warfighting device and warfighter, have a complex and multiple relationship with time. While scholars have reflected upon the role and experience of drone operation (as demonstrated in the introduction), drone operation is also tied to alternative temporalities. For example, in thinking with the practice of the lethal drone strike (or “targeted killing”), scholars have pointed to the US’ justificatory invocation of the legal “right of anticipatory self-defence” in order to protect from an “imminent threat” (Boyle [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR21): 111). Therein, an individual under suspicion (a “target”) is not considered in relation to past “crimes committed” but rather in relation to their “potential to become dangerous” (Weizman [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR100): 368). A *potential future* is thus forecast and drawn into the present. Then, in developing a “case for action” for conducting such a strike, a list of potential targets is collated and, subject to verification (of various forms of “intelligence information”), is edited and finalised into a “kill list” (McNeal [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR64): 701). This process informs a wider sequence of events known as the “kill chain”, in which the case for an approval for an attack is conducted, followed by the “authorisation and actioning” of that strike (see The Intercept [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR94)). While detailed and diagrammatised as a linear sequence, this process is in fact demonstrative and inclusive of multiple (aforementioned) temporalities, that rather than being sequential are in fact enmeshed and intertwined. The drone then, is variously bound to, and productive of, different temporalities. This article thus approaches the training of the operator via simulators as a further temporality to be examined, and one through which the “anticipatory gaze” is importantly learned and fostered more widely (Amoore [2007](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR6): 216).

In thinking further with these entangled temporalities, we can again turn to helpful questions raised by drone geographers Francisco Klauser and Silvana Pedrozo. In calling for further work attending to the “making of” the drone, they ask, for example, “How do particular actors, forms of authority, and interests, coalescing in the making of drone projects, affect the visual, aerial, and spatial logic of the drone gaze?” (Klauser and Pedrozo [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR62): 290). Here, questions of power, human and non-human agency, and the sites, sources, and knowledges through which digital warfighting platforms are enabled and underpinned remain particularly pertinent, inviting additional exploration still. Further, as a political geographer, I am particularly drawn to accounts thinking critically with the historical and enduring dominance of the “downward looking view-from-above” (Williams [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR103): 225). In interrogating and seeking to dismantle and re-assemble this gaze, Williams ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR103): 225) argues for geopolitical understandings of airspace that “recognises the aerial view as generated from below as well as from above”. In other words, Williams ([2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR103)) is seeking a “re-orientation”. While interestingly pursued in her article through an examination of the (representation of the) Royal Air Force’s Air Surveillance and control system, I think the sentiment of her provocation can be extended further still. While of course valuable to encompass “looking up”, this notion could also be valuably extended—that is made differently directional—as a *temporal* provocation. By focusing on the multiple temporalities—that is points, practices, sites, and knowledges that precede the drone, and through which the drone, as one digital warfighting technology, *becomes* airborne—this act of temporal re-orientation would enable the telling of further drone stories still. Here, we can of course turn to work which has examined, for example, the showcasing of warfighting technology (Rech [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR77)) and the recruitment of warfighters (Rech [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR76)), but can also look beyond such contexts, as will shortly be explicated. What is interesting about such a temporal provocation is that it is bound to another: namely a more active temporal re-orientation invites, and even necessitates, methodological reflection.

As William Merrin ([2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR65): 1) aptly articulates, digital war is “not a new form of war, but an entire, emerging field”. As a political geographer, I turn often to the work of geographers interested in the digital, who have identified what has been described as a “digital turn” in the discipline (Ash et al. [2018a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR11): 25; Elwood & Leszczynski [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR107)). In exploring the “intensifying relationship between geography and the digital” (Ash et al. [2018a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR11): 25), geographers have developed a series of “methodological strategies” enabling engagement with the digital (Ash et al. [2018a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR11): 25; Leszczynski [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR109)). While important to be cognisant of the range of access limitations and impediments that surround working with technologies that are variously “redacted, hidden in plain sight, present but opaque” (Coley and Lockwood [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR30): 3–4; Gregory [2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR52); Leszczysnki [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR109)), it remains pertinent to pursue and explore a range of different sites and knowledges through which digital warfighting technologies come to function. Here, we might take inspiration from scholars who have variously located, negotiated, and navigated the digital and/or warfighter. For example, in examination of military recruitment at UK air shows, Matt Rech ([2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR77)) developed a reworked “observant practice” attentive to both the visual and material cultures through which recruitment is enabled and underpinned. In approaching the warfighter at an alternative site, the Navy Warship, Adey et al. ([2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR3)) instead reflect on the ways in which “the digital” (in this case social media) “cuts through” different spatialities, both personal and professional. Here, notions of technological mediation are differently approached—not through the lens of the digital warfighting technology service personnel employ, but rather through their private and personal usage of social media. This re-approaching evidences, the researchers argue, a “blurring and re-articulation of the boundaries of the military institution” (Adey et al. [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR3): 20). Lastly, in thinking with the very access to, and within, the digital, Garnett and Hughes ([2018](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR38)) explore what they term “obsfucatory practices”, that is “obscuring access” to particular forms of information (e.g. classified documents). In reflecting on what it means to work within such redacted and reductive confines, the authors raise questions about scholarly engagement with such artefacts (e.g. Freedom of Information requests or leaked materials), asserting that further reflection on research methodology therein remains necessary—a provocation with clear resonance to scholars of digital war more widely (see also Leszczynski [2019](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR109)).

In this article I approach the digital differently—drawing upon fieldwork at military conferences and through the completion of industry-hosted drone consultancy online training. While valuable sites at which drone knowledges “touch down” (see Jackman [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR58)), further methodological work attentive to the nuanced challenges, complexities, negotiations and navigations involved in such data gathering and analysis remains necessary. In pursuing the methodological opportunities that come with the labelling of an “emerging field”—and doing so, in this case, with a particular temporal orientation, then, I’d like to close by pointing to some initial potential directions. In working with the drone as an object of research more widely, for example, myself and fellow drone researcher Max Jablonowski are beginning to explore the commercial drone through the lens of both patents and speculative visualisations—each of which importantly anticipates and envisions particular drone futures. Here, interrogating both sites, and the role, of speculation we argue that such documents visually, textually and performatively act to promote a particular set of aerial-desires—those variously informing and constituting discourses and understandings of the drone more widely. This work is spurred largely by Sam Kinsley’s ([2010](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR60)) interrogation of “vision videos”, that is videos envisioning, depicting and promoting particular technological futures. Such videos, Kinsley ([2010](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR60)) argues, can be understood as forms through which “futures are made present”—that is both anticipated, and actively constitutive of understandings and imaginations more widely (see also Kinsley [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR61)). As such, when thinking about methodological approaches and diversity (in scope and temporal orientation), there remains a rich vein of digitally orientated work beyond a focus on warfare to be, I think, very valuably consulted (see Ash et al. [2018a](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR11), [b](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR12)). This conclusion then has sought to act as a small space for provocation, one seeking to call for further illumination of the variety and myriad of actors, practices, sites, spaces, temporalities and knowledges through which different forms of digital warfare and warfighter are formed, forged, practiced and felt; and importantly, a reflection on the affordances, barriers, navigations, and negotiations entangled in their access.

**Notes**

1. This article draws upon fieldwork at military conferences and through the completion of industry-afforded online training. The military conferences attended were UAS Training and Simulation [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR105) (8–10 December 2014, London Park Plaza, UK) and UAS [2015](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR106) (1–2 December 2015, Twickenham Stadium, London UK). Held over several days, they were billed as “leading events” for members of international military drone operating forces to gather, with industry partners, to discuss agenda-setting items. The online training completed was hosted by Unmanned Experts, and included the completion of six courses (UAS Introduction course ICI, UAS Completion course CC1, UAS Market and Careers course MC and CI, 3ic Remote pilot authorisation course, An introduction to UAS: the good, the bad, the ugly INT1, UAS rules and guidance update SR1A1). While formal military training courses sat by recruited operators of course remains closed to civilians, I approached the aforementioned online courses as a form of adjacent and accessible, albeit distinct, training authored by drone consultants. The company Unmanned Experts, for example, describes itself as a “world-leading provider of subject matter expertise in unmanned aircraft systems”, and has a Chief Executive Officer with extensive experience flying military drones. Following the forging of connections at one of the aforementioned military conferences, I was kindly gifted and completed six online Unmanned Experts courses.
2. When using the term “drone operator”, I refer to the wider operational team of both pilot, sensor operator, and Mission Intelligence Coordinators. This is not to conflate the distinct roles (see Ouma et al. [2011](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR71); Asaro [2013](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR8)), but essentially to avoid repeatedly stating “both pilots, sensor operators and Mission Intelligence Coordinators”. Where distinctions are particularly pertinent they are made.
3. Here, I refer to the US Air Force hosting, 2012–2013, a game in which members of the public could “play” drone operator, using a simulator-style game. Here, users were tasked with the mission of “locat[ing] and destroy[ing] enemy targets using AGM-114 Hellfire missiles launched rom a MQ-9 Reaper” (Download [2016](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR35): n.p). Once you had “armed” your platform, with the click of a mouse you could fire your simulated Hellfire missile, being rewarded with different numbers of points, depending on the “level” of target destroyed. After using your four missiles, you were given a total scope and tips on how to improve it. While no longer available, this game was previously located at <https://www.airforce.com/interactive/uav/index.html>.
4. In this section, the article explores aspects of the training process as an alternative temporality informing and constituting in theatre drone operations. In so doing, it focuses upon pre-operational or pre-live training—though it should also be noted that training provision does extend beyond this, for example the ongoing provision of “follow-on” or continuation training.
5. “Live simulation” refers to instances in which a scenario is simulated by people/equipment “in a setting where they would operate for real”, and “constructive simulation” refers to that which involves no human, and seeks to model natural phenomena, such as the path of a hurricane (University of central Florida [2014](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR95): n.p).
6. While of course pertinent to note that while simulators can be understood as a form of videogame, in the case of drone operator simulations, their usage informs subsequent overwatch and lethal striking operations—those associated with serious violence for the populations below them (Shaw and Akhter [2012](https://link.springer.com/article/10.1057/s42984-020-00003-0#ref-CR87)).

**Bibliography:**

Adey, P. 2010. Aerial life. Oxford: Wiley.

Adey, P., and B. Anderson. 2012. Anticipating emergencies: Technologies of preparedness and the matter of security. Security Dialogue 43(2): 99–117.

Adey, P., D. Denney, R. Jensen, and A. Pinkerton. 2016. Blurred lines: Intimacy, mobility, and the social military. Critical Military Studies 2(1–2): 7–24.

Adey, P., M. Whitehead, and A.J. Williams. 2011. Introduction: Air target. distance, reach and the politics of verticality. Theory, Culture and Society 28(7–8): 173–187.

Allinson, J. 2015. The necropolitics of drones. International Political Sociology 9: 113–127.

Amoore, L. 2007. Vigilant visualities: The watchful politics of the war on terror. Security Dialogue 38(2): 215–232.

Anderson, B. 2010. Preemption, precaution, preparedness: Anticipatory action and future geographies. Progress in Human Geography 34: 777–798.

Asaro, P.M. 2013. The labor of surveillance and bureaucratized killing: New subjectivities of military drone operators. Social Semiotics 23: 196–224.

Ash, J. 2013. Technologies of captivation: Videogames and the attunement of affect. Body and Society 19: 27–51. https://doi.org/10.1177/1357034X1141173.

Ash, J., B. Anderson, R. Gordon, and P. Langley. 2017. Unit, vibration, tone: A post-phenomenological method for researching digital interfaces. Cultural Geographies. https://doi.org/10.1177/1474474017726556.

Ash, J., Kitchin, R., Leszczynski, A. (2018a) Digital turn, digital geographies? Progress in Human Geography 42(1): 25–43.

Ash, J., Kitchin, R., Leszczynski, A. (eds). 2018b. Digital geographies. Sage Publishing, London: UK.

Ash, J., and L.A. Gallacher. 2011. Cultural geography and videogames. Geography Compass 5(6): 351–368.

Baggiarini, B. 2015. Drone warfare and the limits of sacrifice. Journal of International Political Theory 11(1): 128–144.

Barnard, L. 2014. Ensnared by the machine, the burdened protagonist: The drone pilot, the visual interface and the cultural phenomenon of trauma. https://southwales.academia.edu/lisabarnard. Accessed 10 Dec 2019.

BBC News. 2015. Drone operators risk mental trauma, says RAF commander. http://www.bbc.co.uk/news/uk-33384526. Accessed 10 July 2015.

BBC News. 2017. The US Air Force’s commuter drone warriors. https://www.bbc.co.uk/news/magazine-38506932. Accessed 8 Jan 2017.

BBC Radio 4. 2016. Drone pilot: You’re not thinking about taking a life. http://www.bbc.co.uk/programmes/p03tp4m8. Accessed 11 May 2016.

Bos, D. (2018) Answering the call of duty: Everyday encounters with the popular geopolitics of military-themed videogames. Political Geography 63: 54–64.

Bentley, M. 2018. Fetishised data: Counterterrorism, drone warfare and pilot testimony. Critical Studies on Terrorism 11(1): 88–110.

Boyle, M.J. 2015. The legal and ethical implications of drone warfare. The International Journal of Human Rights 19(2): 105–126. https://doi.org/10.1080/13642987.2014.991210.

Breaking Defense. 2014. War is no video game—not even remotely. http://breakingdefense.com/2014/11/war-is-no-video-game-not-even-remotely/. Accessed 20 Nov 2014.

Business Insider. 2012. Drone pilots say their job is not like a video game. Website Accessed 24 Sept 2012. http://www.businessinsider.com/drone-pilots-say-their-job-is-not-like-playing-a-video-game-2012-9?IR=T.

Center for the study of the drone. 2015. Training drone pilots. http://dronecenter.bard.edu/training-drone-pilots/. Accessed 10 July 2015.

Chamayou, G. 2011. The manhunt doctrine. Radical Philosophy 169: 2–6.

Chappelle, W., T. Goodman, L. Reardon, and W. Thompson. 2014. An analysis of post-traumatic stress symptoms in United States Air Force drone operators. Journal of Anxiety Disorders 28(5): 480–487.

Chappelle, W., E. Skinner, T. Goodman, J. Swearingen, and L. Prince. 2018. Emotional reactions to killing in remotely piloted aircraft crewmembers during and following weapon strikes. Military Behavioural Health 6: 357–367.

Clark, L.C. 2018. Grim reapers: Ghostly narratives of masculinity and killing in drone warfare. International Feminist Journal of Politics 20(4): 602–623.

Cole, C., M. Dobbing, and A. Hailwood. 2010. Convenient killing: Armed drones and the ‘PlayStation’ mentality. Website Accessed 15 Dec 2012. https://dronewarsuk.files.wordpress.com/2010/10/conv-killing-final.pdf.

Coley, R., and D. Lockwood. 2015. As above, so below: Triangulating drone culture. Culture Machine 16: 1–19.

Congressional Budget Office. 2011. Policy options for unmanned aircraft systems. https://www.cbo.gov/sites/default/files/112th-congress-2011-2012/reports/06-08-uas.pdf. Accessed 15 July 2011.

Crogan, P. 2011. Gameplay mode: War, simulation, and technoculture. Minneapolis, MN: University of Minnesota Press.

Defence Committee. 2014. Tenth report. Remote control: Remotely piloted air systems—Current and future UK use, house of commons. http://www.publications.parliament.uk/pa/cm201314/cmselect/cmdfence/772/772.pdf. Accessed 20 June 2014.

Developments, Concepts and Doctrine Centre. 2013. Joint Doctrine Publication 0-30. UK Air and Space Doctrine, Ministry of Defence. https://www.gov.uk/government/publications/uk-air-and-space-doctrine-jdp-0-30. Accessed 10 Aug 2014.

Download. 2016. MQ-9 reaper simulator game. http://a1.g.akamai.net/f/1/15157/1h/dodairforce.download.akamai.com/15157/airforce/videos\_more/interactive\_features/v0040/games/game\_flyTheMQ-9Reaper/. Accessed 10 Jan 2016.

Dreazen, Y. 2014. Stop pretending drone warfare is casualty-free for America. TIME. http://time.com/3478425/american-troops-ptsd-casualties/. Accessed 10 Nov 2014.

ECCHR Berlin. 2014. Brandon Bryant, a former US-drone pilot, speaks at ECCHER in Berlin. https://www.youtube.com/watch?v=s2osKq0OWss. Accessed 29 Oct 2014.

Elwood, S., Leszczynski. 2018. Feminist digital geographies. Gender, place & Culture 25(5): 629–644.

Garnett, P., Hughes, S. M. (2018) Obfuscated democracy? Chelsea Manning and the politics of knowledge curation, Political geography. 68: 23–33.

Gettinger, D. 2019. Drone databook. Center for the study of the drone. https://dronecenter.bard.edu/projects/drone-proliferation/databook/. Accessed 25 Sept 2019.

Government Accountability Office. 2014. Unmanned aerial systems: Actions needed to strengthen management of unmanned aerial system pilots, GAO-14-316. http://gao.gov/products/GAO-14-316. Accessed 10 June 2014.

Government Accountability Office. 2015. Unmanned systems: Actions needed to improve DOD pilot training, GAO-15-461. http://www.gao.gov/products/GAO-15-461. Accessed 11 Dec 2015.

GQ. 2013. Confessions of a drone warrior. http://www.gq.com/story/drone-uav-pilot-assassination. Accessed 23 Oct 2013.

Graham, S. 2007. War and the city. New Left Review 44: 121–132.

Gregory, D. 2011a. Lines of descent. Open democracy https://www.opendemocracy.net/en/lines-of-descent/. Accessed 8 Nov 2011.

Gregory, D. 2011b. The everywhere war. The Geographical Journal 177(3): 238–250. https://doi.org/10.1111/j.1475-4959.2011.00426.x.

Gregory, D. 2011c. From a view to a kill: Drones and late modern war. Theory, Culture and Society 28(7–8): 188–215.

Gregory, D. 2013a. Theory of the drone 3: Killing grounds. Geographical imaginations https://geographicalimaginations.com/2013/07/29/theory-of-the-drone-3-killing-grounds/. Accessed 29 July 2013.

Gregory, D. 2013b. Theory of the drone 9: Psychopathologies of the drone. Geographical imaginations. http://geographicalimaginations.com/2013/08/13/theory-of-the-drone-9-psychopathologies-of-the-drone/. Accessed 14 Aug 2013.

Gregory, D. 2013c. Theory of the drone 8: From invisibility to vulnerability. Geographical imaginations. https://geographicalimaginations.com/2013/08/08/theory-of-the-drone-8-from-invisibility-to-vulnerability/. Accessed 20 Dec 2013.

Gregory, D. 2013d. War and simulation, Geographical imaginations, https://geographicalimaginations.com/2013/01/11/war-and-simulation/. Accessed 15 July 2016.

Gregory, D. 2014. Drone geographies. Radical Philosophy 183: 7–19.

Gregory, D. 2018. Eyes in the sky: Bodies on the ground. Critical Studies on Security. https://doi.org/10.1080/21624887.2018.1432534.

Hall Kindervater, K. 2016. The emergence of lethal surveillance: Watching and killing in the history of drone technology. Security Dialogue 47: 1–16.

Hall Kindervater, K. 2017. The technological rationality of the drone strike. Critical Studies on Security 5(1): 28–44.

Hardison, C.M., M.G. Mattock, and M.C. Lytell. 2012. Incentive pay for remotely piloted aircraft career fields, project air force. RAND corporation https://www.rand.org/content/dam/rand/pubs/monographs/2012/RAND\_MG1174.pdf. Accessed 10 Jan 2013.

Holmqvist, C. 2013. Undoing war: War ontologies and the materiality of drone warfare. Millenium: Journal of International Studies 41(3): 535–552.

Hughes, A. 2007. Geographies of exchange and circulation: Flows and networks of knowledgeable capitalism. Progress in Human Geography 31(4): 527–535.

Jackman, A. 2016. Rhetorics of possibility and inevitability in commercial drone tradescapes. Geographica Helvetica 71: 1–6.

Jackman, A. 2019. Consumer drone evolutions: Trends, spaces, temporalities, threats. Defense and Security Analysis. https://doi.org/10.1080/14751798.2019.1675934.

Kinsley, S. 2010. Representing ‘Things to Come’: Feeling the visions of future technologies. Environment and Planning A 42(11): 2771–2790.

Kinsley, S. 2012. Futures in the making: Practices to anticipate ‘ubiquitous computing’. Environment and Planning A 44: 1554–1569.

Klauser, F., and S. Pedrozo. 2015. Power and space in the drone age: A literature review and politico-geographical research agenda. Geographica Helvetica 70: 285–293.

Leszczynski, A. 2019. Digitial methods II: Digital-visual methods. Progress in Human Geography 43(6): 1143–1152.

Macdonald, J., and J. Schneider. 2019. Battlefield responses to new technologies: Views from the ground on unmanned aircraft. Security Studies 28(2): 216–249.

McNeal, G.S. 2014. Targeted killing and accountability. Georgetown Law Journal 102: 681–794.

Merrin, W. 2019. Digital war: A critical introduction. London and New York: Routledge.

Ministry of Defence. 2011a. The UK approach to unmanned aircraft systems. Joint Doctrine Note 2/11. https://www.gov.uk/government/publications/jdn-2-11-the-uk-approach-to-unmanned-aircraft-systems. Accessed 16 June 2014.

Morris, D. 2015. Can drone operators get PTSD? Foreign policy. Website Accessed 4 June 2015. http://foreignpolicy.com/2015/06/02/can-drone-operators-get-ptsd/.

Neocleous, M. 2013. Air power as police power. Environment and Planning D: Society and Space 31: 578–593.

Noys, B. 2014. Drone metaphysics, presentation at “as above, so below: A colloquium on drone culture”, University of Lincoln, Lincoln, UK, 24 May 2014.

Otto, J.L., and B.J. Webber. 2013. Mental health diagnoses and counseling among pilots of remotely piloted aircraft in the United States Air Force. MSMR 20(3): 3–8.

Ouma, J.A., W.L. Chappelle, and A. Salinas. 2011. Facets of occupational burnout among U.S. Air Force active duty and national guard/reserve MQ-1 predator and MQ-9 reaper operators. Air Force Research Laboratory. www.dtic.mil/get-tr-doc/pdf?AD=ADA548103. Accessed 10 Feb 2012.

Pinchevski, A. 2016. Screen trauma: Visual media and post-traumatic stress disorder. Theory, Culture and Society 33(4): 51–75.

Power, M. 2007. Digitised virtuosity: Video war games and post 9/11 cyberdeterrence. Security Dialogue 38: 271–288.

Pugliese, J. 2011. Prosthetics of law and the anomic violence of drones. Griffith Law Review 20(4): 931–961. https://doi.org/10.1080/10383441.2011.10854726.

Pugliese, J. 2016. Drone casino mimesis: Telewarfare and civil militarization. Journal of Sociology 52(3): 500–521.

Rech, M. 2014. Recruitment, counter-recruitment and critical military studies. Global Discourse 4(2–3): 244–262. https://doi.org/10.1080/23269995.2014.909243.

Rech, M. 2015. A critical geopolitics of observant practice at British military airshows. Transactions of the Institute of British Geographers 40: 536–548.

Rech, M., D. Bos, K.N. Jenkings, A. Williams, and R. Woodward. 2015. Geography, military geography, and critical military studies. Critical Military Studies 1(1): 47–60.

Rolling Stone. 2016. 9 Things we learned from pissed off drone operators. http://www.rollingstone.com/culture/news/9-things-we-learned-from-repentant-drone-operators-20160314. Accessed 18 Mar 2016.

Rothstein, A. 2015. Drone. Object lessons. New York: Bloomsbury Publishing Inc.

Schei, T.H. 2014. DRONE documentary. https://www.imdb.com/title/tt3801730/. Accessed 15 Jan 2015.

Schwarz, E. 2016. Prescription drones: On the techno-biopolitical regimes of contemporary ‘ethical killing’. Security Dialogue 47(1): 59–75.

Shaw, I.G.R. 2012. Life and death in Droneworld. Critical Asian Studies 44(4): 651–658.

Shaw, I.G.R. 2014. History of US drones. Understand empire: Technology, power, politics. https://understandingempire.wordpress.com/2-0-a-brief-history-of-u-s-drones/. Accessed 10 June 2016.

Shaw, I.G.R. 2016. Scorched atmospheres: The violent geographies of the Vietnam war and the rise of drone warfare. Annals of the American Association of Geographers 106(3): 688–704.

Shaw, I.G.R. 2017. Robot wars: US Empire and geopolitics in the robotic age. Security Dialogue 48(5): 451–470.

Shaw, I.G.R., and M. Akhter. 2012. The unbearable humanness of drone warfare in FATA, Pakistan. Antipode 44(4): 1490–1509.

Stahl, R. 2006. Have you played the War on Terror? Critical studies in media communication 23(2): 112–130.

Stahl, R. 2013. What the drone saw: The cultural optics of the unmanned war. Australian Journal of International Affairs 67(5): 659–674. https://doi.org/10.1080/10357718.2013.817526.

Suchman, L. 2015. Situational awareness: Deadly bioconvergence at the boundaries of bodies and machines. Media Tropes 5(1): 1–24.

Suchman, L. 2016. Configuring the other: Sensing war through immersive simulation. Catalyst: Feminism, Theory, Technoscience 2(1): 1–36.

The Guardian. 2015a. Life as a drone operator: Ever step on ants and never give it another thought? https://www.theguardian.com/world/2015/nov/18/life-as-a-drone-pilot-creech-air-force-base-nevada. Accessed 10 Dec 2015.

The Guardian. 2015b. Drone wars: The gamers recruited to kill. https://www.theguardian.com/news/video/2015/feb/02/drone-wars-gamers-recruited-kill-pakistan-video. Accessed 2 Feb 2015.

The Intercept. 2015. The Drone Papers https://theintercept.com/drone-papers/. Accessed 10 Jan 2019.

US Air Force. 2015. MQ-9 Reaper. https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104470/mq-9-reaper/. Accessed 10 Feb 2020.

UAS Training and Simulation. 2014. InThe military conferences attended were UAS Training and Simulation 2014, 8–10 December 2014. London Park Plaza, UK.

University of central Florida. 2014. Simulation. https://www.ist.ucf.edu/About/WhatisMS.aspx. Accessed 4 Dec 2019.

Wall, T. 2013. Unmanning the police manhunt: Vertical security as pacification. Socialist Studies/Études Socialistes 9(2): 32–56.

Wall, T., and T. Monahan. 2011. Surveillance and violence from afar: The politics of drones and liminal security-scapes. Theoretical Criminology 15(3): 239–254.

Walsh, J.I., and M. Schulzke. 2015. The ethics of drone strikes: Does reducing the cost of conflict encourage war? Strategic Studies Institute.

Weber, J. 2015. Keep adding. On kill lists, drone warfare and the politics of databases. Environment and Planning D: Society and Space. https://doi.org/10.1177/0263775815623537..

Weizman, E. 2014. Introduction, part II: Matter against memory. In Forensis: The Architecture of Public Truth, ed. Forensic Architecture Collective (2014). Sternerg Press: Berlin.

Wilcox, L. 2016. Embodying algorithmic war: Gender, race, and the posthuman in drone warfare. Security Dialogue 48(1): 11–28.

Williams, A.J. 2011. Enabling persistent presence? Performing the embodied geopolitics of the unmanned aerial vehicle assemblage. Political Geography 30: 381–390.

Williams, A.J. 2013. Re-orientating vertical geopolitics. Geopolitics 18(1): 225–246. https://doi.org/10.1080/14650045.2012.717237.

Woodward, R. 2014. Military landscapes: Agendas and approaches for future research. Progress in Human Geography 38(1): 40–61.