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The Actors Are Leaving the Control Station

The Crisis of Cooperation in Image-guided Drone Warfare

The Ground Control Station in Remote Warfare[1]

Under the condition of extreme remoteness, as is facilitated by computer-aided and robotic weapon technologies, military interventions, both geographically and in relation to the laws of war, have become increasingly "limitless".[2] Paradoxically, remote military interventions are, by their very nature, restricted to the *closed system* of computerised, heavily mediated environments of control. The potential for crisis in the cooperation of human and non-human actors is nowhere more apparent than in the ground control stations (GCS) in remotely-controlled drone warfare. A GCS provides image-guided control over the deployment of so-called *unmanned* weapon systems. It forms the central operative unit for decision-making and action in remote warfare by linking human perception to the sensor technology of the drone. It is, thus, a crucial component of a control setting, where questions of agency culminate in a distinctly political operation – the remote execution of a military command to kill.

Due to their remote setting, drone operations structurally rely on visibility and controllability via a complex system of sensors, control instruments, software interfaces, and transmission technologies. In such cases, knowledge of a situation in an area of operation, the *situational awareness*, is based mainly on operative images in the form of visualised sensor data, but even where images form the primary, often sole, basis for action, the analysis must not be narrowed down to the level of depiction. The situation in which the images are being applied must also be considered. Against the background of an expanded understanding of what constitutes a military operation, we will discuss the ground control station as a site of image-operations in contemporary warfare.

Contact Zones of Sensing

The terminology of *unmanned aerial vehicles* is misleading in the context of remote-controlled military interventions, in that both the infrastructures for guiding and controlling drones at a distance and the decisions underlying the actions are the result of intricate cooperation between a large

1 This text first appeared in German in: Johannes Bennke, Johanna Seifert, Martin Siegler, Christina Terberl (eds.), *Prekäre Koexistenz*, Paderborn: Fink, 2018. The authors would like to thank Timothy Cullen for the opportunity for critical discussion, Deborah Curtis for the translation, and Habib William Kherbek for editing.

2 Derek Gregory, The Everywhere War, in: *The Geographical Journal*, 177, 3 (2011), pp. 238–250; Caroline Holmqvist-Jonsäter, War as Perpetual Policing, in: Caroline Holmqvist-Jonsäter, Christopher Coker (eds.), *The Character of War in the 21st Century*, London/New York, 2010, pp. 103–118.

number of people in a situation of shared responsibility,[3] as well as the complex technological processes that could be said to facilitate those actions. While traditional aviation, even if cockpits have become computerised and automatised, still demands a comparatively high degree of independence on the part of pilots, the operational structure for the deployment of drones is essentially based on the communication between very different actors, such as cameras, relay stations, pilots, ground troops, military lawyers, data analysts and imaging specialists.[4]

Marie-Luise Angerer has highlighted the fact that the "the zones of contact between the interior and exterior domains of sensing can be understood to be simultaneous processes of connection, disruption, and translation", which generally proceed with a high degree of friction and conflict and are ultimately shaped by the "radical in-translatability (of 'sensing' and 'sense-ability')".[5] Accordingly, the contact zones between the human sensorium and machine-based sensing can be investigated as spaces in which some of these sources of friction and conflicts come to the surface while others disappear entirely behind the surfaces of the interface design and are rendered imperceptible to the operators. As a particular contact zone of sensing, the CGS points to the question of human-technological *co-existence* as a fundamental problem of military intervention and, arguably, as one of the most extreme means of political agency.

Analysing the use of the GCS, as illustrated in the available literature, and based on conversations with US Air Force pilots, we want to highlight the ways in which the conditions for human-machine cooperation refer to the circumstances of their design, and, thereby, to the tightly interwoven political, scientific and economic relations that extend far beyond the dedicated technological processes of control. In doing this, we seek to reach beyond a description of "distributed agency" and "chains of operations" to put the emphasis on the question of how the distribution of control is implemented and negotiated, i. e., on which parameters it is based, and where specifically *human* agency is distributed in these human-machine configurations.[6] In focusing on the moments of crisis within this cooperative process, we moreover seek to shed light on the apparent methodological reduction that comes with the terminological *symmetrisation* of human-technological co-existence which pervades not only the discourse in current cognitive science and media theory, but, also, military policy and action. Thus, we hope to return the focus to the politically pertinent – and explicitly human – interests invested in these processes.

3 Up to 200 people are required to run an aerial patrol with Reaper or Predator drones. In addition to the crew and technical personnel, this includes data and image analysts. See also Derek Gregory, From a View to a Kill. Drones and Late Modern War, in: *Theory, Culture & Society* 28.7–8 (2012), pp. 188–215, p. 195. See also M. C. Elish, Remote Split. A History of US Drone Operations and the Distributed Labor of War, in: *Science, Technology & Human Values* 42.6 (2017), pp. 1100–1131.

4 More detail in ibid., pp. 195–197.

5 Marie-Luise Angerer, *Ecology of Affect. Intensive Milieus and Contingent Encounters*, translated from German by Gerrit Jackson, Lüneburg, 2017, p. 46.

6 As Lucy Suchman and Jutta Weber have argued in their theorisation of the use of drones in a military setting the position that in a situation of shared "human-machine autonomy", agency should not be thought of as something pertaining specifically to humans or machines, but should be treated as a conglomeration of "effects of specific human-machine configurations", the analysis of which requires the careful setting of a framework, a "cut in the network", that allows a certain unit in the expansive system of agency to be rendered comprehensible, and its specific entanglement to be identified. Lucy Suchman, Jutta Weber, Human-Machine Autonomies, in: Nehal Bhuta, Susanne Beck, Robin Geiß, Hin-Yan Liu, Claus Kreß (eds.), *Autonomous Weapons Systems. Law, Ethics, Policy*, Cambridge, 2016, pp. 75–102, p. 91.

1 Ground Control Station, external view, Holloman Air Force Base.

2 Pilot and sensor operator in a Ground Control Station, Holloman AFB.

The Ubiquity of Operations

The GCS is composed of multiple workstations that are usually installed in a mobile shipping container (fig. 1). The configuration of hardware and software in the central control unit defines the options of visual access to the combat zone. The members of the crew are referred to generally as *operators,* and are then subdivided into pilots and sensor operators on the one hand, and a mission intelligence coordinator overseeing the procedure on the other. Pilots and sensor operators sit in front of multiple vertically and horizontally arranged monitors (fig. 2). These provide a range of options for visualising the sensor data from the multi-spectral targeting system[7], an array of different sensors that is attached to the body of the drone, also called the sensor ball. Furthermore, the screens show air traffic and cartographic information, as well as software applications for chat and email, in addition to other mission data, such as maps, command and control options, and the warning system.

The pilots guide the aircraft and control the weapons system while the sensor operators control the sensor system and are responsible for targeting. The mission intelligence coordinator prepares the deployment of the aircraft and provides support in the analysis and interpretation of the incoming sensor data, their comparison with external sources, and coordination with ground forces, lawyers, and superior officers. The information exchange between individual actors happens through chat clients and audio link, which connect the crew to the other participants in the so-called *remote split operations*.[8] Military research on the control and navigation of unmanned aircraft con-

7 The Multi-Spectral Targeting System is composed of an infrared sensor, an image amplifier, a daylight camera, a laser marker, and a laser illuminator.

8 Mark C. Elish, Remote Split. A History of US Drone Operations and the Distributed Labor of War, in: *Science, Technology & Human Values* 42 (2017), pp. 1100–1131.

ceives the relationship between human and machine as an immersive synthesis, in which processes relating to action, decision-making, and perception are realized in cooperation with humans. Correspondingly, military operations are increasingly understood as a convergence between human users and technical processes at the interface between senses, sensors and computational processes. In cultural and media theory this form of entanglement of the human and non-human is commonly framed by terms such as *cultural technique*[9], *operational chain*[10], *a priori*[11] and *hybrid*[12]. The debate about human machine cooperation has recently been expanded by the inclusion of older approaches from various disciplines, in which the symmetrical relation between humans and machines is taken as a given.[13] The way in which these approaches contribute to clarifying the precarious constellation of the actions of humans and machines in the context that concerns us here can only be elucidated based on the concrete observation of such operations through relevant practices with attention paid to the terminology of *operation* in a military context as well as in current media theory.

The US military regards any military action that serves the purpose of achieving a planned objective or military mission as an operation.[14] Military operations are increasingly understood as cooperation between automated and (partially) autonomous technologies and the human *operating crew*, whose agency and decision-making abilities are placed in a precarious relationship with the efficiency of technical systems. Somewhat oblivious to current media-theoretical debates on the recognition of non-human actors, in the military and technological discourse, *agency* is readily understood as *co-agency*, and the human actor is regarded as an "element"[15] or "component"[16] of an operative system. Against this background of the military understanding of operation, we will discuss the ground control station as a site of image-operations in contemporary warfare. To

9 See Bernhard Siegert, Cultural Techniques. Or the End of the Intellectual Postwar Era in German Media Theory, in: *Theory, Culture & Society* 30 (2013), pp. 48–65; Thomas Macho, Christian Kassung (eds.), *Kulturtechniken der Synchronisation*, Munich, 2013, pp. 16–18; Erhard Schüttpelz, Die medienanthropologische Kehre der Kulturtechniken, in: Lorenz Engell, Bernhard Siegert, Joseph Vogl (eds.), *Archiv für Mediengeschichte 6. Kulturgeschichte als Mediengeschichte (oder vice versa?)*, Weimar, 2006, pp. 87–110.

10 See André Leroi-Gourhan, *Gesture and Speech*, translated from French by Anna Bostock Berger, Cambridge, MA, 1993, pp. 219–235; as well as the texts referred to in fn. 3. For a critique of the concept of operativity in current German media theory, see Dieter Mersch, Kritik der Operativität. Bemerkungen zu einem technologischen Imperativ, in: Dieter Mersch, Michael Mayer (eds.), *Techne/Mechane. Internationales Jahrbuch für Medienphilosophie 2* (2016), pp. 31–52.

11 See Friedrich Kittler, Manfred Schneider, Editorial, in: Friedrich Kittler, Manfred Schneider (eds.), *Diskursanalysen 2. Institution Universität*, Opladen, 1987, pp. 7–11; Lorenz Engell, Joseph Vogl (eds.), *Archiv für Mediengeschichte 1: Mediale Historiographien*, Weimar, 2001; Erich Hörl (ed.), *Die technologische Bedingung. Beiträge zur Beschreibung der technischen Welt*, Frankfurt/M., 2011.

12 See Bruno Latour, *We Have Never Been Modern*, translated from French by Catherine Porter, Cambridge, MA, 1993; see also Gustav Roßler, Kleine Galerie neuer Dingbegriffe. Hybriden, Quasi-Objekte, Grenzobjekte, epistemische Dinge, in: Georg Kneer, Markus Schroer, Erhard Schüttpelz (eds.), *Bruno Latours Kollektive. Kontroversen zur Entgrenzung des Sozialen*, Frankfurt/M., 2008, pp. 76–107, pp. 79–82.

13 Among them Human Factor Studies, Work Place Studies or Science and Technology Studies. See: Erhard Schüttpelz, Sebastian Gießmann, Medien der Kooperation. Überlegungen zum Forschungsstand, in: AG Medien der Kooperation (eds.), *Navigationen. Zeitschrift für Medien- und Kulturwissenschaften* 15.1 (2015), pp. 7–54.

14 See Charles Messenger, *Dictionary of Military Terms*, published by the US Department of Defense, Greenhill, London, Stackpole, 1995, p. 274; see also Jimena Canales, Operational Art, in: Niels van Tomme (ed.), *Visibility Machines. Harun Farocki and Trevor Paglen*, Baltimore, 2015, pp. 37–54, p. 37.

15 Assistant Secretary of Defense for Research and Engineering, Human Performance Training and Biosystems Directorate: Human Systems, http://acq.osd.mil/rd/hptb/programs/human_systems (accessed January 8, 2017).

16 Ibid.

date, there is a notable lack of detailed descriptions of the interactions between drone crews and the systems of control, communication, and the sensors on which they rely,[17] despite armed drones having been deployed by the US Air Force since the Yugoslav Wars in the mid-1990s, and by now have become a cornerstone of US-military strategy.[18]

Cooperation and the Eroding Boundaries of Agency

The English term operation is ubiquitous in contemporary military discourse. The *US Department for Defense Dictionary of Military Terms* defines an operation as "[a] military action or the carrying out of a strategic, tactical, service, training, or administrative military mission; the process of carrying on combat, including movement, supply, attack, defense and maneuvers needed to gain the objectives of any battle or campaign."[19] In other words, the term operation describes *all* actions required to achieve a military objective, independent of their hierarchical level or the means to carry them out.

Jimena Canales, a historian of science, emphasises that the term operation, already very broad in its scope and usage within military strategy, has undergone a further expansion in recent times through the development of the related term of *operational art*. In the *Field Manual of US Military Doctrine*, published in 1999, the term operational art, previously used to refer exclusively to military interventions, was used for actions of war, as well as for all "operations outside warfare", including "diplomatic activity, economics and information", as well as "political and other non-military factors".[20] In our view, this expansion of the doctrinal meaning of military operations must be taken seriously, as it refers to a change in the understanding of military actions and of the actors in the military itself.

A tendency to group together different military personnel (e. g. pilots, operators of weapon and sensor systems) under the term *operator*, previously only used for certain participants in secret service missions becomes apparent. In the light of the numerous other meanings of the word *operator*, such as *machine operator, user*, or *supervisor*, military actions are correlated to a greater extent with technological equipment, without which modern warfare is inconceivable. The interplay between the human operator and the increasingly complex and networked technological infrastructure is described as a state of "cooperation" and "collaboration"[21] in which human and non-human actors participate on an equal level, leading to an apparent symmetrisation between human and non-human actors. However, under the condition of automated technological systems, the military discourse characterises this cooperation primarily

17 Notable exceptions are Peter M. Asaro, The Labor of Surveillance and Bureaucratized Killing. New Subjectivities of Military Drone Operators, in: *Social Semiotics* 23.2 (2013), pp. 1–29 and David J. Blair, Nick Helms, The Swarm, the Cloud, and the Importance of Getting There First. What's at Stake in the Remote Aviation Culture Debate, in: *Air & Space Power Journal* (2014), pp. 33–52.

18 By now, the number of pilots for remotely piloted aircraft (RPA) exceeds the number of those operating piloted aircrafts within the US Air Force. See Oriana Pawlyk, Drone Milestone: More RPA Jobs Than Any Other Pilot Position, March 8, 2017, http://military.com/daily-news/2017/03/08/drone-milestone-more-rpa-jobs-any-other-pilot-position.html (accessed August 17, 2017).

19 Messenger 1995 (as fn. 14), p. 274. See also Canales 2015 (as fn. 14), p. 37.

20 Ibid., p. 37.

21 James A. Winnefeld, Frank Kendall, *Unmanned Systems Integrated Roadmap FY2013-2038,* 2013; Robotics Collaborative Technology Alliance / Army Research Laboratory, *FY 2012 Annual Program Plan*, 2011, https://arl.army.mil/www/pages/392/rcta.fy11.ann.prog.plan.pdf (accessed December 7, 2017).

as a technological process of action and decision-making, which the human operator approaches in an increasingly passive manner,[22] namely, as a supervisor who monitors autonomous actors. In a different disciplinary context, but in a somewhat parallel way, the term "operative image" has recently attracted much attention in contemporary media studies and cultural theory. In this context the term links the use of an image to an "object-constituting", "generative" function of "manageability and explorability" that is understood as "operativity".[23] Particularly in the context of automated image processing those practices constitute a new type of image that is defined by the exclusion of the human actor.[24] From this point of view, images become *actors* that not only facilitate human actions within chains of operations via the screen, as in the case of camera-aided remote control, or in the context of graphical user interfaces, but they also are attributed to act with a degree of autonomy.

Distributed Cognition

Thanks to the study *The MQ-9 Reaper Remotely Piloted Aircraft: Humans and Machines in Action*[25], carried out by Timothy Cullen, a Lieutenant Colonel in the US Air Force, between 2009 and 2011 at the Engineering Systems Division of the Massachusetts Institute of Technology (MIT), we can base our considerations on a relatively detailed – albeit also heavily redacted and undoubtedly partisan – description of the theatre of operations of the *MQ-9 Reaper* drone. We can add, for consideration, the perspective of the drone crews and trainers working for the US Air Force, with whom we held discussions in the jointly organised workshop on the topic *Technology and Expertise in Remote Warfare* at Maxwell Air Force Base in Montgomery, Alabama, in February 2017.

Cullen's study, carried out using methods from Science and Technology Studies, is a significant document, in that a member of the military who is familiar with the internal culture of knowledge within the U.S. Air Force provides information on the setting of remote warfare. The study not only reveals some of the less known operative processes of modern warfare, but it also, inevitably, provides information on the way in which members of the "RPA community"

22 Grundel et al. provide the following definition for "cooperative systems", which also include weapons systems: "They have some common elements: 1) more than one entity, 2) the entities have behaviors that influence the decision space, 3) entities share at least one common objective, and 4) entities share information whether actively or passively." The objective of "cooperative technical systems" in these contexts is no longer solely the revaluation of non-human actors, but the minimisation of human participation: cooperative systems "capitalize on the availability of various interconnected resources and on the sharing of key information among the networked entities with minimal involvement of the operating crew". Don Grundel, Robert Murphey, Panos M. Pardalos, Oleg A. Prokopyev (eds.), *Cooperative Systems. Control and Optimization*, Berlin/Heidelberg, 2007, preface, without page numbering.

23 Sybille Krämer, Operative Bildlichkeit. Von der ‚Grammatologie' zu einer ‚Diagrammatologie'? Reflexionen über erkennendes ‚Sehen', in: Martina Hessler, Dieter Mersch (eds.), *Logik des Bildlichen. Zur Kritik der ikonischen Vernunft*, Bielefeld, 2009, pp. 94–123, p. 98.

24 Harun Farocki, on whose investigation of automated image-based navigation techniques the term is based, for example in remote-controlled rockets (*Auge/Maschine I–III*, 2001–2003 and *Erkennen und Verfolgen*, 2003), defined "operative images" as those images that "do not represent an object, but are rather part of an operation." Harun Farocki, Phantom Images, in: *Public* 29 (2004), pp. 12–24, p. 17. Volker Pantenburg explains further that this new type of image is "in no way any longer a 'separate entity' and located opposite a potential observer, but becomes fully integrated into an electronic technical operation". Volker Pantenburg, *Film als Theorie. Bildforschung bei Harun Farocki und Jean-Luc Godard*, Bielefeld, 2006, pp. 189–234. Trevor Paglen calls operational images "images made by machines for other machines". Trevor Paglen, Operational Images, in: *e-flux Journal* 59 (2014), http://e-flux.com/journal/59/61130/operational-images (accessed May 7, 2017).

25 Timothy Cullen, *The MQ-9 Reaper Remotely Piloted Aircraft. Humans and Machines in Action*, Cambridge, MA, 2011.

wish to be perceived, how they reflect on their own position within the scope of military interventions, and what role they claim for themselves in this process.

Cullen describes his work in *Human and Machines in Action* as an illustration of "how social, technical, and cognitive factors mutually constitute remote air operations in war".[26] From a methodological perspective, the study is guided both by Bruno Latour's *Science in Action*[27] and by Edwin Hutchins' 1995 study, *Cognition in the Wild*[28], with its concept of situated and socially distributed cognition. The latter study develops this concept based on the example of pre-modern navigation practices in Micronesia, Hutchins' personal observations gleaned from his time serving on the bridge of a US Navy ship, as well as on Lucy Suchman's descriptions from the 1980s of the "use, combination and re-representation" of information in so-called "intelligent machines", for which she introduced the term "situated cognition".[29]

Hutchins' approach lends itself to the description of the military control environment, as humans and things are described as participants in one and the same "system" in both contexts, namely, as participants in "a distributed process composed of emergent interactions among people and tools".[30] At this point, the common epistemic roots of both the US military discourse on technology and the discourse of cognitive science and media anthropology become apparent, each of which, in their own way, can be traced back to their origin in the systems thinking of cybernetics.[31]

Similar to Hutchins, Cullen follows the navigational control sequences as examples of "socially distributed cognition"[32] through describing and mapping the actions of a crew in the cockpit. He finds the concept of computation useful, without which a horizontal description (in contrast to the hierarchical description of a human as the sole actor) would not be possible. According to Hutchins, navigation takes place based on a sequence of activities, "in which representations of the spatial relationship of the ship to known landmarks are created, transformed, and combined in such a way that the solution to the problem of position fixing is transparent".[33] In his view, this results in a generalised definition of computation, a very broadly defined concept in cognitive science, as "the propagation of representational states across a series of representational media".[34] This definition is striking in its rejection of any clear distinction between the media of the representation, whether these are internal images produced by human imagination, a diagrammatic sketch, a map, or a computer-aided model that is shown on a screen. Defining the process of computation as such an act of constituted translation allows the nominal reduction of the friction between senses and sensors, algorithms and human cognition, decision-making, and programming.

26 Ibid., p. 37

27 Bruno Latour, *Science in Action. How to Follow Scientists and Engineers through Society*, Cambridge, MA, 1987.

28 Edwin Hutchins, *Cognition in the Wild*, Cambridge, MA, 1995; Edwin Hutchins, Understanding Micronesian Navigation, in: Dedre Genter, Albert L. Stevens (eds.), *Mental Models*, Hillsdale, NJ, 1983, pp. 191–225.

29 Lucy A. Suchman, *Plans and Situated Actions. The Problem of Human-Machine Communication*, New York, 1987, as cited in Cullen 2011 (as fn. 25), p. 29.

30 Cullen 2011 (as fn. 25), p. 29.

31 See Paul N. Edwards, *The Closed World. Computers and the Politics of Discourse in Cold War America*, Cambridge, MA, 1996. On the cybernetic origins of the cognitive sciences, see Jean-Pierre Dupuy, *On the Origins of Cognitive Science. The Mechanization of the Mind*, Cambridge, MA, 2000. On the history of cybernetics in US military science, see for example Antoine Bousquet, Cyberneticizing the American War Machine. Science and Computers in the Cold War, in: *Cold War History* 8.1 (2008), pp. 77–102.

32 Hutchins 1995 (as fn. 28), p. xii, xiii and 129, see also Cullen 2011 (as fn. 25), p. 30.

33 Hutchins 1995 (as fn. 28), p. 117.

34 Ibid., p. 117.

Building on this idea, Cullen also recognises the drone cockpit as a system in which both humans and automated tools are participating: "[P]ilot, sensor operator, automated tools, and other elements of Reaper were part of a larger computational system that performed in ways specific to the environment and circumstances of operation."[35] However, his characterisation of the operating crew can be seen as an attempt to separate human action from the automated and technologically defined sequences of action.

The processes that are very broadly defined as *computation* by Cullen and Hutchins can be clarified based on the operations that are essential to remote-controlled warfare. Central to operating the GCS are voice, images, and computation, these serve to visualise and synthesise complex relationships, and render them legible on screen – a procedure that Cullen refers to as "building a picture".[36]

Vision at a Distance

The deployment of drones for targeted killing, missions in warfare, and surveillance presents a paradigm for a type of military intervention that is defined and organised by imaging, sensor and network technologies. It is based on a configuration of humans and machines that not only permits seeing without being seen, but also killing in real time without being physically present. On the one hand, this is made possible by the spatial mobility of sensor technologies that are ever more independent from human presence, and, thus, become the preconditions for human decision making. On the other hand, it is based on the almost immediate temporal availability of data provided by transmission and visualisation technologies, through which operations at a distance are moved into the sphere of real time.

Imaging technologies, such as thermographic or electromagnetic measuring techniques, as well as light- or sound-based methods, allow visual and operative access to a situation in the conduct of war. While the pilots of manned aircraft are generally neither in the position to observe a target over the longer term, nor of making it visible at a small distance or in high resolution, the visual practices of drone crews are based on a continuous video stream, which constitutes an important criterion for distinction according to Peter Asaro:

> *In most manned combat missions, the target is simply a set of geographic coordinates that were obtained from another source, such as soldiers on the ground, an aircraft or satellite up above, or the outcome of the analysis of multiple intelligence sources. They also rarely remain close to a target to observe the consequences of their attack, a task called 'battle damage assessment' that is often given to unarmed surveillance aircraft or soldiers on the ground.*[37]

In contrast, drone operations present a visual practice in which vision becomes a cooperative process. Based on the example of the merging of the visualisation process and the ability of human vision, Cullen shows how the awareness of the boundary between human and machine is strategically eliminated in military training and practice. According to Cullen, the operation of the sensor system by the sensor operator will only function successfully when operators dissociate the ability to see from the presence of their own

35 Cullen 2011 (as fn. 25), p. 32.
36 Ibid., p. 117.
37 Asaro 2013 (as fn. 17), p. 14.

bodies: "Instructor sensor operators taught their students to visualize themselves being on the Reaper aircraft, floating above the ground and looking down at their quarry from the belly of the aircraft"[38]. The eye takes the place of the sensor, negating machine action, but also acting as a sensor itself: "A sensor operator's close relationship with the sensor ball helped them to do their jobs well. Experienced sensor operators who 'flew' the sensor ball from an 18-inch monitor became the machine. They became the eye in the sky".[39]

This demonstrates the extent to which the work of the crews is dependent upon the production of visibility. Wherever imagery intervenes between soldiers and the battlefield, the interplay of structures and processes, behind and in front of the screen, are crucial in order to understand how operators act via sensor and imaging technologies. Published video feeds that are based on the sensor data have contributed to making the practice of drone warfare more visible.[40] However, the existence of such material hardly reveals *what* the crews themselves see, and, above all, *how* they saw a given situation. The actors' remote interaction, their diverging perspectives, and the underlying workflows can only be vaguely surmised, if at all. Even so, the essential arguments that are linked to vision at a distance can be revealed based on the debate about these documents.

Advocates of drone use emphasise the aspects related to safety and the minimisation of risk, in particular, as vision and action at a distance do not necessarily require the presence of human actors.[41] Further, they note that this distance implies, above all, the option of the "projection of agency without vulnerability".[42] Soldiers' lives are not at risk during an operation. Additionally, from a military technological perspective, a positive cost-benefit ratio is attributed to surveillance at a distance in comparison to the options for observation by ground troops or manned aircraft.[43] To this end, it is predominantly techniques for visualisation that are listed: the methods for obtaining ISR (intelligence, surveillance, reconnaissance), the argument proposes, produce a continuous and ubiquitous visibility that forms the basis for a clean, almost surgical conduct of a war.[44]

In contrast, critics regard drone technology as no less than "the technical – and technological – solution *par excellence* for the political problem of imperial overreach".[45] They argue that "death of distance enables death from a distance,"

38 Cullen 2011 (as fn. 25), p. 166.

39 Ibid.

40 See, for example, projects such as Forensic Architecture (http://forensic-architecture.org), Dronestagram (http://dronestagram.tumblr.com) or Airwars (https://airwars.org), which visualize the locations and consequences of drone attacks (accessed March 1, 2018).

41 See Peter W. Singer, *Wired for War. The Robotics Revolution and Conflict in the Twenty-First Century*, New York, 2009.

42 David Deptula, *The Use of Drones in Afghanistan*, CNN *Amanpour*, November 24, 2009, as cited in Grégoire Chamayou, *A Theory of the Drone*, New York, 2015, p. 12.

43 See Department of Defense, *Unmanned Systems Integrated Roadmap, FY2011-2036*, 2011, http://acq.osd.mil/sts/docs/Unmanned%20Systems%20Integrated%20Roadmap%20FY2011-2036.pdf (accessed January 8, 2017).

44 See Conor Friedersdorf, Calling U.S. Drone Strikes 'Surgical' is Orwellian propaganda, in: *The Atlantic* 27 (2012), http://theatlantic.com/politics/archive/2012/09/calling-us-drone-strikes-surgical-is- orwellian-propaganda/26292 (accessed January 8, 2017); John O. Brennan, The Ethics and Efficacy of the President's Counterterrorism Strategy, Lecture at the Woodrow Wilson International Center for Scholars, Washington, DC, April 30, 2012, http://cfr.org/counterterrorism/brennans-speech-counterterrorism-april 2012/p28100 (accessed January 8, 2017); Harold Koh, The Obama Administration and International Law, in: *Annual Meeting of the American Society of International Law*, Washington DC, March 25, 2010, https://geneva.usmission.gov/2010/04/01/obama-administration-international-law/ (accessed July 27, 2017).

45 Laleh Khalili, Fighting over Drones, in: *Middle East Report*, No. 264; Pivot, Rebalance, Retrench. The US Posture in the Middle East (2012), pp. 18–21, p. 21.

and that this “replaces one tyranny of geography with another”.[46] One of the ramifications of this that is often criticised is that the visual presentation and simulation of the events implies an emotional distance, which leads participants to dissociate from the consequences of their action.[47] For example, the aesthetics, as well as the software interfaces and control instruments of the GCS, are often compared to those of video games; the term, “push-button-war” is frequently used to characterise this phenomenon, in which it is no longer possible to distinguish between simulation and reality.[48] Conversely, arguments are promulgated stating that the spatial proximity and chronological continuity created by the real time video feeds moves the participants far *closer* to events, and, also, renders the consequences of actors’ actions visible:

> *You’re 8,000 miles away. […] But it’s not really 8,000 miles away, it’s 18 inches away. […] We’re closer in a majority of ways than we’ve ever been as a service. […] There’s no detachment. […] Those employing the system are very involved at a personal level in combat. You hear the AK-47 going off, the intensity of the voice on the radio calling for help. You’re looking at him, 18 inches away from him, trying everything in your capability to get that person out of trouble.*[49]

Peter Asaro suggests that most of these arguments miss the point in relation to the actual complexity of drone technologies, as they only view the agency of the technology in the sense of a simple reaction without considering how the use of the technology also changes human agency.[50] Derek Gregory has pointed out that the visually-conditioned spheres of action of drone operations are not technical, but techno-cultural phenomena, the problems of which can only be revealed through their use.[51] In order to understand the actions and decisions relating to the deployment of drones, it is, therefore, not only their workflows that must be documented, and their consequences that must be made visible, but, also, the pragmatic conditions of the intervention. In this sense, it appears necessary to question the interplay between human and technical actors in relation to how this dynamic engenders or prevents specific forms of vision and visibility; this is the key practice of remote-controlled warfare.

Crafting a View

Based on the example of the live video feed, Cullen describes how the cooperative production of the image in real time becomes a source of identity for the different actors distributed in space: “The feed is distributed and networked. It is the *product* of the aircrew. The crew ties their identity and their worth to this feed.”[52] He emphasises the importance of

46 Gregory 2012 (as fn. 3), p. 192.
47 James Der Derian, *Virtuous War. Mapping the Military-Industrial-Media-Entertainment Network*, Boulder, 2001, pp. 9–10.
48 Rachel Plotink, Predicting Push-Button Warfare. US Print Media and Conflict from a Distance, 1945–2010, in: *Media, Culture & Society* 34.6 (2012), pp. 655–672.
49 Col. Pete Gersten, commander of the 432nd Air Expeditionary Wing at Creech Air Force Base, in Megan McCloskey, The War Room. Daily Transition between Battle, Home takes a Toll on Drone Operators, 2009, https://stripes.com/news/the-war-room-daily-transition-between-battle-home-takes-a-toll-on-drone-operators-1.95949#.WYSF0dPyjmE (accessed December 8, 2017).
50 See Asaro 2013 (as fn. 17), p. 5.
51 Gregory 2012 (as fn. 3), p. 190.
52 Timothy Cullen, “MQ-9 Reaper Operations and the Evolution of Remote Warfare”, Presentation during the workshop *Technology and Expertise in Remote Warfare* February 1, 2017, Air University, Maxwell Air Force Base, transcript by Nina Franz.

the chat room, in which members of the crew communicate on the content of the feed, in which events are described and interpreted. Vision becomes a cooperative process through this interplay between language and image. The production of the video feed by the crew, as highlighted by Cullen, implies the involvement of non-human actors, because in order to recognise anything on the screen at all, the human observers require context. Context is not provided primarily by the written communication in the chat rooms alone, but "is facilitated with the help of tactical displays, moving maps [...] and chat rooms".[53]

The cooperative production of the feed as an actual task of the crew represents a stark contrast to the role of fighter jet pilots, from whom the US Air Force drone pilots distinguish themselves, sometimes in a polemic form, in their self-image as "desk workers in flying uniform".[54] While aircraft pilots profess to act on an individual, and accordingly autonomous basis, the operators of the GCS are co-authors[55] in an interactive software environment. However, Cullen simultaneously positions this creation of visibility as predominantly a "product of the crew".[56] Contrary to the strategic elimination of human-machine differences that he observes in the training of Reaper crews, human actors remain superior to technology for Cullen: they not only recognise the errors and weaknesses of the technology, but also anticipate these by using their knowledge-based experience, and they develop work-arounds to exploit the technology in individual situations.

This reveals Cullen's own perspective as an erstwhile Air Force pilot, a tradition into which he attempts to enlist the role of drone pilot. Cullen argues in favour of understanding drone crews as *autonomous*, and, thus, decidedly human decision-makers: "They struggled to be human", he states, and, thereby, locates the problem in the transformation "from automatons and technicians into military professionals who viewed the interpretation and manipulation of the virtual world they created as matters of life and death".[57] According to Cullen, this battle for the identity of an acting human subject, who is not simply an element in the technical process, takes place at the level of interfaces that are designed by engineers without adequate input from the users. The design of the control surfaces is revealed to be a point of contention, based on statements by members of the crew:

> *General Atomics engineers initially designed the aircraft to fly autonomously for the bulk of a mission, but pilots modified the ground control station and their procedures to share aircraft control with the autopilot*

53 Ibid.

54 Workshop participants at Maxwell Air Force Base pointed out that the requirement to wear a flying suit in the GCS appeared to them to be slightly absurd. On the modification of the use of the classification of "pilots", and the term Air Force Operator, Cullen 2011 (as fn. 25), p. 20.

55 In this, the situation in the GCS as opposed to the cockpit shares similarities with the set-up that Timothy Lenoir and Sha Xin Wei have described as the "operative theatre" of computer-mediated surgery that is marked by the "necessary cooperation between human and machine". The surgical, like the remote military intervention, is today mediated by a technological infrastructure, in which individual operators are "replaced by software-mediated, machine-human collectivities". Accordingly, the unified authorship of the operator/agent is transformed into "co-authorship" within "interactive 3-D simulations". Timothy Lenoir, Sha Xin Wei, Authorship and Surgery. The Shifting Ontology of the Virtual Surgeon, in: Bruce Clark, Linda Henderson (eds.), *From Energy to Information*, Stanford, 2002, pp. 283–308, pp. 284–285.

56 Cullen, *MQ-9 Reaper Operations and the Evolution of Remote Warfare*, 2017, handout on the lecture with the same title given in the workshop *Technology and Expertise in Remote Warfare* February 1, 2017, Air University, Maxwell Air Force Base, p. 13.

57 Cullen 2011 (as fn. 25), p. 119.

> *in order to maneuver more quickly and destroy a target at a specific time. […] To make the system work for them, Reaper operators determined the time and place to use automated tools; avoided modes of operation known to trigger failure; adjusted to the erroneous behavior of subsystems and other operators; and translated data into formats other humans and machines could receive, interpret, and evaluate […].*[58]

Here, Cullen emphasises the self-reliance of the prospective drone pilots in the 29th Attack Squadron of Holloman Air Force Base and highlights their options for intervention and sovereignty of action in comparison to weapons systems that are designed for "autonomy". According to Cullen, their own expertise in the handling of the control panel allows the members of the crew to intervene in the automated processes and "share" control of the aircraft with the autopilot, such that targets that are being aimed at can be destroyed "more effectively". What is notable here is the fact that it is not those qualities that enable a secure and reliable assessment that are emphasised (for example, to identify a legitimate military target under the laws of war), but those that have the objective of ensuring speed of decision. Likewise, "failure" and "erroneous behaviour" of subsystems and other operators that are designed to prevent intervention do not primarily refer to causing collateral damage or civilian victims.

The drone crew's practice of "translation" of the data produced by computer systems into "formats others could receive, interpret and evaluate"[59] that Cullen observes, follows the definition of computation introduced by Hutchins. While these forms of human *translation* were apparently possible in the Reaper cockpit described by Cullen, it is improbable that this still applies in current and future control stations in the same way. This is because modern computer systems can collect and analyse ever greater quantities of data practically in real time and visualise these data on the screen at an increasingly uncircumventable level of sensory perception; users can only accept or reject in the specific application contexts, but are now hardly capable of comprehending the weight of such data.[60]

Interpretation and Decision

The high resolution, real time video feed that forms the basis for action and decisions taken by drone crews amounts to a use of images that is fundamentally different from previous military practices in planning, surveillance, reconnaissance, and intervention. The circumstance that both control and navigation, as well as the visual access to the area of operations, are guided by images, implies a structurally different image practice to that suggested by the visual methods and competencies of traditional military reconnaissance.[61]

When visualization practices mediate between drone crews and the area of operations, this not only demands an examination of what can be seen and recognised in and on

58 Ibid., p. 119.

59 Ibid., p. 43.

60 Mark Hansen, Feed-Forward, in: Robin Mackay (ed.), *Simulation, Exercise, Operations*, Falmouth, 2015, pp. 57–61, p. 57.

61 On this point, see Antoine Bousquet, *The Martial Gaze. The Logistics of Military Perception in the Age of Global Targeting*, Minneapolis [publication in 2018], therein Chapter 3 Imaging [We would like to thank Antoine Bousquet for sharing an unpublished version of the manuscript]. On the civilian use of image-guided navigation techniques, see Manovich, *The Language of New Media*, Cambridge, MA, 2001, therein The Poetics of Navigation, pp. 259–268; Tristan Thielmann, The ETAK Navigator. Tour de Latour durch die Mediengeschichte der Autonavigationssysteme, in: Georg Kneer, Markus Schroer, Erhard Schüttpelz (eds.), *Bruno Latours Kollektive. Kontroversen zur Entgrenzung des Sozialen*, Frankfurt/M., 2008, pp. 180–218.

these images. How images facilitate, complicate, or even prevent vision and action in an operative process is also a subject for negotiation. In this case, the visualisation of sensor data not only creates static situations for a temporally and spatially subordinate reception, but also essentially guides and controls the actions and decisions of the crews. Drone operations, therefore, correspond to a new type of intervention in which military action is directly guided, or misguided, by what and how images depict or obscure.

The interpretation of sensor data in real time now represents a significant number of decisions taken during military interventions. While the techniques and methods of obtaining information, surveillance, and reconnaissance that are required for this were separated from the use of weapons in conventional warfare, the selection and observation of the target and the decision to kill are now part of the remit of the crew. This confronts soldiers with complex cognitive demands: decisions taken by drone crews are based on a practice that Asaro defines as a "fast-paced multimedia and social media environment of intelligence gathering and killing".[62] The practices of seeing and visualising for the Reaper crews are based on a view according to which humans and machines must enter into a cooperative "partnership"; they must become a "functional system"[63], as outlined by Hutchins.

Even if the active design, manipulation and intervention in the feed, that Cullen describes as "building a picture"[64] and as "growing a video track"[65], still forms part of the core competencies and learning objectives of drone crews, it may become progressively less of a requirement in future operative scenarios where drones are deployed. Given the newer sensor systems, the commonly cited "view through a soda straw"[66], which continues to be opposed to the popular concept of total visibility through omnipotent *seeing* sensor systems, now hardly seems applicable to the visual practices of drone crews. Based on more recent studies, human-based visual scanning of the surfaces of the combat zone will hardly form part of the core competencies of drone crews in the future.[67] Target acquisition and observation is, indeed, still carried out based on restricted fields of view, zooms, and camera perspectives. However, sensor systems, such as the so-called Argus-IS (Autonomous real time ground ubiquitous surveillance Imaging System), now record moving images of areas on the scale of entire cities.[68]

There has been a corresponding rise in the requirement for personnel tasked with data analysis and interpretation. In distributed common ground systems, infrastructures for the processing and analysis of the data from different sensor systems that are firmly established as weapons systems; screeners are employed to monitor incoming data signals and video streams – an activity that is also increasingly being delegated to private companies (fig. 3).[69] In this case,

62 Asaro 2013 (as fn. 17), p. 13.
63 Hutchins 1995 (as fn. 28), p. 170, see Cullen 2011 (as fn. 25), p. 198.
64 Cullen 2011 (as fn. 25), p. 117.
65 Cullen 2017 (as fn. 56).

66 Ibid., p. 130: "The ability of Reaper pilots, sensor operators, and mission coordinators to communicate, develop, and execute a plan to 'look through a soda straw' was a critical skill necessary to defend ground forces and to obtain the best video possible."
67 See Valerie J. Gawron, Keven Gambold, Scott Scheff, Jay Shively, Ground Control Systems, in: Nancy J. Coke, Leah J. Rowe, Winston Bennett Jr, DeForest Q. Joralmon (eds.), *Remotely Piloted Aircraft Systems. A Human Systems Integration Perspective*, Chichester, 2017, pp. 63–109.
68 Defense Science Board, Office of the Secretary of Defense, *Autonomy*, 2016, p. 50.
69 Abigail Fielding-Smith, Crofton Black, Revealed. The Private Firms Tracking Terror Targets at Heart of US Drone Wars, in: *The Bureau of Investigative Journalism*, July 30, 2015, https://thebureauinvestigates.com/stories/2015-07-30/revealed-the-private-firms-tracking-terror-targets-at-heart-of-us-drone-wars (accessed December 8, 2017).

3 Distributed common ground system, US Air Force.

the forensic monitoring is still based on culturally acquired knowledge, as noted by Gregory.[70] However, due to the enormous quantity of video material, the observation of images within the scope of anthropological vision is increasingly impossible as "no human eye is capable of analysing such images with a volume of several terabytes per minute, which is why movement profiles of humans and vehicles are pre-sorted through automated pattern recognition"[71], as Michael Andreas points out. Using a "Global Information Grid, i. e. a communication network or raster that is interconnected with the military databases [...], the interconnection of surveillance drones and precision weapons thereby renews the fiction of military real time [...], the phantasms of which have penetrated through to the acronyms used in military terminology"[72], Andreas argues.

70 Gregory 2012 (as fn. 3), p. 195.
71 Michael Andreas, Flächen/Rastern. Zur Bildlichkeit der Drohne, in: *Behemoth. A Journal on Civilization* 8.2 (2015), pp. 108–127 [translated by the authors].
72 Ibid., p. 114.

The use of automated software systems for image analysis, for example, to filter out abnormal activities, or to pursue moving targets, demonstrates how seeing and visualising in the deployment of drones cannot be understood as solely the distributed activity of human actors, for example, as a result of the collaborative observation of the screen by a crew. This not only changes "the ideas about who the agent of image production is in situations of war"[73], but the situations in which data is depicted visually at all. Through the establishment of forms of automated recognition and selection, data visualisation may only be required if human actors need to verify or falsify pre-filtered results of calculated decisions, i. e. when they need to comply to juridical routines or military workflows. In other words: the exclusion of the human observer goes so far that action and decision-making do not require images at all.

However, it is not only the visualisation, but also the operationalisation of the combat zone that is increasingly system-controlled. The drone cockpit of the future intends to fuse the division of labour between the sensor operator and pilot – which has existed to date – into labour carried out by only one person.[74] Given the increasing automation of the controlling of an ever greater number of aircraft by ever fewer operators[75], and the division and partition of combat zones into geometric decision spaces, so-called kill boxes, this appears to herald the start of a new, worrying para-

73 Carolin Höfler, Eyes in the Sky. Körper, Raum und Sicht im bildgeführten Krieg, in: Martin Scholz, Friedrich Weltzien (eds.), *Design und Krieg*, Berlin, 2015, pp. 13–34, p. 31 [translated by the authors].
74 Maia B. Cook, Harvey S. Smallman, Human-Centered Command and Control of Future Autonomous System, Power Point presentation at the *18th International Command and Control Research & Technology Symposium* Track C2 in Underdeveloped, Degraded, and Denied Operational Environments, June 21, 2013, Alexandria, https://dodccrp.org/events/18th_iccrts_2013/post_conference/presentations/090.pdf (accessed May 7, 2017).
75 Gawron et al. 2017 (as fn. 67), p. 99, p. 102.

digm of control and operation in which the the human factor becomes a precarious element which is only loosely attached to increasingly autonomous processes of computation.

Crisis of Cooperation

Weapons manufacturers, with the Californian company General Atomics leading the way, are still designing GCS control and communication interfaces based on the classic cockpit architecture of manned aircraft, in which a crew acts and observes within a specific aerial space. However, recent research in Human Factor Studies is resulting in the design of the GCS more like platforms, where operators monitor automated processes. Gawron et al. view operators as no longer being capable of translating the increasing quantities of data into actions:

> *[M]onitoring a systems status is burdensome and requires continuous effortful filtering of relevant versus irrelevant information, but emerging technologies can make this a supervisory task by presenting operators only with those alerts that require operator attention, in turn freeing up operator resources for other tasks or even making some monitoring tasks obsolete.*[76]

Cook and Smallman, on the other hand, regard the demand for a new operative paradigm in the design of GCS as justified by the fact that future crews will coordinate numerous activities carried out by different "autonomous platforms and agents"[77] in parallel, instead of tasks being allocated to a single aircraft. In such cases, operators function as supervisory decision-makers,[78] instead of as observers.

In conversation with the US Air Force drone crews on the Maxwell Air Force Base, participants openly discussed their frustration with the fact that more and more responsibility and power of decision-making is being transferred from the operators of the weapons systems to the engineers, i. e. from members of the military to actors who are pursuing fundamentally different, primarily market-driven, interests and have no military responsibility. Criticism was aimed, in particular, at the armaments group General Atomics, which not only manufactures the most frequently used armed drone systems, Predator and Reaper, but which is also responsible for the design of the control stations that are currently used. Complaints focused mainly on the growing *rigidity* of the interfaces and the lack of scope for influence on the system by military personnel, especially when defining the requirements of the GCS.

David Blair and Nick Helms, both US Air Force drone pilots, contrast what they refer to as the *capability*-oriented view of the military users with a *cybernetics*-oriented view taken by developers and manufacturers:

> *From a capabilities view, crew members—in partnership with a fleet of maintainers and support personnel – take 'their' aircraft into the fight to hunt down threats. Conversely, a cybernetics view uses a crew to supply a set of inputs that in turn produces x number of hours of intelligence, surveillance, and reconnaissance.*[79]

76 Ibid., p. 93.
77 Cook, Smallman 2013 (as fn. 74), p. 2.
78 See Gawron et. al. 2017 (as fn. 67), p. 93.
79 Blair, Helms 2014 (as fn. 17), pp. 40–41.

Their "capability perspective" can be assigned to the heroising tradition of classic pilots, who are first and foremost self-reliant and use technology as "amplifiers of human will".[80] Similar to Cullen, Blair and Helms accordingly view the problems of a cybernetics perspective mainly within the context of a diffusion of agency, through which crews become "subsystems within larger sociomechanical constructs", which locks them into closed "control loops"[81] that regulate the systemic variables of specified parameters.

In contrast, a "capabilities perspective", such as is also advocated by Cullen, highlights the "technical" aspect of the skills required for control. In order to "tease out" details from an image, parameters such as "gain, level and focus" must be manipulated manually, or different imaging modalities must be organised in various ways and overlaid.[82] According to this description, that is in contrast to more critical perspectives on what constitutes these *image operations*,[83] what becomes visible is based primarily on the competence of the operator.

Even so, the crew members are convinced that the sphere of influence they are granted is significantly affected by software and hardware engineers and developers, and that these actors are simultaneously determining, to an ever greater extent, what is visualised and how, i. e. what can actually become the focus of attention. The selection process that precedes the workflow in the cockpit is not transparent to the operators, who, as the human actors, bear the responsibility for the decisions taken based on data visualisations, and it is hardly recognisable as such, or even comprehensible. This circumstance is further complicated by applications based on artificial intelligence or machine learning; this is especially true in the case of automation of the data analysis[84] in surveillance missions and for target recognition, wherein the identification of a legitimate target is precisely the critical function, a function that then sets a precedent.

A new Defence Advanced Research Projects Agency (DARPA) programme called Explainable AI (XAI) demonstrates that the US Air Force is aware of the problems posed by increasing automation. The head of the programme, David Gunning, was also responsible for the DARPA programme CALO (Cognitive Assistant that Learns and Organises), whose most prominent spin-off is Siri, Apple's language recognition software. In a public statement on XAI, Gunning explains the objectives of the new programme, the focus of which, as cited in the mission statement, "is the development of a model that will enable human users to understand, appropriately trust, and effectively manage the emerging generation of artificially intelligent partners".[85]

The anthropomorphism that pervades military references to *cooperation*, *partners* and *human-machine teams*, expresses a new turn in the rhetoric of Explainable AI, where not only agency, but also the ability to think is attributed to the machines:

80 Ibid., p. 40.
81 Ibid.
82 Cullen 2011 (as fn. 25), pp. 165–167.
83 See Kathrin Friedrich, Moritz Queisner, Anna Roethe (eds.), *Image Guidance. Bedingungen bildgeführter Operation*. Berlin, 2016; Jens Eder, Charlotte Klonk (eds.), *Image Operations. Visual Media and Political Conflict*, Manchester, 2016.

84 An example of this is provided by the identification of military targets through the analysis of behavioural patterns, see Patrick Tucker, A New AI Learns Through Observation Alone. What That Means for Drone Surveillance, in: *Defense One*, September 6, 2016, http://defenseone.com/technology/2016/09/new-ai-learns-through-observation-alone-what-means-drone-surveillance/131322/?oref=d-channeltop (accessed September 30, 2017); see also Nina Franz, Targeted Killing and Pattern-of-life Analysis. Weaponised Media, in: *Media, Culture & Society* 30.1 (2017), pp. 111–121.
85 Explainable AI, https://darpa.mil/program/explainable-artificial-intelligence (accessed September 30, 2017).

> *Continued advances promise to produce autonomous systems that will perceive, learn, decide, and act on their own. However, the effectiveness of these systems will be limited by the machine's inability to explain its* thoughts and actions *to human users. Explainable AI will be essential, if users are to understand, trust, and effectively manage this emerging generation of artificially intelligent partners.*[86]

The step from the controlling human to "manager", intelligent "partner" or decision-maker, therefore, appears completed, at least rhetorically. It is perhaps no coincidence that Timothy Cullen was asked to act as a consultant on the programme, given his intensive investigation of the practitioner's perspective with reference to the user interface in the increasingly automated ground control stations. He was invited to participate in a working group involving behavioural psychologists from the field of naturalistic decision making, the objective of which is the development of an explanatory model for decision-making processes. In turn, this model is to be used by computer scientists for the development of a "system" to explain the performance of "other systems", such as so-called "deep neural networks".[87]

In this case, *cooperation* remains primarily a matter of technical requirements at the level of model development and the provision of trustworthy technological *partners* that also supply the comprehensibility of their own decisions remains a desideratum. It does not seem unlikely that this initiative is more of a symptom anticipating an apparent crisis of the *human* operator rather than a realistic perspective for opening the black box of highly complex neuronal networks, as Explainable AI seems to do little more than adding further, deeper levels to the operating interfaces providing instructions, and increase the epistemic distance between an automated decision and the human executing the decision.

While the symmetrisation of agency appears to be a progressive notion for thinking the complex relationships between humans and machines in media theoretical reflection, especially in the wake of Latour, the tendency to put human and machines on an equal plain in the context of military operative discourse is recognisable as a rhetoric that nominally reduces the confrontational nature of this co-operation and obscures the influence of powerful actors that are not necessarily part of the command chain. A report by the Bureau of Investigative Journalism from the year 2015 warned that service providers of powerful defense suppliers like General Atomics are increasingly taking over responsibilities that are defined as "inherently governmental functions".[88] This is true for instance, when surveillance missions are outsourced to contractors, as one commentator notes:

> *The Pentagon may not have plans to allow contractors to fire missiles off drones. But allowing them to feed targeting data to the uniformed trigger-puller takes the world one step closer in that direction.*[89]

86 David Gunning, Explainable Artificial Intelligence (XAI), DARPA/I20, Distribution Statement A, https://cc.gatech.edu/~alanwags/DLAI2016/(Gunning)%20IJCAI-16%20DLAI%20WS.pdf (accessed July 30, 2017) [emphasis by authors]; Explainable Artificial Intelligence (XAI), [official website], https://darpa.mil/program/explainable-artificial-intelligence (accessed July 30, 2017). A later version of the statement on the website for the programme replaces "thoughts and actions" with "decisions". Explainable Artificial Intelligence (XAI), [official website], https://darpa.mil/program/explainable-artificial-intelligence (accessed September 30, 2017).

87 Timothy Cullen, email correspondence with the authors on July 22, 2017 and September 10, 2017.

88 Fielding-Smith, Black 2015 (as fn. 69).

89 Laura Dickinson, Drones and Contract Mission Creep, in: *Just Security*, August 5, 2015, https://justsecurity.org/25223/drones-contractors-mission-creep (accessed September 15, 2015).

Adding to that, over the course of the development of increasingly automated control interfaces that form the eye of the needle for a technological authority, and through the introduction of the newest generation of AI technologies, which diverge from the path of strictly rule-based cybernetic models, the Command and Control functions are increasingly disappearing behind a rhetoric of cooperation that no longer only places objects, humans, and algorithms on the same cognitive plane, but essentially removes the agency from the human element within the control environment. This discourse, which attributes the ability to think and act to things and which obliges humans to primarily believe in the explanations provided by technology, pays no attention to the fact that the real decisions have been taken by engineers during the design process: The actors are leaving the control station.

Figures

1 US Air Force, Timothy Cullen, 2010.

2 US Air Force, Christopher Flahive, https://media.defense.gov/2009/Apr/20/2000593687/-1/-1/0/090409-F-0502F-001.jpg (accessed January 2, 2018).

3 US Air Force, 2014, http://af.mil/About-Us/Fact-Sheets/Display/Article/104525/air-force-distributed-common-ground-system (accessed January 3, 2018).